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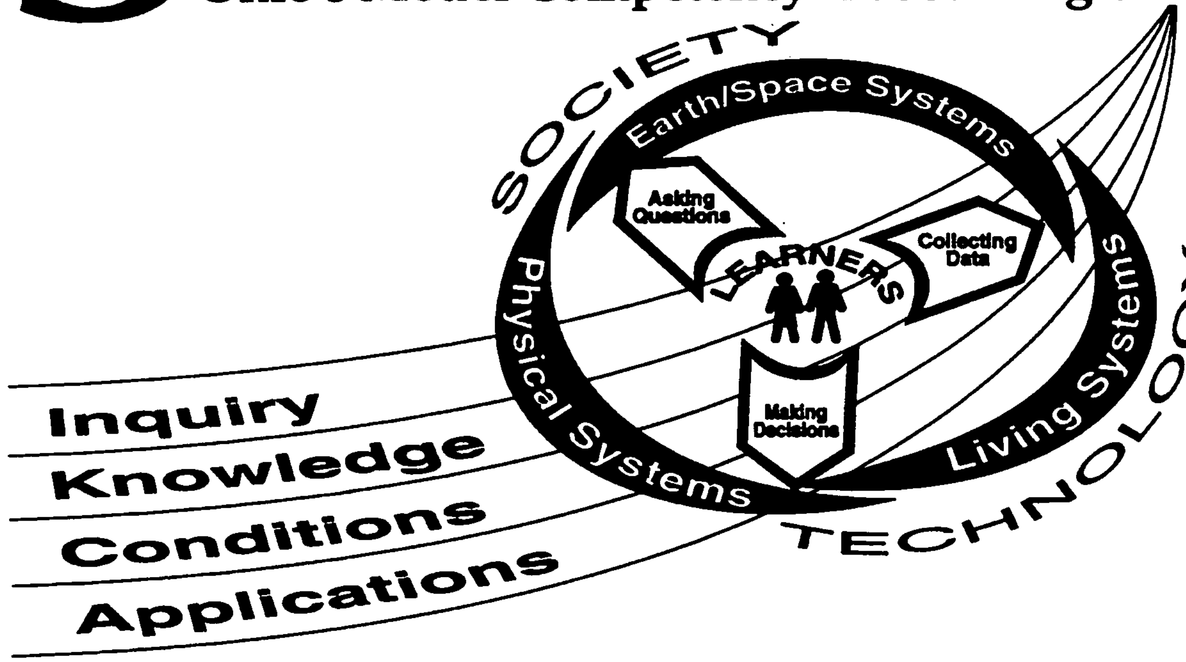
ABSTRACT

This document contains a set of model competency-based education (CBE) assessments that provide three types of assessment for students in grades 1-8 in science. Types of assessment include: traditional: multiple choice, short-answer, and open-ended items; performance-like: more authentic forms that involve students outside of the classroom; and open-ended: more substantive performance assessments requiring out-of-class preparation and holistic scoring procedures. The design of model assessment instruments is discussed, including: balanced assessments; test development; materials and conditions for development; relationship to proficiency tests; and student evaluation. A content summary chart accompanies each grade-level instrument. Item discussions accompany all grade-level CBE assessments. Item descriptions provide an overview of items and pertinent content. A rubric summary further organizes these elements in a quick reference table reflective of suggested stages of an acceptable student response. (DDR)

Competency-Based Education Assessment Series

Model Assessments Supporting Implementation

SCIENCE
Ohio's Model Competency–Based Program



Ohio Department of Education

1998

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Acknowledgments

Justification for assembling assessment strategies supportive of *Ohio's Model Competency-Based Science Program* is rooted in the purpose of the Model — "to provide direction for school districts in developing local competency-based science education programs." (1994, p. 3) An overarching assumption regarding assessment guided the authors of this document: "[...effective instruction] must always be tied to curriculum-embedded assessment." (*Ohio's Model Competency-Based Science Program*, 1994, p. 57) Assessments assembled in this document represent the current thinking and level of development of assessment strategies that illustrate instructionally centered assessment consistent with the Model. The revised assessments feature some new and revised items, correlation with science proficiency outcomes, and an introduction to science portfolio as part of a comprehensive assessment strategy.

As project coordinators for the science component of the Competency-Based Education Assessment Series we invite on-going dialogue and cooperative efforts to build on these assessment strategies.

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Contents

Assessment Type	Grade-level							
	1	2	3	4	5	6	7	8
• **Type 1.** Introduction	√	√	√		√		√	√
• Content Summary Chart	√	√	√		√		√	√
• Model Instructional Objectives	√	√	√		√		√	√
• Portfolio Scoring Guide								
• Portfolio Discussion/Example								
• Item Discussion/Scoring	√	√	√		√		√	√
• Assessment Item Block	√	√	√		√		√	√
• **Type 2.** Introduction	√	√	√	√	√	√	√	√
• Content Summary Chart	√	√	√	√	√	√	√	√
• Model Instructional Objectives				√		√		
• Portfolio Scoring Guide			🗁	🗁	🗁	🗁	🗁	🗁
• Portfolio Discussion/Example				🗁		🗁		🗁
• Item Discussion/Scoring	√	√	√	√	√	√	√	√
• Assessment Item Block	√	√	√	√	√	√	√	√
• **Type 3.** Introduction	√	√	√	√	√	√	√	√
• Content Summary Chart	√	√	√	√	√	√	√	√
• Model Instructional Objectives								
• Portfolio Scoring Guide			🗁	🗁	🗁	🗁	🗁	🗁
• Portfolio Discussion/Example				🗁		🗁		🗁
• Item Discussion/Scoring	√	√	√	√	√	√	√	√
• Assessment Item Block	√	√	√	√	√	√	√	√

Overview of the Science Model Competency Assessment Instruments

The attached grade-level assessment instruments make up the science component of the Model Competency-Based Education (CBE) Assessment Series. They are based on *Ohio's Model Competency-Based Science Program.* The Science Model provides direction for school districts in developing CBE science education programs which accentuate a need to align districts' CBE science assessment strategies, curriculum, and instructional programs implemented by teachers.

- *Teachers will ... translate instructional and performance objectives from their local science curriculum into science learning experiences ensuring that learners are appropriately challenged and demonstrate achievement to the limits of their abilities.*
- *Teachers will assess learner success in terms of both processes and products which focus upon clusters of skills, complex performances, analysis and communication strategies, and demonstration of increasingly sophisticated science literacy that emerge over time.* (Ohio's Model Competency-Based Science Program, 1994, p. 3)

The assessment instruments have been developed with certain assumptions. To better understand these assumptions, this overview clarifies the purpose of the instruments; highlights differences between the instruments; and explicates assumptions regarding the design of the model assessment instruments.

Purpose

These science assessments have been developed as a service to districts to assist in meeting district CBE assessment requirements. Each year, students in grades one through eight must be assessed to determine if they are making satisfactory progress in the district's CBE science program. This is the basis for reporting student performance through the Education Management Information System at the conclusion of each school year. These instruments serve as a model for such assessments to be administered in a standard way. They can be used and adapted in whatever manner the district determines best meets its needs.

The science model assessments have been selected and adapted based on their appropriateness and to demonstrate the spirit and intent of the Science Model.

In summary:

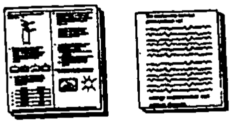
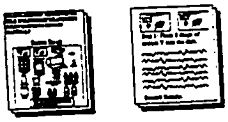
1. Science is for All Students.
2. Science content must actively engage learners.
3. Science programs should be articulated, pre K–12.
4. Science content should be grounded in and connect the three domains of science — science in physical, living, and earth/space systems.
5. Science programs must adequately reflect all four instructional strands of the Model — Scientific Inquiry, Scientific Knowledge, Conditions for Learning Science, and Applications for Science Learning.
6. Science instructional and performance objectives should emphasize higher order thinking skills and complex performances. (Ohio's Model Competency-Based Science Program, 1994, p. 5)

It's our sincere hope that these models will help to provide you with examples of the kinds and variety of assessment strategies that you might use in your local CBE assessment program depending on your local performance objectives and the rigor of which your community expects in an educational assessment program.

Types of Assessment Instruments Developed

Districts have varying options in choosing from or selecting combinations of assessment strategies to determine whether students are meeting targeted district objectives. Consequently, assessment strategies sampled from among three assessment options, including portfolio, have been assembled. These options range from traditional, to on-demand events, to more authentic tasks. The more authentic assessment strategies (i.e., Type 2 and Type 3) are designed to be student centered and conducted within an instructional – rather than solely testing – environment. Districts may choose to employ a balance of these instrument types (including portfolio), possibly in combination with other assessment strategies, to assess student performance and their CBE programs.

These assessment strategies are organized into three types of model science assessment instruments at grade-levels — 1, 2, 3, 4, 5, 6, 7, and 8. Characteristics of the three types are summarized below:

	Type	Description
	• **1** (*Traditional*)	Combination of multiple-choice, short answer and extended response items; requires a minimum of a class period to complete; scored with answer key in combination with (interviews at first- and second-grade and) rubrics.
	• **2** (*Performance-Like*)	On demand problem-solving events; requires more than one class period to complete and some out-of-class time; scored holistically with portfolio scoring guide and interviews; or in combination with check-lists and rubrics.
	• **3** (*Open-Ended*)	Relevant inventive and creative application-based performance tasks; requires more out-of-class time to complete; holistic scoring (i.e., portfolio scoring guide and interviews.)

Scenario-based, task-oriented assessment items are used across all types. These items are designed to highlight student demonstrations of depth of knowledge; evidence of inquiry; communication of thinking; and relevance to society. Student demonstrations, products, and self-evaluations that result from these assessment items (to be given throughout the school year) are quite suitable for collecting in a student portfolio and reviewed at year's end as part of an overall appraisal of student progress.

Design of Model Assessment Instruments

Certain assumptions have been made regarding use of these instruments. To better understand their intended use, we make explicit those assumptions — including balanced assessments; test development; materials and conditions for assessment; relationship to 4th, 6th and 9th Grade Proficiency Tests; and student evaluation.

Balanced Assessments

The instruments provided include blocks of assessment items that are designed to provide a good measure of whether students can perform satisfactorily relative to identified objectives. These items have been chosen by science education professionals for their appropriateness and to complement the spirit and intent of the Science Model. A **Content Summary Chart** accompanies each grade-level instrument. The chart contains the following references for each block of assessment items:

- page locations of suggested connections with specific content examples across the three science content domains (science in living, earth/space, and physical systems);
- identification of potential portfolio items/entries (Type 2 and Type 3 only);
- answer key (Type 1 only) or see discussion (for constructed response, Type 2, and Type 3 items);
- suggested performance levels (acquiring, processing, and extending scientific knowledge);
- suggested connections with Science Model grade-level performance objectives;
- suggested connections with instructional objectives from all four Science Model instructional strands;
- suggested connections with unifying concepts (e.g., systems, models, patterns, constancy); and
- suggested connections with Ohio Proficiency Test Outcomes.

This information is provided to assist district efforts to plan and implement a balanced CBE science program. By design, these assessment instruments provide a model for creating links between, among, and across assessment blocks, types of instruments, and grade levels. "The science program offered in schools must be articulated, pre K - 12 to meet the goals set by districts' science curricula." (*Ohio's Model Competency-Based Science Program*, p. 4) District strategies to achieve this end should accommodate "[t]eachers of all grade levels [meeting to] decide on the appropriate placement of science units containing scientific knowledge and skill that are increasingly sophisticated." (*Ohio's Model Competency-Based Science Program*, p. 15)

In the *Content Summary Chart*, the Model's instructional objectives are referenced at each grade level by such coding as **I: 1, 3** — indicating the instructional strand, *Scientific Inquiry*, and specifically *instructional objectives 1* and *3*. For your convenience and handy reference, a numbered listing of all Model instructional objectives appropriate to the grade-level is included with all Type 1 instruments, or Type 2 instruments for fourth- and sixth-grade.

Also in the *Content Summary Chart*, suggested connections with the fourth-, sixth-, and ninth-grade Ohio Proficiency Test Outcomes are referenced at each grade level by such coding as **N: 1, 3** — indicating the proficiency test strand, *Nature of Science*, and specifically *proficiency test outcomes 1* and *3*. These outcomes are found in three Department publications: 1) Science: Ohio's Model Competency-Based Program (reprint October '96), 2) Fourth-Grade Proficiency Tests: Information Guide, 3) Sixth-Grade Proficiency Tests: Information Guide and 4) Fact Sheet Ninth-Grade Proficiency Test in Science.

Test Development

The assessment strategies assembled here represent a revision of 1995 field test instruments. During the 1995-96 school year, we collected specific information through limited field test sites and formed expert panels to advise the subsequent revision of these instruments. This revision also benefits from Ohio's ongoing participation in CCSSO SCASS science assessment item and science portfolio development. Although these revised assessments closely match the Model, the district will need to compare these materials with the content of the local CBE science program.

The assessment blocks in each instrument are organized by instructional topic for the purpose of referencing by staff and students. (See the *Content Summary Chart)* These topics serve only to provide a content context for students to demonstrate depth of knowledge; evidence of inquiry; communication of thinking; and relevance to society. These topics **do not** constitute a content mandate for district CBE science programs. Local variability in resources, expertise, and emphasis and rigor should ultimately shape the final form of the district CBE assessments.

As additional science assessment items and science portfolio materials are developed through the CCSSO SCASS Science Project, these strategies and materials will be made available to district CBE curriculum and instruction planners.

Materials and Conditions for Assessment

Conducting assessments in a standardized manner assumes standard assessment conditions appropriate to the grade-level. For all types of instruments all students in the district get:

- the same assessment (and will have access during the assessments to appropriate materials and tools);
- assessments that are based on the same performance objectives;
- assessments that are scored in the same manner (suggested rubrics and science portfolio scoring guide are provided); and
- assessments that are administered in a comparable time frame (suggested time allocations are intended only as guides).

Relationship to 4th, 6th and 9th Grade Proficiency Tests

These instruments are designed to assess CBE science program objectives at a particular grade level. They are not intended as off-grade-level proficiency tests - assessing cumulative performance over several grades. However, a strongly balance CBE science program provides the background for a strong student performance on subsequent proficiency tests. These instruments reflect the quality of assessment strategies available to date which assess the breadth and richness of the program for individual grade levels. The use of these instruments should support a high quality district program that strives for superior student performance, including that on proficiency testing. To reinforce the curriculum connection, the *Content Summary Chart* identify the Ohio Proficiency Test Outcomes demonstrated through student performance in each of the assessment blocks.

Student Evaluation

Evaluation decisions (i.e., student grades and student promotion) should reflect comprehensive documentation that occurs throughout the school year (e.g., formal and informal teacher-student interviews and observations, student portfolio building, culminating performances). Such decisions are best left to the classroom teacher and subject to district policies. Whereas the results from these CBE instruments might be used, in part, to inform such decision, they are not intended for that exclusive purpose or use.

Item Discussion

ITEM DISCUSSIONS accompany all GRADE-LEVEL MODEL CBE ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content. A **Rubric Summary** further organizes these elements in a quick reference table reflective of suggested stages of an acceptable student response. A *Science Portfolio Scoring Guide* is provided with parameters for holistic evaluation of TYPE 2 and TYPE 3 ASSESSMENT work being considered as potential science portfolio entries. (See *Science Portfolio Scoring Guide* on *page viii.*)

Science Portfolio Framework

The diagram below is provided to communicate the structure and relationship of the components of the Ohio Model CBE science portfolio. From bottom to top, the figure illustrates the process that involves students, with assistance and feedback from teachers, in documenting their learning as they investigate scientific principles and in using a portfolio of their work to determine what they have learned.

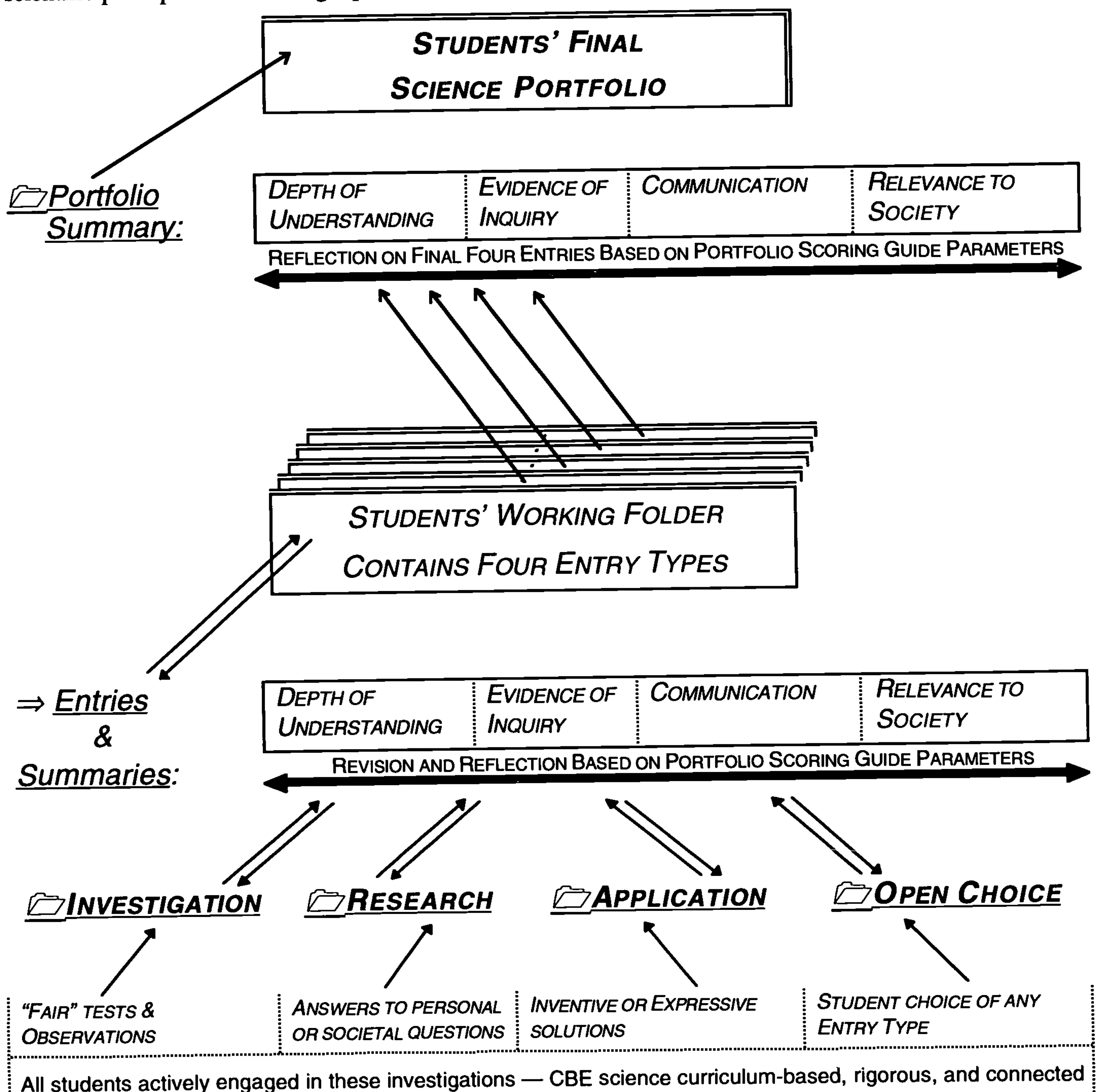


Figure 1: Ohio Model CBE Science Portfolio

RATIONALE. A science portfolio assessment strategy supports improved proficiency performance. A portfolio supports science program implementation, framing teachers' on-going guidance and suggestions to keep students' work manageable, productive, and relevant to the objectives for student learning. A portfolio interfaces with previous assessment development*. A portfolio allows holistic assessment of students' doing and knowing science. (See *Figure 1: Ohio Model CBE Science Portfolio* on *page vi.*)

ASSUMPTIONS. Potential science portfolio entries will result from a combination of teacher initiated questions and student initiated questions. Students will learn and extend self-evaluation skills. The student's **final science portfolio** contains his or her choices of the best four products, with revisions, to represent his or her science learning. These products are selected from among all the learning activities and demonstrations he or she completes over a set time period (i.e., quarter, semester, year). Products are selected as **portfolio entries** and placed in one of the four categories of science work described below.

🗁 **Investigation** — Experimental research: Requires students to design, carry-out, and report results of an observational and/or experimental process.

🗁 **Research** — Non-experimental research: Requires students to access, analyze, synthesize, evaluate, and use the kind of information the average citizen might use to investigate and solve a problem of personal or societal significance. Students also identify alternatives, trade-offs, and make a decision regarding an issue.

🗁 **Application** — Inventive or expressive in nature: Requires students to choose a manner of demonstrating what they *can do*, what they *can apply*, and how thoroughly they *can justify* their thinking. An inventive application allows students to show how scientific information can be used to solve real-world problems. An expressive application allows students to communicate scientific information in a medium of his or her choice. His or her work includes a written or verbal description of the scientific basis for the entry.

🗁 **Open Choice** — Students may use this entry to provide further evidence of his or her science learning. This entry may be another piece of the previously described categories of science work.

Each entry is accompanied by the student's **entry summary** (self-evaluation). Students discuss how well the entry reflects the *Science Portfolio Scoring Guide's* **four parameters.** In the process students answer the corresponding questions.

• Depth of Understanding	How well do I know science?
• Evidence of Inquiry	What can I do in science?
• Communication	How well do I communicate what I know and can do in science?
• Relevance to Society	How well do I show how science affects people's lives

🗁 **Portfolio Summary** — The *fifth entry* of the students' final science portfolio: The student writes his or her **portfolio summary** to illustrate how the final portfolio entries reflect one or more of the above **four parameters.**

Student Evaluation and the *Science Portfolio Scoring Guide*. Teachers, parents, and administrators can use the **portfolio summary** as a road map of how students' final portfolios demonstrate progress toward the objectives of instruction in place of and/or in addition to all other assessment strategies. The act of scoring students' final science portfolios may be mediated by teachers (and others) holistically comparing students' final portfolios to the suggested parameters in the *Science Portfolio Scoring Guide*. In this process take into consideration that each student entry (e.g., product or demonstration) need not reflect all parameters, or all indicators for all parameters in the *Science Portfolio Scoring Guide* (i.e., the *Guide* is not intended for use as a checklist). A district may elect to design their own portfolio scoring guide. Teachers will need time and on-going support to grow in confidence in implementing the district competency-based science program using portfolios.

Portfolio Discussion/Examples: *Note: Refer to the portfolio folder icons, 🗁, in the table titled **Grade-Level Instruments Provided,** on *page ii.* Use this table to locate science portfolio materials.

Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description: Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

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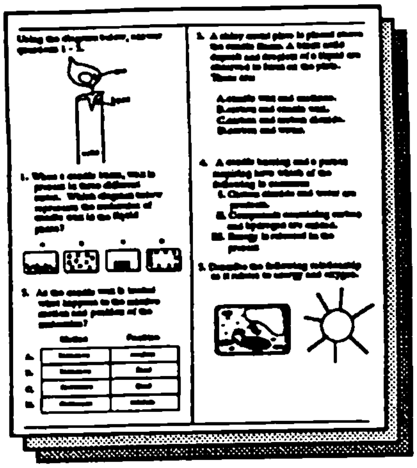
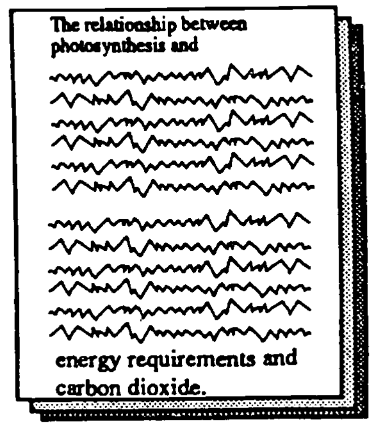
Type 1

First Grade Science

Competency-Based Education Assessment Series





° Multiple Choice and a Few Open-Ended Items °

(Traditional)

Characteristics

- Requiring a minimum of a session
- Items may be read to the students and spelling assistance may be provided.
- Scoring of the items is done in combination with teacher interviews with individual students

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments reflect all performance levels, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure district assessments reflect a coherence with instructional strands and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.

• First Grade Type 1 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	Item	Answer	Performance Level	Performance Objective(s)	Instructional Objective(s)	Unifying Concept(s)	Proficiency Test Outcome(s) Fourth Grade
P. 1							
Objects' Materials	1	See Discussion	Processing	3	I: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 K: 1, 5, 6, 8, 9 C: 4, 5 A: 4, 5	Order and Organization, Models	N: 1, 2, 3, 4, 8 P: 11 E: L:
PP. 2 - 3							
Sorting Objects	2	B	Processing	3, 6	I: 1, 2, 3, 4, 6, 7, 8 K: 1, 5, 6, 8, 9 C: 1, 2, 4, 5, 8 A: 1, 4, 5	Order and Organization, Diversity	N: 1, 2, 3, 4, 5, 8, P: 11 E: L: 18
	3	A	Processing				
	4	See Discussion	Extending				
PP. 4 - 5							
Sorting Leaves	5	C	Processing	3, 6	I: 1, 2, 3, 4, 6, 7, 8 K: 2, 4, 5, 6, 9 C: 1, 2, 4, 5, 6, 7, 8 A: 1, 8	Order and Organization, Diversity	N: 1, 2, 3, 4, 5, 8 P: 11 E: L: 17, 18
	6	See Discussion	Processing				
	7	See Discussion	Extending				
PP. 6 - 7							
Food Web	8	B	Processing	7, 8, 9	I: 1, 4, 5, 7, 10, 11 K: 6, 8, 9 C: 2, 4, 5, 7 A: 1, 5	Systems, Cause and Effect	N: 1, 2, 4, 5, 8 P: E: L: 16, 18, 19
	9	A	Processing				
	10	A	Processing				
	11	See Discussion	Extending				

Ohio's Model Competency-Based Science Program

• Performance Objectives: Grade 1

1. Given a situation in which a physical change is evident, the learner will observe and describe the physical change.
2. The learner will follow a simple set of instructions to construct a useful item (e.g., bird feeder, doorstop).
3. Given a set of familiar objects, the learner will design and describe categories and use them to organize the set.
4. Presented with unfamiliar situations or phenomena, the learner will ask questions related to cause and effect.
5. Given a familiar but unordered sequence of pictures that represent a physical change, the learner will describe the sequence using terms such as before, during, and after.
6. The learner will use a classification system that he/she has previously developed to classify a new set of items, citing modifications of the systems as necessary.
7. The learner will observe events in which the causes of the effects are not observable (e.g., magnets, static electricity, illness, respiration rate, wind), and ask questions about their effects.
8. Given a simple question regarding natural phenomena, the learner will suggest several places to find information that may lead to answers to the questions.
9. Provided with a suggested familiar organism, the learner will describe or draw a picture of a simple home for the organism and describe its contributions to meeting the needs of the organism.
10. Provided with a familiar object, the learner will describe the potential safe uses of the object.

structional Strands • Grade 1•

Objectives	*Inquiry* • The learner will:	*Knowledge* •The learner will:	*Conditions* • The learner will be:	*Applications* • The learner will be:
1	make multiple observations of events and explorations using their five senses.	explore simple models of very large and very small objects that can be made from simple familiar materials (e.g., clay, sand, paper, wood).	selecting material related to science, technology, topics and questions of personal interest (e.g., print, audiovisual, electronics).	searching for and collecting information from a variety of sources on topics of interest to complete a task (e.g., library collections, hobby collections, stories and legends, pictures, persons).
2	investigate and discuss measurement using standard and non-standard units.	explore different factors that affect the rate of change in the attributes of organisms and objects (e.g., melting of ice, changing leaves).	discussing events (both short and long duration) that occur in the learning environment when they occur.	discussing the reasonableness of legends, stories, fantasies, and dreams presented in books, television, radio, and cartoons.
3	make simple graphs (e.g., histograms, pictographs) of observations with the aid of various technologies and real objects.	explore observable patterns in their lives (e.g., seasons, day/night cycles).	meeting persons who use science and discussing the science they use.	constructing carefully designed and useful items (e.g., bird feeders, book ends, doll houses, door stops, and others).
4	seek information from many different sources.	explore the abilities of some objects to influence other objects (e.g., wind, magnets, static electricity, and others).	exploring ideas over extended periods of time.	practicing appropriate conservation of materials and waste disposal.
5	ask "What if ...?" questions and explore multiple possible explanations.	explore his or her own classification schemes to distinguish among and between objects and organisms in terms of observable physical properties.	taking time to redesign and repeat investigations.	resolving personal disputes and making decisions.
6	persist at simple tasks.	explore similarities and differences observed in a wide diversity of objects and organisms.	exploring discrepant events.	
7	test ideas using physical materials and models.	explore the concepts of time (e.g., before, after, and during).	investigating indoor and outdoor environments.	
8	make and organize collections individually and collaboratively.	explore drawings and models of very large and very small objects.	experiencing and describing food in sensory terms.	
9	conduct simple explorations based on his/her own questions.	explore different ways (e.g., orally, pictorially) of asking different kinds of questions (e.g., who, what, where, why, when and how?).	exploring and discussing natural phenomena with older and younger learners in small- and large-group settings.	
10	examine existing knowledge by asking 'Why?' and 'How do we know?'		using keyboards (e.g., games, calculators, computers, musical instruments) to express ideas.	
11	respectfully consider the ideas and impressions expressed about natural events by others.			
12	record ideas, data, and events by using a variety of media (e.g., computer, audio, video, visual arts).			

About This Instrument

This **Type 1** assessment instrument is a combination of multiple choice and open-ended response items. The assessment may be administered individually, in small groups, or to the whole class. The teacher may read the items to the students and provide them with any spelling assistance they require. A rephrasing of the questions by the teacher during the administration of the assessment instrument may help the student recall and use what they know. Questions and answers both contain possible ambiguities so there must be dialogue between the teacher and the student to ensure the student is fully assessed.

Scoring of the items needs to be done in combination with teacher interviews with individual students, either during the administration of the assessment if the instrument is administered individually, or after if administered to a group. It will be essential that the teacher ask clarifying questions to infer understanding from student responses.

The questions in multiple choice items (2, 3, 5, 8, 9, and 10) fundamentally have one correct answer but the other items are open to interpretation. For example, the correct response to the first question in item 1 could be any number, if justified by the student, that indicates the student understands that a pencil is made of more than one material. An answer of "one material" would not be correct but "two, three, or four" might be. The correct answer to the second question, that a shell is made of only "one material," may not be the answer a student would give if he or she is thinking of their toy shell made of plastic and wood. The objective is for the student to know if an object is made of one or more than one material. In this example the student would know but would give the wrong answer.

Many of the items on this assessment instrument refer to a graphic. The teacher needs to know if the graphic conveys the correct meaning to the student in order for the teacher to infer correctly if the student has the knowledge and reasoning skills the item is designed to assess. The teacher should provide each student the opportunity to clarify and justify inherently ambiguous responses. Placing the graphics in front of the student as they are working on the items that refer to them should be considered. This could be accomplished by back-to-back printing.

It is important that the student's teacher be the assessor. This assessment instrument is sensitive to different meanings and to context. The teacher is the only one who knows their curriculum and the student well enough to contextualize and articulate meaningful questions and follow up on confused or ambiguous answers. Prompting, intervening, or cueing students in an offhanded way will not corrupt the test results on this assessment because without doing so the assessor will not have sufficient insight into the student's knowledge.

The specific knowledge and skills this instrument is designed to assess are outlined and explained in the teacher information section of this instrument. Correct spelling should not be used as an indicator of a student's scientific knowledge, however the use of precise scientific vocabulary can be. The use of the scientific terms *materials, properties, sort*, and *sense* are being assessed at this level.

Scoring information is provided in the teacher information section. Analysis of the item results for an individual student will assist in the determination of that student's attainment of the objective. Analysis of the item results for a grade level will assist in the determination of a program's effectiveness in helping the student attain the objectives. If this is to be used for EMIS reporting, determination of the attainment standard for the overall assessment will be necessary for reporting data to the State Board of Education on the number and percentage of students who have not made satisfactory progress toward achieving the objectives during the previous school year.

Teacher Information:

Major Concept: **Order and Organization**

Organize data, objects, or events by observing the world and looking for patterns.

The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- **sort** objects into two groups according to specific properties;
- record data on paper in an organized way;
- explain that sorting is a way of organizing objects;
- identify what properties they used to sort objects.

Scoring guide:
Information used to assess student skill for organizing objects will be based on the student's responses to **questions 2 through 7** and **individual teacher interviews.**

Concept: **Materials**

Objects can be described in terms of the **materials** they are made of (clay, cloth, paper, etc.) and their physical properties (color, size, shape, weight, texture, flexibility, etc.).

Students will identify objects made of certain materials and then sort them into two groups: (1) objects made of one material, and (2) objects made of more than one material.

The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- sort objects by the materials of which they are made;
- identify the materials in different objects;
- identify objects made up of more than one material;
- describe the procedure she/he followed to classify the objects

Scoring guide:
Information used to assess student understanding of the concept of material will be based on the student's responses to **questions 1 through 4** and **individual teacher interviews**.

Concept: **Properties of Objects and Materials**

The categories used to organize a set of objects are **properties** of the objects (or object's materials) such as size, shape, color, texture, shininess, absorbency, hardness, temperature, volume, pitch, weight, and transparency.

Some of the properties of leaves that could be used to sort them into two groups might be the following:

- bigger than my hand or smaller than my hand
- light or dark veins
- few or many veins
- green or not green
- one color or more than one color
- wavy or zigzag edges
- points or no points
- rough or smooth surface
- shiny or dull
- damaged or whole
- flat or round stems
- one or several parts
- fuzzy or waxy feeling

The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- describe the properties of an object;
- use one common property as a criteria to sort objects into two groups;
- say which sense they used to determine the property;
- classify correctly objects by the property identified by the teacher;
- identify correctly a property of the objects and classify the objects by that property;
- add an object correctly to a given classification scheme using an identified property;
- use properties as criteria to sort and sequence objects.

Scoring guide:
Information used to assess student understanding of the concept of property will be based on the student's responses to **questions 5 through 7** and **individual teacher interviews**.

Concept: **Food Web Systems**:

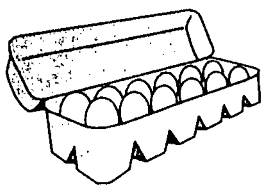
Plants and animals both need to take in water, and animals need to take in food. In addition, plants need light. Animals eat plants or other animals for food and may also use plants (or even other animals) for shelter and nesting. A **food web** is a diagram that represents the feeding dependencies between organisms. The arrows indicate the direction the food moves through the **system**.

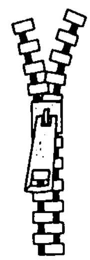
The student's **Depth of Understanding** can be assessed by the extent to which the student can:

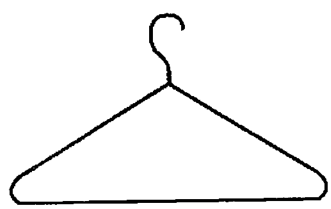
- understand the feeding relationships that exist among the organisms pictured;
- understand that some animals feed on plants and some animals feed on other animals;
- understand the predator-prey relationship that exist among the organisms pictured.

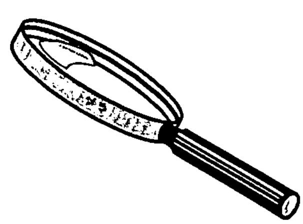
Scoring guide:
Information used to assess student understanding of the concept of food web will be based on the student's responses to **questions 8 through 11** and **individual teacher interviews**.

1. How many different kinds of materials make up each object? Write the number next to the object. Tell your teacher what you think the materials might be.



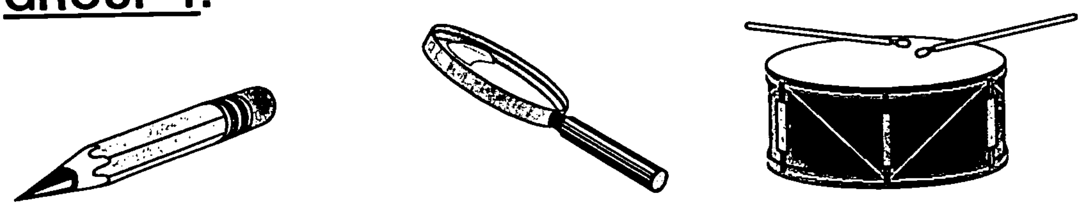




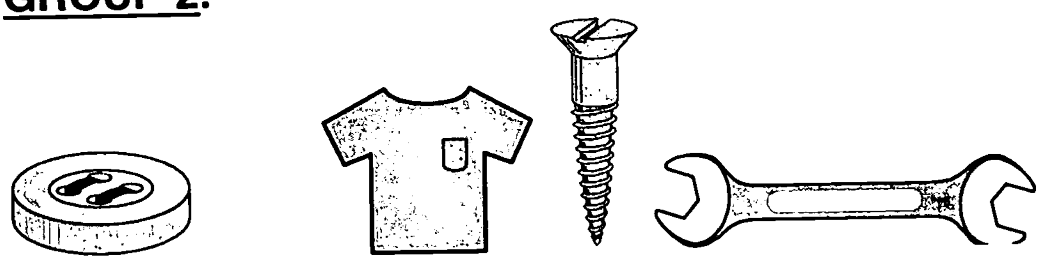


These objects were sorted into two groups.

GROUP 1:



GROUP 2:



2. Of how many different kinds of materials are the objects in GROUP 1 made?

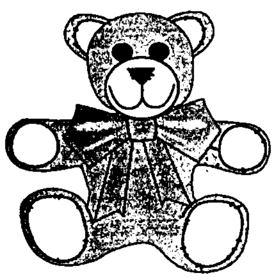
A. One
B. More than one

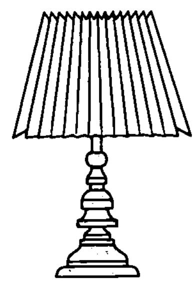
3. Of how many different kinds of materials are the objects in GROUP 2 made?

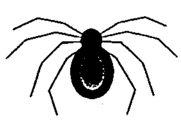
A. One
B. More than one

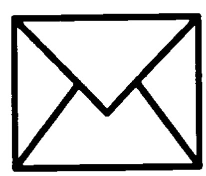
4. **Look at the objects on this page and decide in which group they belong. <u>GROUP 1</u> has objects made of one material. <u>GROUP 2</u> has objects made of more than one material.**

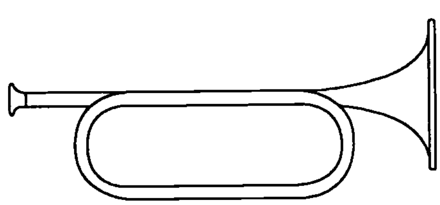
Write "1" next to the **objects** that belong in **<u>GROUP 1</u>**
and
write "2" next to the **objects** that belong in **<u>GROUP 2</u>**.











Tell your teacher why you think these objects belong in group 1 or group 2.

These leaves were sorted into two different groups.

Leaf group 1:

Leaf group 2:

5. What property was used to sort the leaves?

A. One or several parts.
B. Large or small.
C. Rounded or smooth edges.

6. What property do all leaves in this second group have ?

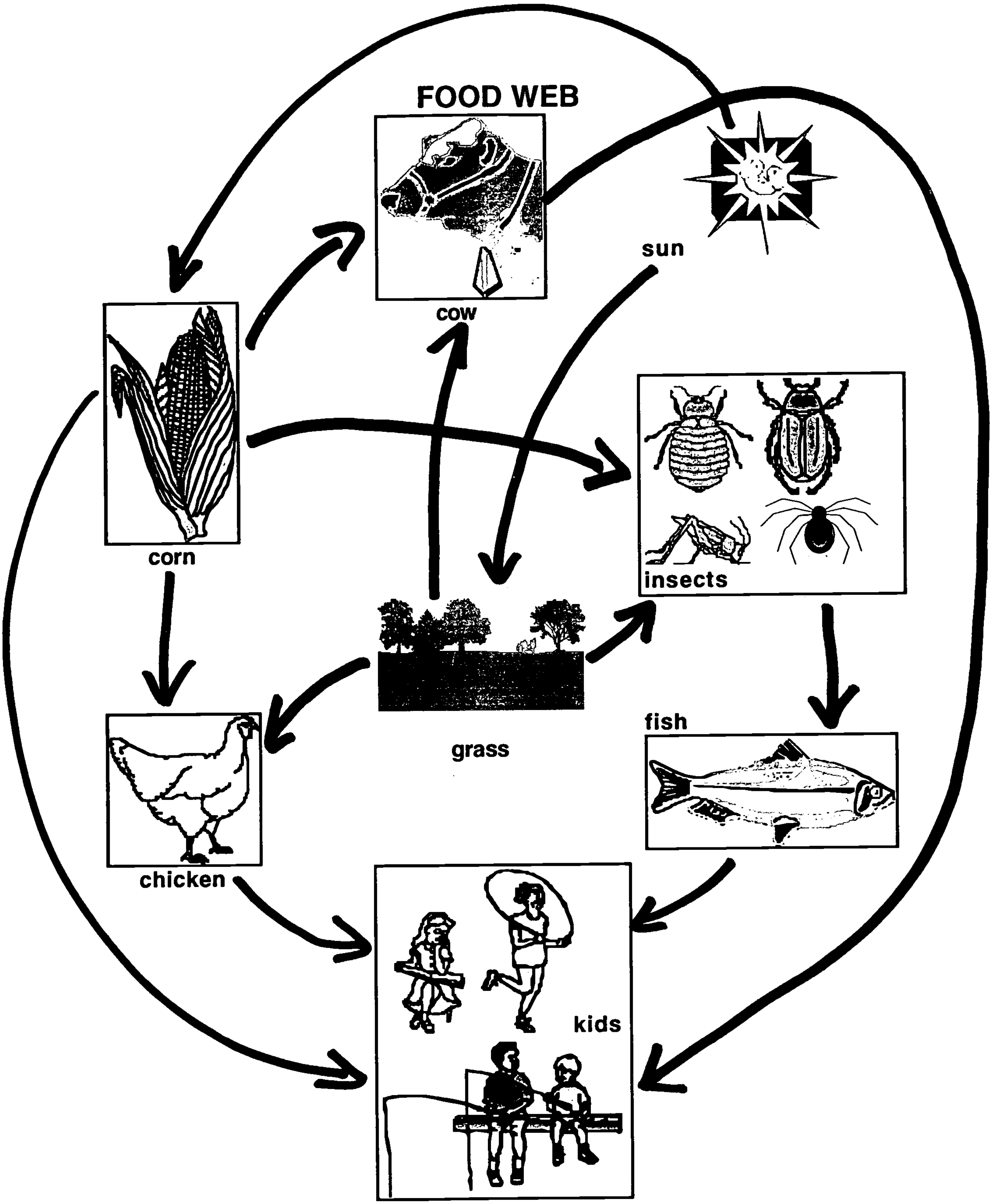
They are all ______________________________.

Leaf group 1:

Leaf group 2:

7. Sort these leaves the same way. Write "1" under the leaves that belong in GROUP 1 and "2" under the leaves that belong in GROUP 2.

Draw a new leaf that belongs in GROUP 2. Tell your teacher why the leaf you drew doesn't belong in GROUP 1.


FOOD WEB
sun
cow
corn
insects
grass
chicken
fish
kids

Look at the pictures in the **FOOD WEB**. Find the picture of the **cow, sun, insects, fish, kids, chicken, corn**, and the **grass**.

Answer the following questions:

8. The arrow coming from the grass is pointing to the insects. This means grass is eaten by insects. What else is eaten by insects?

A. Cows
B. Corn
C. Sun

9. One arrow shows that fish are eaten by kids. What else are eaten by kids?

A. Cows
B. Grass
C. Insects

10. There is no arrow pointing from the grass to the corn. Why?

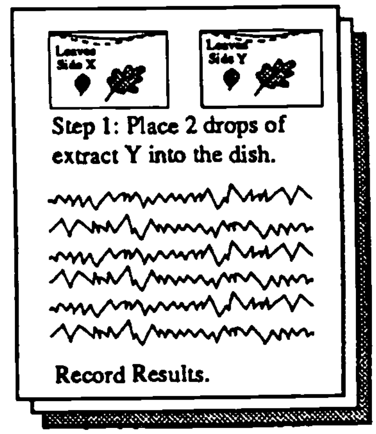
A. Because they are both plants and plants need the sun's light in order to grow.
B. Because corn is eaten by children and grass is not.

11. What do you think would happen to the corn and the grass if there was too much rain and not enough sunlight for a month? Write your answer below.

Type 2

First Grade Science

Competency-Based Education Assessment Series



° Open-Ended and Multiple Choice Items °

(Performance-Like)

Characteristics

- Open-ended and multiple choice response items, requiring a single session
- Scoring of the items is done in combination with teacher interviews with individual students

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments reflect all performance levels, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with instructional strands and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.

• First Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	Item	Answer	Performance Level	Performance Objective(s)	Instructional Objective(s)	Unifying Concept(s)	Proficiency Test Outcome(s) Fourth Grade
P. 1							
Objects' Materials	1	See Discussion	Processing	3	I: 1, 2, 4, 5, 6, 7, 8, 9, 10 K: 1, 5, 6, 8, 9 C: 4, 5 A: 4, 5	Order and Organization, Models	N: 1, 2, 3, 4, 8 P: 11 E: 15 L:
PP. 2 - 3							
Sorting Objects	2	See Discussion	Processing	3, 6	I: 1, 2, 3, 4, 6, 7, 8 K: 1, 5, 6, 8, 9 C: 1, 2, 4, 5, 8 A: 1, 8	Order and Organization, Diversity	N: 1, 2, 3, 4, 5, 8 P: 11 E: 15 L: 18
	3	See Discussion	Processing				
	4	See Discussion	Extending				
P. 4							
Hot and Cold	5	See Discussion	Processing	3, 6	I: 1, 2, 3, 4, 6, 7, 8 K: 1, 5, 6, 8, 9 C: 1, 2, 4, 5, 8 A: 1, 8	Order and Organization, Diversity	N: 1, 2, 3, 4, 5, 8 P: 11 E: 15 L: 18
	6	See Discussion	Processing				
	7	See Discussion	Extending				
PP. 5 - 6							
Sorting Leaves	8	See Discussion	Processing	3, 6	I: 1, 2, 3, 4, 6, 7, 8 K: 2, 4, 5, 6, 9 C: 1, 2, 4, 5, 6, 7, 8 A: 1, 8	Order and Organization, Diversity	N: 1, 2, 3, 4, 5, 8 P: 11 E: L: 17, 18
	9	See Discussion	Processing				
	10	See Discussion	Extending				
PP. 7 - 8							
Food Web	11	See Discussion	Processing	7, 8, 9	I: 1, 4, 5, 7, 10, 11 K: 6, 8, 9 C: 2, 4, 5, 7 A: 1, 5	Systems, Cause and Effect	N: 1, 2, 4, 5, 8 P: E: L: 16, 18, 19
	12	See Discussion	Processing				
	13	See Discussion	Processing				
	14	See Discussion	Processing				

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• Performance Objectives: Grade 1

1. Given a situation in which a physical change is evident, the learner will observe and describe the physical change.
2. The learner will follow a simple set of instructions to construct a useful item (e.g., bird feeder, doorstop).
3. Given a set of familiar objects, the learner will design and describe categories and use them to organize the set.
4. Presented with unfamiliar situations or phenomena, the learner will ask questions related to cause and effect.
5. Given a familiar but unordered sequence of pictures that represent a physical change, the learner will describe the sequence using terms such as before, during, and after.
6. The learner will use a classification system that he/she has previously developed to classify a new set of items, citing modifications of the systems as necessary.
7. The learner will observe events in which the causes of the effects are not observable (e.g., magnets, static electricity, illness, respiration rate, wind), and ask questions about their effects.
8. Given a simple question regarding natural phenomena, the learner will suggest several places to find information that may lead to answers to the questions.
9. Provided with a suggested familiar organism, the learner will describe or draw a picture of a simple home for the organism and describe its contributions to meeting the needs of the organism.
10. Provided with a familiar object, the learner will describe the potential safe uses of the object.

About This Instrument

This **Type 2** assessment instrument is a combination of multiple choice and open-ended response items. Most of the items are open-ended. The assessment may be administered individually, in small groups, or to the whole class. The teacher may read the items to the students and provide them with any spelling assistance they require. A rephrasing of the questions by the teacher during the administration of the assessment instrument may help the student recall and use what they know. Questions and answers both contain possible ambiguities so there must be dialogue between the teacher and the student to ensure the student is fully assessed.

Scoring of the items needs to be done in combination with teacher interviews with individual students, either during the administration of the assessment if the instrument is administered individually, or after if administered to a group. It will be essential that the teacher ask clarifying questions to infer understanding from student responses.

The questions in multiple choice items (2, 3, 4, and 6) fundamentally have one correct answer but are open to interpretation as are the open-response items. For example, the apple in item four belongs in group 2 because an apple is made of only one material (apple). However, a student may be thinking of an apple at home that is made of wood and glass, and place the apple in the wrong group. The objectives are to distinguish between objects made of one or more than one material and to sort objects by the materials of which they are made. The student in this example would be able to do both.

Many of the items on this assessment instrument refer to a graphic. The teacher needs to know if the graphic conveys the correct meaning to the student in order for the teacher to infer correctly if the student has the knowledge and reasoning skills the item is designed to assess. Provide each student the opportunity to clarify and justify inherently ambiguous responses. Placing the graphics in front of the student as they are working on the items that refer to them should be considered. This could be accomplished by back-to-back printing.

It is important that the student's teacher be the assessor. This assessment instrument is sensitive to different meanings and to context. The teacher is the only one who knows the students and the curriculum well enough to contextualize and articulate meaningful questions and follow up on confused or ambiguous answers. Prompting, intervening, or cueing students in an offhanded way will not corrupt the test results on this assessment because without doing so the assessor will not have sufficient insight into the student's knowledge.

The specific knowledge and skills this instrument is designed to assess are outlined and explained in the teacher information section of this instrument.

Correct spelling should not be used as an indicator of a student's scientific knowledge, however the use of precise scientific vocabulary can be. The use of the scientific terms *materials, properties, sort*, and *sense* are being assessed at this level.

Scoring information is provided in the teacher information section. Analysis of the item results for an individual student will assist in the determination of that student's attainment of the objective. Analysis of the item results for a grade level will assist in the determination of a program's effectiveness in helping the student attain the objectives. If this is used for EMIS reporting, determination of the attainment standard for the overall assessment will be necessary for reporting data to the State Board of Education on the number and percentage of students who have not made satisfactory progress toward achieving the objectives during the previous school year.

Teacher Information:

Major concept: **Order and Organization**
Students should be able to organize data, objects, or events by observing the world and looking for patterns.

The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- explain that sorting is a way of organizing objects
- identify what properties she/he used to sort objects

The student's **Evidence of Inquiry** can be assessed by the extent to which the student can:

- **sort** objects into two groups according to specific properties
- record data on paper in an organized way

Concept: **Materials**

Objects can be described in terms of the **materials** from which they are made (clay, cloth, paper, etc.) and their physical **properties** (color, size, shape, weight, texture, flexibility, etc.).

Students will identify objects made of certain materials and then sort them into two groups: (1) objects made of one material, and (2) objects made of more than one material.

The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- identify the materials in different objects;
- identify objects made up of more than one material

The student's **Evidence of Inquiry** can be assessed by the extent to which the student can:

- sort objects by the materials of which they are made
- describe the procedure they followed to classify the objects

Information to be used to assess students will be based on the student responses to **questions 1-4** and individual **teacher interviews** with student.

Concept: **Property**

The categories used to organize a set of objects are **properties** of the objects (or object's materials) such as size, shape, color, texture, shininess, absorbency, hardness, temperature, volume, pitch, weight, and transparency.

Some of the properties of leaves that could be used to sort them into two groups might be the following:

- bigger than my hand or smaller than my hand
- light or dark veins
- few or many veins
- green or not green
- one color or more than one color
- wavy or zigzag edges
- points or no points
- rough or smooth surface
- shiny or dull
- damaged or whole
- flat or round stems
- one or several parts
- fuzzy or waxy feeling

The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- describe the properties of an object
- say which sense he/she used to determine the property
- classify correctly objects by the property identified by the teacher
- add an object correctly to a given classification scheme using an identified property

The student's **Evidence of Inquiry** can be assessed by the extent to which the student can:

- use one common property as a criteria to sort objects into two groups
- identify correctly a property of the objects and classify the objects by that property
- use properties as criteria to sort and sequence objects

Information to be used to assess students will be based on the student responses to **questions 5-10** and individual **teacher interviews** with student.

Concept: **Food Web System**:
Plants and animals both need to take in water, and animals need to take in food. In addition, plants need light. Animals eat plants or other animals for food and may also use plants (or even other animals) for shelter and nesting. A **food web** is a diagram that represents the feeding dependencies between organisms. The arrows indicate the direction the food moves through the **system**.

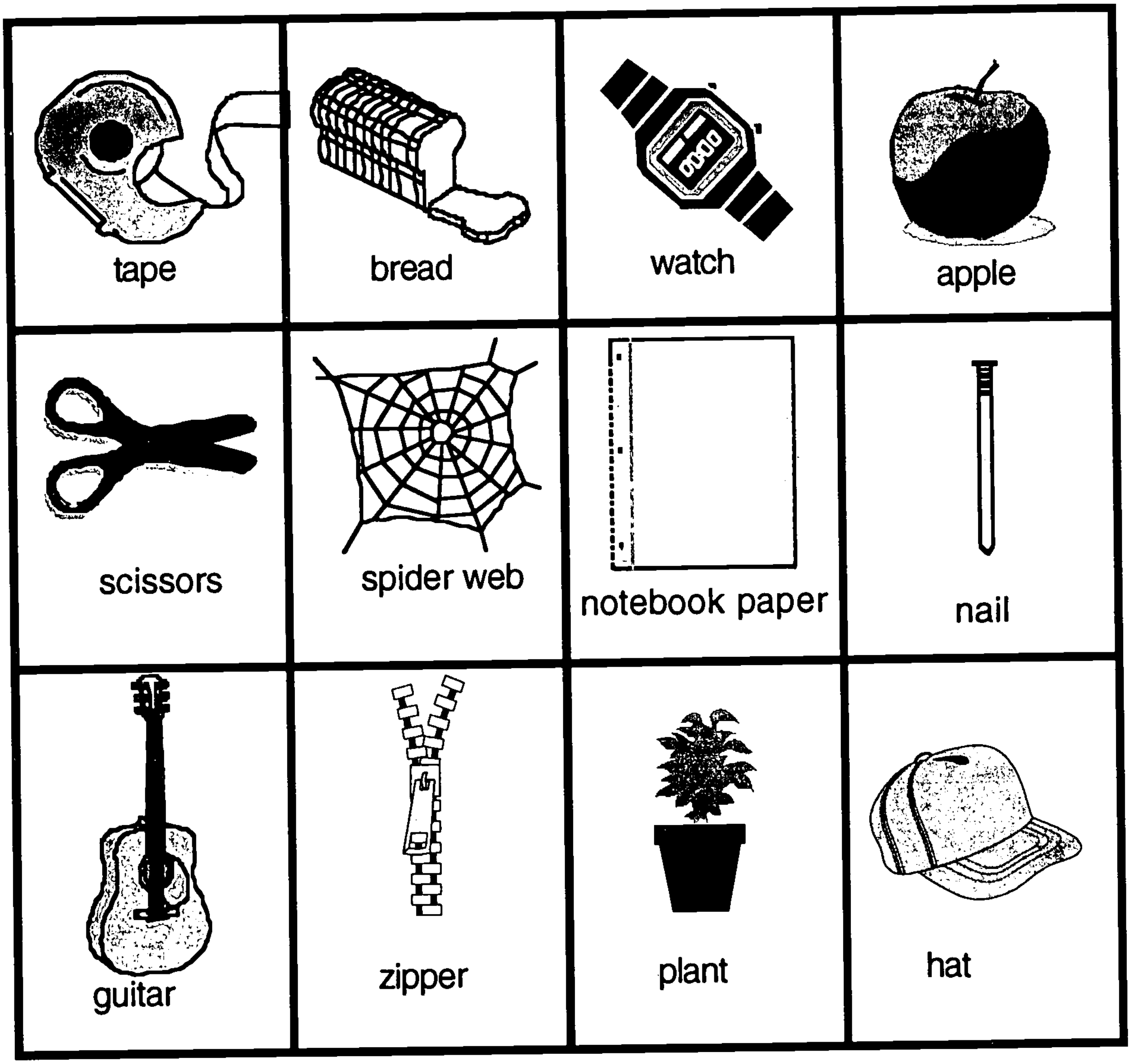
The student's **Depth of Understanding** and **Evidence of Inquiry** can be assessed by the extent to which the student can:

- understand the feeding relationships that exist among the organisms pictured
- understand that some animals feed on plants and some animals feed on other animals
- understand the predator-prey relationship that exist among the organisms pictured

Talk with students individually to determine what they meant and to uncover any misunderstandings. Reversing the arrow may not indicate the student does not understand the feeding relationship and therefore the meaning of *food web*.

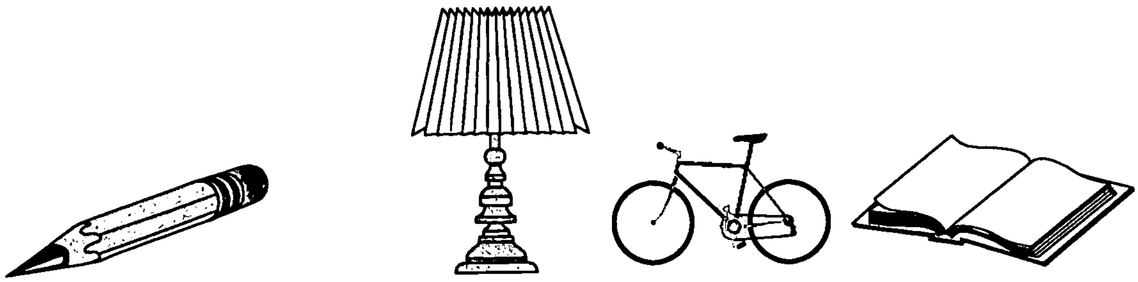
Information to be used to assess students will be based on the student responses to **questions 11-14** and individual **teacher interviews** with student.

1. List the objects made of only **one** material. Can you name any of the materials from which these objects are made?

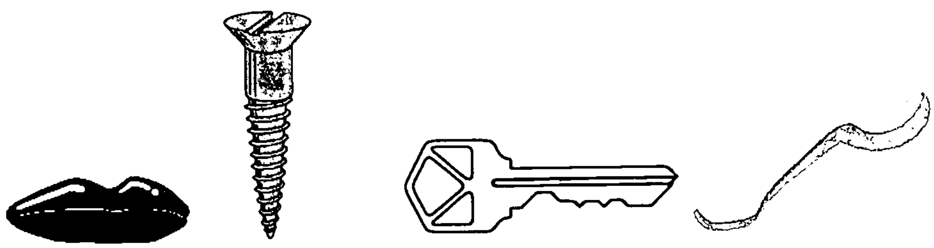


The objects on this page were sorted into two groups.

GROUP 1:



GROUP 2:



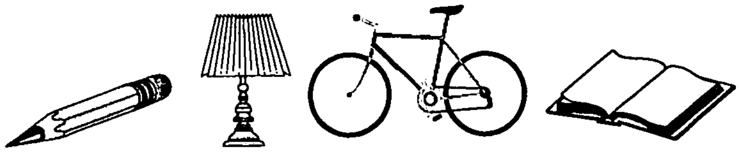
2. Are the objects in GROUP 1 made of one material or more than one?

Can you tell your teacher the names of any of the materials that make up these objects?

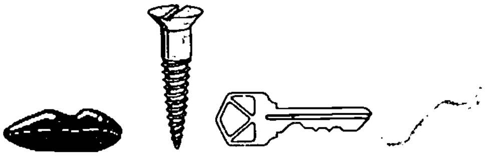
3. Are the lips, screw, key and spoon in GROUP 2 made of one material or more than one?

Tell your teacher what materials you think make up these objects.

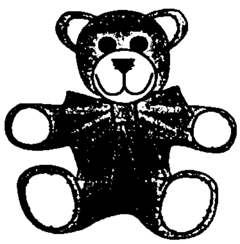
GROUP 1:

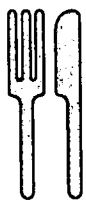


GROUP 2:

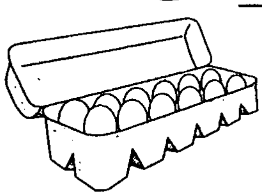


4. Write "1" next to the objects that belong in our <u>GROUP 1</u> and "2" next to the objects that belong in our <u>GROUP 2</u>.

 ____

 ____

 ____

 ____

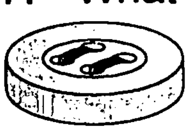
Look down at your shoe. In which group does it belong?

5. **Hot** and **Cold** are **properties** of many objects. Hot is a property of hot coffee and cold is a property of ice-cream. What other objects can be sorted by hot or cold? Add some more to the chart (you may draw pictures or write names).

COLD	HOT
	

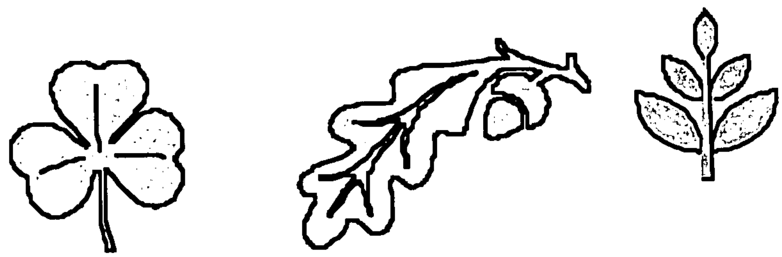
6. What **sense** do you use to find out if something is hot or cold?

7. What **properties** could you use to sort buttons?



These leaves were sorted into two groups.

LEAF GROUP 1:



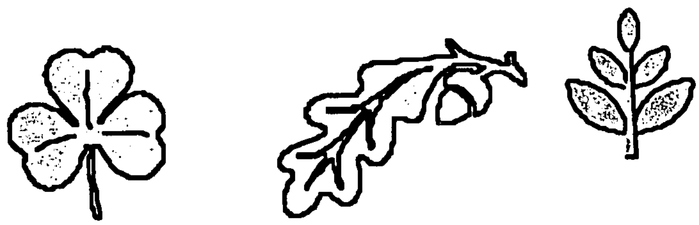
LEAF GROUP 2:

8. What property was used to sort the leaves?

9. What property do all leaves in this second group have ?

10. Sort these leaves the same way.

LEAF GROUP 1:



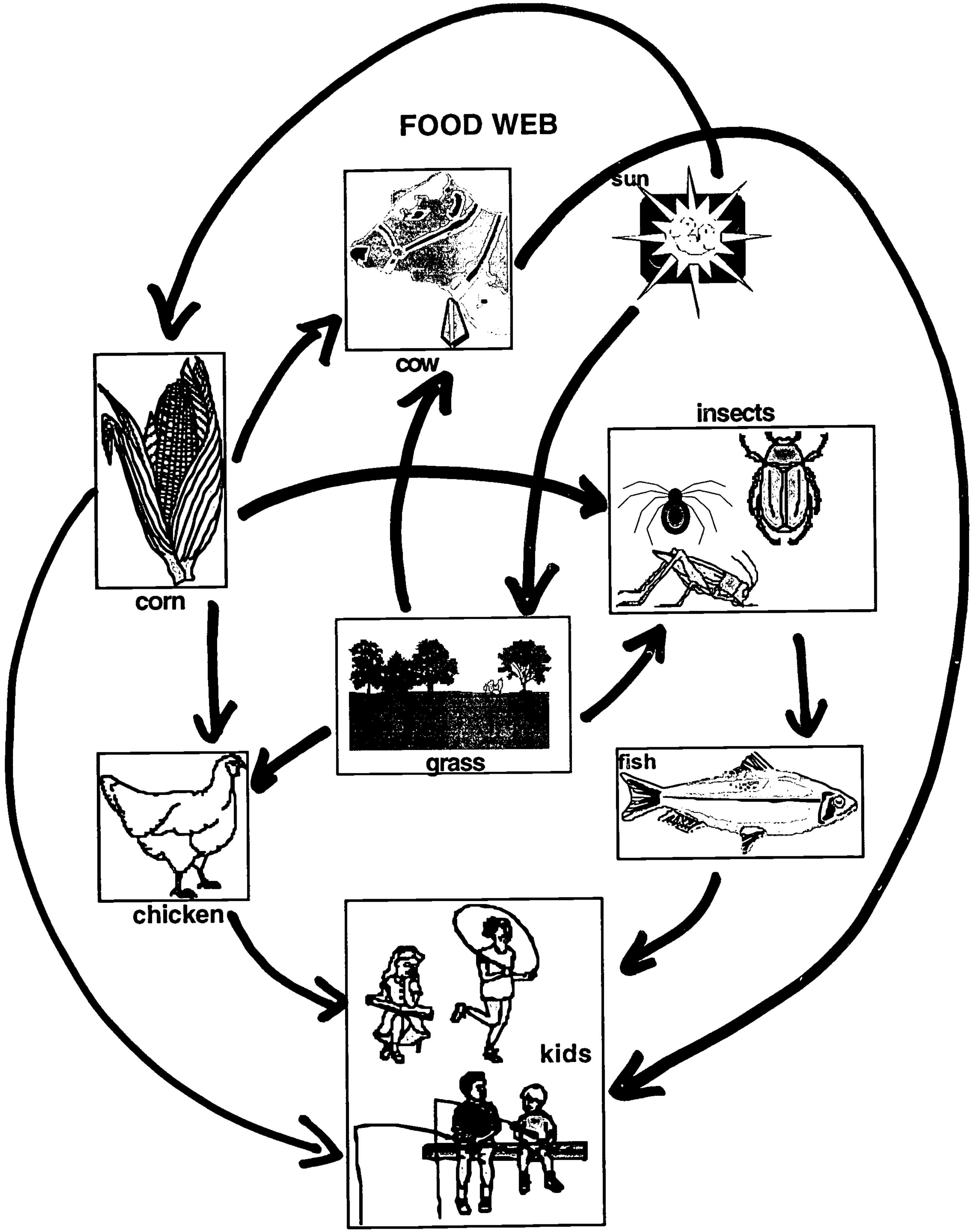
LEAF GROUP 2:

Write "1" under the leaves that belong in GROUP 1

and

write "2" under the leaves that belong in GROUP 2.

FOOD WEB



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Look at the pictures in the **Food Web**. Find the picture of the **cow, sun, insects, fish, kids, chicken, corn,** and the **grass** in the middle.

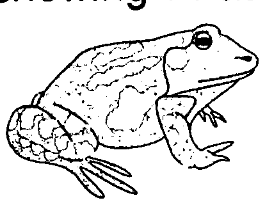
Answer the following questions:

11. The **arrow** coming from the grass **is pointing to** the insects. This means **grass is eaten by insects**. What else is eaten by insects?

12. Children (**kids**) need energy from food in order to grow. What does grass need for it to grow?

13. How does a **cow** get the energy it needs in order to live?

14. Add a **frog or rabbit** to the food web. Draw arrows showing what it eats. Tell your teacher why you think so.

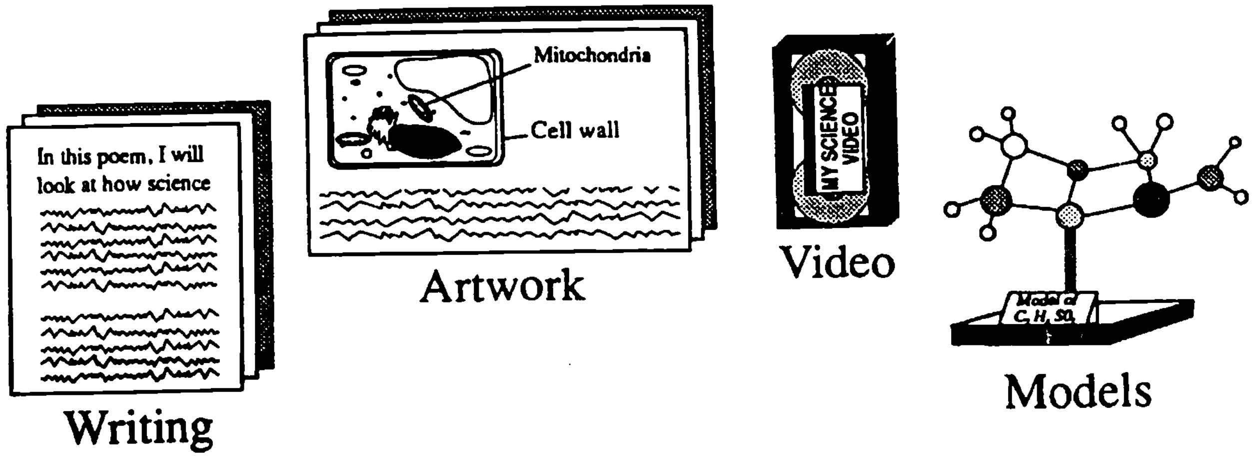


What eats frogs? Rabbits?

Type 3

First Grade Science

Competency-Based Education Assessment Series



Substantive Application-Based Performance Tasks

(Open-Ended)

Characteristics

- Relevant inventive and creative applications, requiring experimental research, non-experimental research, and more out-of-class preparation
- Holistic scoring (e.g., including interviews)

Item discussions provide an overview of items, pertinent content, and scoring parameters. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments reflect all performance levels, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with instructional strands and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.

• First Grade Type 3 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	Item	Answer	Performance Level	Performance Objective(s)	Instructional Objective(s)	Unifying Concept(s)	Proficiency Test Outcome(s) Fourth Grade
Task One: Properties of Materials		See Discussion	Acquiring Processing Extending	3, 6	I: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 K: 1, 5, 6, 8, 9 C: 1, 2, 4, 5 A: 1, 4, 5	Order and Organization, Diversity	N: 1, 2, 3, 4, 6, 7, 8 P: 11 E: 15 L:
Task Two: Order and Organization		See Discussion	Acquiring Processing Extending	3, 6	I: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 K: 2, 4, 5, 6, 9 C: 1, 2, 4, 5, 6, 7, 8 A: 1, 8	Order and Organization, Diversity	N: 1, 2, 3, 4, 5, 8 P: 11 E: 15 L: 17,18
Task Three: Food Web System		See Discussion	Processing Extending	7, 8, 9	I: 1, 4, 5, 7, 10, 11 K: 6, 8, 9 C: 2, 4, 5, 7 A: 1, 5	Systems, Cause and Effect	N: 1, 2, 4, 5, 8 P: E: L: 16, 18, 19

Ohio's Model Competency-Based Science Program

• Performance Objectives: Grade 1

1. Given a situation in which a physical change is evident, the learner will observe and describe the physical change.
2. The learner will follow a simple set of instructions to construct a useful item (e.g., bird feeder, doorstop).
3. Given a set of familiar objects, the learner will design and describe categories and use them to organize the set.
4. Presented with unfamiliar situations or phenomena, the learner will ask questions related to cause and effect.
5. Given a familiar but unordered sequence of pictures that represent a physical change, the learner will describe the sequence using terms such as before, during, and after.
6. The learner will use a classification system that he/she has previously developed to classify a new set of items, citing modifications of the systems as necessary.
7. The learner will observe events in which the causes of the effects are not observable (e.g., magnets, static electricity, illness, respiration rate, wind), and ask questions about their effects.
8. Given a simple question regarding natural phenomena, the learner will suggest several places to find information that may lead to answers to the questions.
9. Provided with a suggested familiar organism, the learner will describe or draw a picture of a simple home for the organism and describe its contributions to meeting the needs of the organism.
10. Provided with a familiar object, the learner will describe the potential safe uses of the object.

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About This Instrument

This **Type 3** assessment strategy is composed of three performance-based assessment tasks. The tasks may be administered individually to students sometimes working in pairs or small groups in whatever time frame deemed necessary.

It is important that the student's teacher be the assessor. The teacher is the only one who knows the student and the curriculum well enough to contextualize and articulate meaningful questions and follow up on confused or ambiguous answers. Sometimes a rephrasing of the question is all a student needs to recall and use what he or she "knows." Prompting, intervening, or cueing students in an offhanded way will not corrupt the results on this assessment because without doing so the assessor will not have sufficient insight into the student's knowledge.

The specific knowledge and skills these tasks (technically there is no instrument) are designed to assess are outlined and explained in the teacher information section. They are based on the Grade One Instructional and Performance Objectives in *Science: Ohio's Model Competency-Based Program.*

Guidelines must be established by districts for the use of the assessment task scoring rubrics to insure that the student's ability to justify or clarify a response is maximized. Ample opportunity for the student and teacher to explore, clarify and justify inherently ambiguous tasks and performances must be provided.

Scoring information is provided in the teacher information section. Analysis of the results for an individual student will assist in the determination of that student's attainment of the objective. Analysis of the results for a grade level will assist in the determination of a program's effectiveness in helping the student attain the objectives. If this is to be used for EMIS reporting, determination of the attainment standard for the overall assessment will be necessary for reporting data to the State Board of Education on the number and percentage of students who have not made satisfactory progress toward achieving the objectives during the previous school year.

Teacher Information:

Assessment Task ONE:

Concept: **Properties of Materials**

Objects can be described in terms of the **materials** they are made **of** (clay, cloth, paper, etc.) and their physical **properties** (color, size, shape, weight, texture, flexibility, etc.). Materials are the matter from which objects are made.

Students should be able to identify objects made of certain materials and then sort them into two groups: (1) objects made of one material, and (2) objects made of more than one material.

Teacher Instructions:

- First place an assortment of objects (10 or so) on a tray. Ask each student to pick up an object made of (1) wood, (2) metal, (3) plastic, (4) more than one material, and so on.

- Next ask the students who can identify objects made of more than one material to sort their objects into two piles, one pile for all objects made of only one material and another pile for objects made of more than one material.

Scoring guide:

The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- identify the materials in different objects
- identify objects made up of more than one material

The student's **Evidence of Inquiry** can be assessed by the extent to which the student can:

- sort objects by the materials of which they are made
- describe the procedure he/she followed to classify the objects

Assessment Task TWO:

Major concept : **Order and Organization**
Concept: **Properties of Materials**

Students should be able to **organize** data, objects, or events by observing the world and looking for patterns. The categories used to organize a set of objects are **properties** of the objects (or object's materials) such as size, shape, color, texture, shininess, absorbency, hardness, temperature, volume, weight, and transparency.

<u>Teacher Instructions:</u>

Note: Other objects can be used instead of leaves.

• Have students **collect** five to ten kinds of **leaves**. They could be from trees, house plants, the produce section of the grocery store, vegetable or herb gardens. (Safety caution: poisonous plants)

• Combine the leaves of a student and his/her partner (a team of two) and then ask the team to **sort the leaves into two groups**. Partners should agree on the properties to use in sorting.

• Give the students a new set of leaves and ask them to **sort these leaves according to the properties they used to sort their own leaves**. Some of the properties might be the following:

- bigger than my hand or smaller than my hand
- light or dark veins
- few or many veins
- green or not green
- one color or more than one color
- wavy or zigzag edges
- points or no points
- rough or smooth surface
- shiny or dull
- damaged or whole
- flat or round stems
- one or several parts
- fuzzy or waxy feeling

• **Make a leaf-shape bar graph.** Draw a large grid on a piece of chart paper. Label each column with a different geometric shape (oval, rectangle, heart, circle, triangle, etc.). Add an "other" column. After all students in the class sort their leaves have them glue them to the graph to see which is the most common shape.

Scoring guide for organization of objects (leaves):

The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- explain that sorting is a way of organizing objects
- identify what properties he/she used to sort objects (leaves)

The student's **Evidence of Inquiry** can be assessed by the extent to which the student can:

- **sort** objects (leaves) into at least two groups according to specific properties
- record data on paper in an organized way

Scoring guide for the concept of property:

The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- describe the properties of an object (leaves)
- say which sense they used to determine the property
- classify correctly objects (leaves) by the property identified by the teacher
- add an object correctly to a given classification scheme using an identified property

The student's **Evidence of Inquiry** can be assessed by the extent to which the student can:

- use one common property as a criterion to sort objects (leaves) into two groups
- identify correctly a property of the objects (leaves) and classify the objects (leaves) by that property
- use properties as criteria to sort and sequence objects (leaves)

Assessment Task THREE:

Concept: **Food Web System:**

Teacher Instructions:

One of the major requirements of life for plants and animals is food. A **food web** is a diagram that represents the feeding dependencies between organisms. The arrows indicate the direction the food moves through the **system**.

- Give each student a copy of the two food web student pages and a crayon or pencil.
- Tell the students they will be making food webs. Make sure they recognize organisms the illustrations represent and ask them to tell what eats what. For example, grass is eaten by insects, cows, and chickens. Insects are eaten by chickens.
- Following the discussion ask the students to draw arrows making food webs.

Scoring guide:

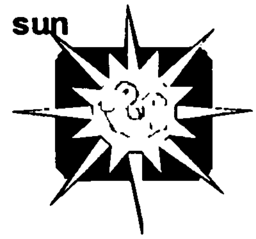
The student's **Depth of Understanding** and **Evidence of Inquiry** can be assessed by the extent to which the student can:

- draw arrows representing the feeding relationships that exist among the organisms pictured.
- draw arrows showing that some animals feed on plants and some animals feed on other animals.
- draw arrows showing the predator-prey relationship that exists among the organisms pictured.
- explain the feeding relationships to the teacher.

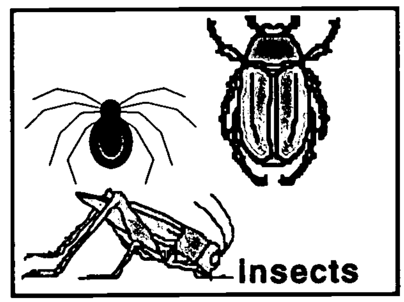
Talk with students individually to uncover any misunderstandings. Reversing the arrow may not indicate the student does not understand the feeding relationship and therefore the meaning of *food web.*

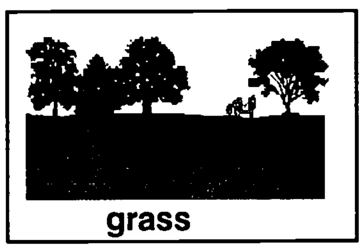
FOOD WEB

cow

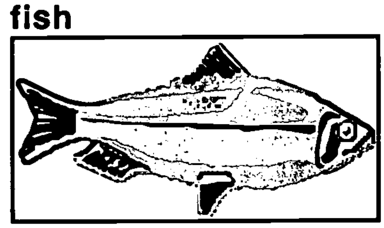


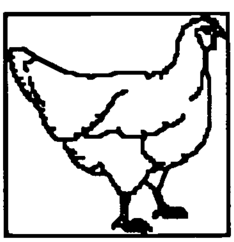
corn



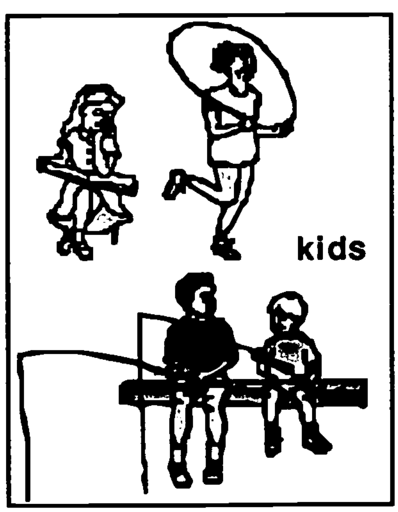


fish





chicken



Food Web Questions: What Eats What?

On the Food Web page find the pictures of the cow, insects, fish, kids, chicken, corn, and the grass in the middle. Draw arrows showing what eats what.

1. What do cows eat?

2. What do kids eat?

3. What eats grass?

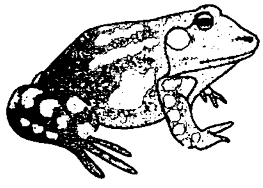
4. What eats corn?

5. What eats fish?

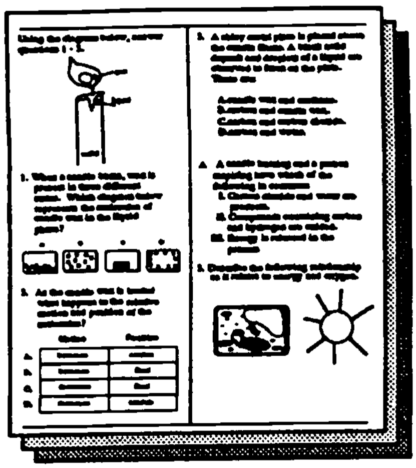
6. What does grass need for it to grow?

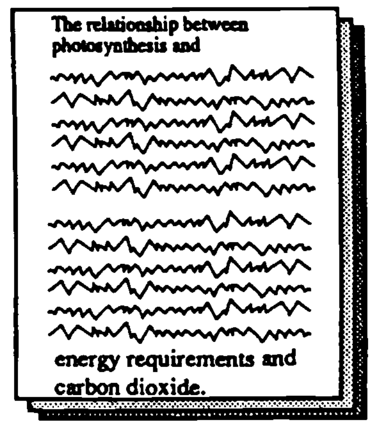
7. How do you grow grass seeds?

8. Add another organism (maybe a frog) to the food web and draw the arrows showing what eats what.



Type 1
Second Grade Science
Competency-Based Education Assessment Series





° Multiple Choice and a Few Open-Ended Items °

(Traditional)

Characteristics

- Requiring a minimum of a session
- Items may be read to the students and spelling assistance may be provided.
- Scoring of the items is done in combination with teacher interviews with individual students

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments reflect all performance levels, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure district assessments reflect a coherence with instructional strands and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.

• Second Grade Type 1 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	Item	Answer	Performance Level	Performance Objective(s)	Instructional Objective(s)	Unifying Concept(s)	Proficiency Test Outcome(s) Fourth Grade
P. 1 - 2							
Weather Calendar	1	D	Acquiring	4, 6, 9	I: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 K: 1, 2, 3, 4, 6, 8, 9 C: 1, 3, 5, 6, 8, 9, 11, 12 A: 3, 4	Change Systems and Interactions, Cause and Effect	N: 1, 2, 5, 8 P: E: 13, 14, 17 L: 16, 17
	2	A	Extending				
	3	C	Processing				
	4	B	Processing				
	5	C	Processing				
P. 3							
Tools	6	See Discussion	Processing	5, 7, 9	I: 1, 2, 3, 4, 6, 7, 8, 9, 10 K: 1, 3, 4, 6, 7, 8, 9 C: 7, 8 A: 1, 2, 3, 4, 5	Change, Systems and Interactions	N: 1, 2, 3, 7, 8, 9 P: 10, 11, 12 E: L: 18
			Extending				
P. 4							
Seasons	7	A	Processing	4, 6 1st grade; 1, 5	I: 1, 3, 4, 5 K: 1, 2, 4, 6 C: 2, 6 A: 3	Change, Cause and Effect	N: 1, 5, P: 11 E: 13, 14 L: 16, 17
	8	A	Processing				
	9	A, See Discussion	Extending				

• Performance Objectives: Grade 2

Ohio's Model Competency-Based Science Program

1. The learner will observe living organisms (animals or plants) in the classroom and make several predictions related to their behavior or response to a stimulus.
2. Given the results of a simple investigation, the learner will suggest several new questions to investigate.
3. The learner will discuss the basic needs of living things and describe the ways that organisms meet these needs.
4. Given a season of the year or local weather conditions the learner will predict how different organisms will react.
5. Given an array of comparative scales and objects appropriate to the scales, the learner will contrast objects and suggest improvements in the scale being used.
6. Shown a natural event, the learner will ask several questions related to what happened and what may have caused it to occur.
7. The learner will use an electronic instrument to record an event.
8. The learner will select and use appropriate materials and tools to construct a useful device.
9. The learner will compare the mass, dimensions, and volume of familiar objects and organisms using nonstandard measures.

Instructional Strands • Grade 2•

Objectives	*Inquiry* • The learner will:	*Knowledge* •The learner will:	*Conditions* • The learner will be:	*Applications* • The learner will be:
1	recognize the limitations and variability of descriptions of objects and events within the range of human senses.	explore ways in which organisms and objects react to changing conditions around them (e.g., hibernation, migration, animals shedding, weathering, phase changes).	individually and collaboratively developing multimedia expressions of ideas and explanations.	inventing and testing creative procedures and devices.
2	solve problems and resolve issues using varied strategies, including observing, questioning, manipulating objects, discussing, and others.	of the moon).	exploring organisms that share indoor and outdoor environments.	discovering ideas and inventions from a wide diversity of persons, cultures, and other sources.
3	design, describe, and carry out simple cause and effect investigations.	explore components and the roles of those components within technological, social, and ecological systems (e.g., toys and tools, families and school groups; habitats, lots and playgrounds).	contributing in a variety of ways in small- and large-group activities (i.e., recorder, reporter, materials manager, encourager).	making appropriate choices regarding the capacity of containers, uses of tools, characteristics of materials, amounts of time, procedures required for tasks, and others.
4	ask "How do we know ...?" questions about objects, events and phenomena.	explore the diversity of and interactions between living things and non-living things.	reading and writing stories about famous men and women in science history.	utilizing technological devices for various purposes. (e.g., computers, videocameras, tape recorders, cameras, musical instruments, computer-based systems).
5	identify sequences of events.	explore the varied needs of living things (e.g., water, nutrients, space, light) and the different ways in which living things meet their needs.	discussing ideas about events that have occurred at home.	making choices regarding personal wellness (e.g., cleanliness, bicycle safety, household safety).
6	restate, illustrate, or summarize what others have said.	explore estimates and comparisons of the passage of time and duration of phenomena, the sizes of objects and organisms, and the distances between objects.	taking time to reflect on observed events.	
7	use a variety of media to search for information.	explore the effects of the use of optical devices on their own observations of the world (e.g., hand lens, telescope, prism).	interviewing and interacting with community members to discuss past events and developments in science and technology.	
8	design, conduct, and repeat explorations.	explore the use of various scales as they are applied to making observations (e.g. thermometers, rulers, color wheels, musical scales).	selecting appropriate technologies to extend the senses, perform tasks, and express ideas.	
9	ask 'Why?'	explore questions of differing focus (e.g., Who?, What?, Where?, When?, Why?, How?).	developing and conducting investigations collaboratively and critiquing the results.	
10	use a variety of instruments to measure and observe.		role-playing re-creations of systems and discussing reasons for the actions of parts of the systems dramatized.	
11			participating in discussions with peers.	
12			reporting the results of explorations and inquiries using a variety of media in various settings.	
13			exploring the similarities and differences in the use of technology in various cultures.	

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About This Instrument

This **Type 1** assessment instrument is a combination of multiple choice and open-ended response items. The assessment may be administered individually, in small groups, or to the whole class. The teacher may read the items to the students and provide them with any spelling assistance they require. A rephrasing of the questions by the teacher during the administration of the assessment instrument may help the student recall and use what they know. Questions and answers both contain possible ambiguities so there must be dialogue between the teacher and the student to ensure the student is fully assessed.

Scoring of the items needs to be done in combination with teacher interviews with individual students, either during the administration of the assessment if the instrument is administered individually, or after if administered to a group. It will be essential that the teacher ask clarifying questions to infer understanding from student responses.

The questions in multiple choice items (1-5, and 7-9) fundamentally have one correct answer yet are open to interpretation. For example, the correct response to question 2, "Would you wear a winter coat at any time this month?" is clearly "yes". A student might not be able to demonstrate the scientific knowledge he or she does possess (which is the knowledge and skills necessary to interpret the data in the Weather Calendar), because he or she is thinking that since he/she hates to wear winter coats no matter how cold it gets, would not wear one given the option.

Many of the items on this assessment instrument refer to a graphic. The teacher needs to know if the graphic conveys the correct meaning to the student in order for the teacher to infer correctly if the student has the knowledge and reasoning skills the item is designed to assess. The teacher should provide each student the opportunity to clarify and justify inherently ambiguous responses. Placing the graphics in front of the student as they are working on the items that refer to them should be considered. This could be accomplished by back-to-back printing.

It is important that the student's teacher be the assessor. This assessment instrument is sensitive to different meanings and to context. The teacher is the only one who knows their curriculum and the student well enough to contextualize and articulate meaningful questions and follow up on confused or ambiguous answers. Prompting, intervening, or cueing students in an offhanded way will not corrupt the test results on this assessment because without doing so, the assessor will not have sufficient insight into the student's knowledge.

The specific knowledge and skills each item in this instrument is designed to assess are outlined and explained in the teacher information section. Correct spelling should not be used as an indicator of a student's scientific knowledge, however the use of precise scientific vocabulary can be. The use of the scientific terms *graph, weather, rainy, snowy, cloudy, sunny, calendar, tools, machines, measure,* and *change* are being assessed at this level.

Scoring information is provided in the teacher information section. Analysis of the item results for an individual student will assist in the determination of that student's attainment of the objective. Analysis of the item results for this grade level will assist in the determination of a program's effectiveness in helping the student attain the objectives. If this is to be used for EMIS reporting, determination of the attainment standard for the overall assessment will be necessary for reporting data to the State Board of Education on the number and percentage of students who have not made satisfactory progress toward achieving the objectives during the previous school year.

Teacher Information:

Major concept: Change

Topic: **Change** in Weather

The student's **Depth of Understanding** of the concept of **change** in weather can be assessed by the extent to which the student can:

- Observe and describe the changes that occur in weather over time.
- Compare weather conditions using a bar graph.
- Use a calendar to monitor and interpret daily weather graphs.

Scoring guide:
Information used to assess students will be based on the student's responses to **questions 1 through 5** and individual teacher interviews.

Concept: **Change** in Technology
Topic: Tools and Machines

The student's **Depth of Understanding** of the concept of **change** in technology can be assessed by the extent to which the student can:

- identify tools that measure changes in materials
- understand that tools help people accomplish tasks, solve problems, and protect themselves
- identify the function, or purpose, of selected tools and machines

Scoring guide:
Information used to assess students will be based on the student's responses to **question 6** and individual teacher interviews.

Concept: **Change**
Topic: Seasonal **change** in a tree

The student's **Depth of Understanding** of the concept of **change** can be assessed by the extent to which the student can:

- understand that objects can change in several ways.
- observe and describe the changes that occur over time.
- provide evidence to support a statement that something has changed.

- be able to compare observations and decide whether a change has occurred.
- predict what change will occur next based on observing a pattern or a sequence of events.

Scoring guide:
Information used to assess students will be based on the student's responses to **questions 7 through 9** and individual teacher interviews.

Weather Calendar

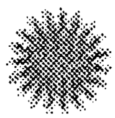
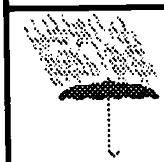
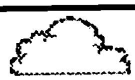
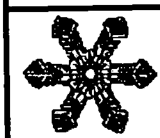
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Weather Symbols:

Sunny Rainy Cloudy Snowy

67

This is a graph showing the number of days of each kind of weather listed during one month.

# of days→	1	2	3	4	5	6	7	8	9	10	11
	X	X	X	X	X						
	X	X	X	X	X	X	X	X	X		
	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X					

Directions: Look at the **Weather Calendar** and the **graph** to find the answer to these questions. Circle the correct answers.

1. More days this month were:

   A. rainy B. sunny C. snowy D. cloudy

2. Would it be a good idea to wear a winter coat at any time during this month?

   A. yes B. no

3. How many days was the weather sunny?

   A. 11 B. 7 C. 5 D. none

4. Does this weather calendar and graph tell you if the days were windy?

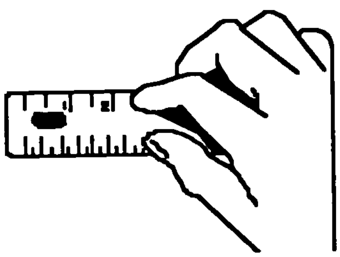
   A. yes B. no

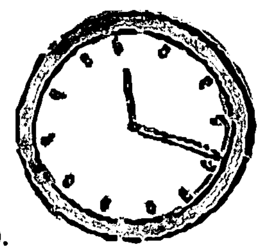
5. What was the weather like at the beginning of this month?

   A. rainy B. sunny C. snowy D. cloudy

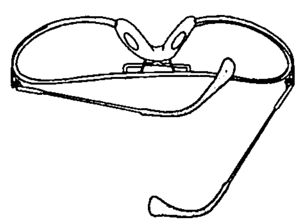
6. **Tools** and instruments let us **observe** changes better. Some tools and instruments can be used to **measure** the amount of change.

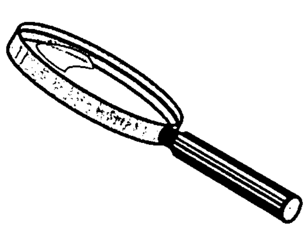
Under each picture below, write
OBSERVE if the tool or instrument helps us **see** the **change** better
or
MEASURE if the tool or instrument helps us measure the **amount of change**.

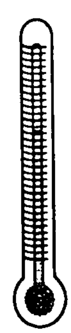
a. 

b. 

c. 

d. 

e. 

f. 

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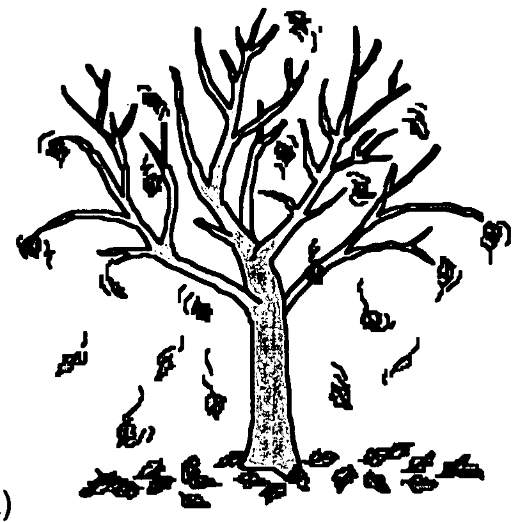
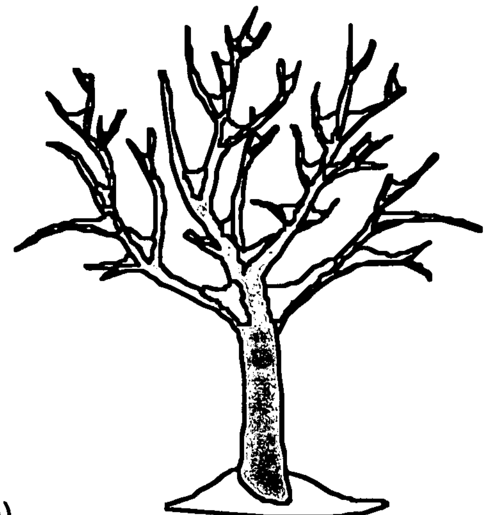
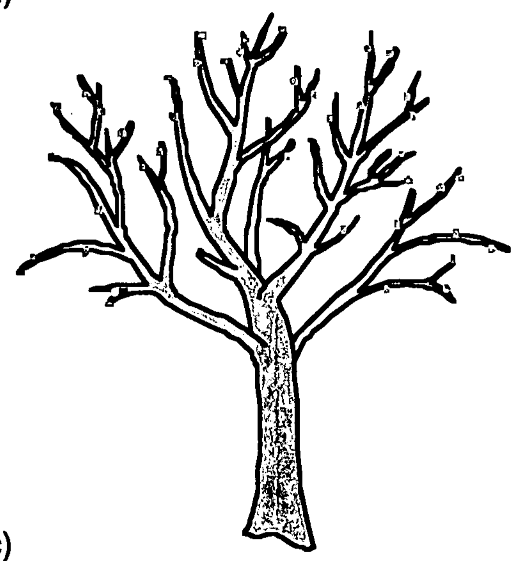
7. **Which picture below shows the tree in autumn?**



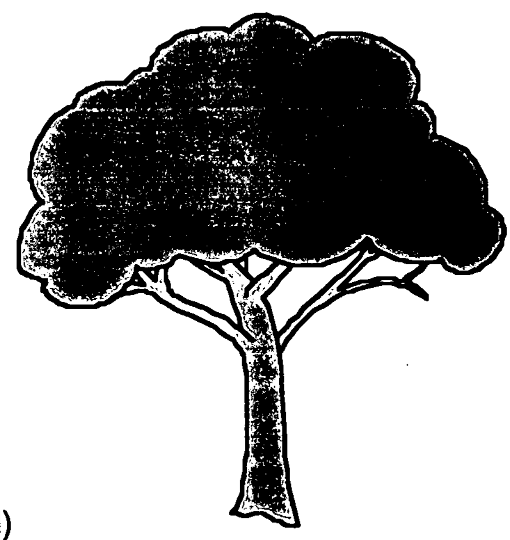
(a)



(b)



(c)



(d)

8. **How long does this whole process take (from autumn to winter to spring to summer to autumn again)?**

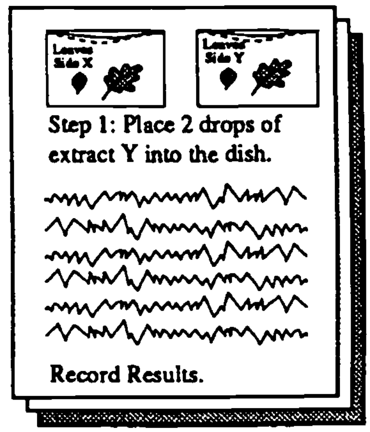
A. one year
B. two years
C. one month
D. two months

9. **What will the tree look like after (d)? Will it look more like it did in picture a, b, c, or d? Draw a picture of the tree the way it would look during the next season. Use the back of this paper if you would like.**

Type 2

Second Grade Science

Competency-Based Education Assessment Series



° Open-Ended and Multiple Choice Items °

(Performance-Like)

Characteristics

- Open-ended and multiple choice response items, requiring a single session
- Scoring of the items is done in combination with teacher interviews with individual students

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments reflect all performance levels, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with instructional strands and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.

• Second Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	Item	Answer	Performance Level	Performance Objective(s)	Instructional Objective(s)	Unifying Concept(s)	Proficiency Test Outcome(s) Fourth Grade
P. 1 - 2							
Weather Calendar	1	See Discussion	Processing and	4, 6, 9	I: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 K: 1, 2, 3, 4, 6, 8, 9 C: 1, 3, 5, 6, 8, 9, 11, 12 A: 3, 4	Change, Systems and Interactions	N: 1, 2, 5, 8 P: E: 13, 14, 17 L: 16, 17
	2	See Discussion	Extending				
PP. 3 - 4							
Tools	3	See Discussion	Processing and Extending	5, 7, 9	I: 1, 2, 3, 4, 6, 7, 8, 9, 10 K: 1, 3, 4, 6, 7, 8, 9 C: 7, 8 A: 1, 2, 3, 4, 5	Change, Systems and Interactions	N: 1, 2, 3, 7, 8, 9 P: 10, 11, 12 E: L: 18
PP. 5 - 6							
Seasons	4	See Discussion	Acquiring Processing Extending	4, 6 1st grade: 1, 5, 9	I: 1, 3, 4, 5 K: 1, 2, 4, 6 C: 2, 6 A: 3	Change, Interactions, Cause and Effect	N: 1, 5 P: 11 E: 13, 14 L: 16, 17
PP. 7 - 11							
Safety Rules	5	See Discussion	Processing and Extending	6 1st grade: 10	I: 6, 9 K: 3, 4, 9, 12 C: 5, 6, 8, 10, 11 A: 1, 3, 5	Change, Interactions, Cause and Effect	N: 1, 2, 5, 6, 7, 9 P: E: L: 16

• Performance Objectives: Grade 2 *Ohio's Model Competency-Based Science Program*

1. The learner will observe living organisms (animals or plants) in the classroom and make several predictions related to their behavior or response to a stimulus.
2. Given the results of a simple investigation, the learner will suggest several new questions to investigate.
3. The learner will discuss the basic needs of living things and describe the ways that organisms meet these needs.
4. Given a season of the year or local weather conditions the learner will predict how different organisms will react.
5. Given an array of comparative scales and objects appropriate to the scales, the learner will contrast objects and suggest improvements in the scale being used.
6. Shown a natural event, the learner will ask several questions related to what happened and what may have caused it to occur.
7. The learner will use an electronic instrument to record an event.
8. The learner will select and use appropriate materials and tools to construct a useful device.
9. The learner will compare the mass, dimensions, and volume of familiar objects and organisms using nonstandard measures.

About This Instrument

This **Type 2** assessment instrument contains open-ended response items. The assessment may be administered individually, in small groups, or to the whole class. The teacher may read the items to the students and provide them with any spelling assistance they require. A rephrasing of the questions by the teacher during the administration of the assessment instrument may help the student recall and use what they know. Questions and answers both contain possible ambiguities so there must be dialogue between the teacher and the student to ensure the student is fully assessed.

Scoring of the items needs to be done in combination with teacher interviews with individual students, either during the administration of the assessment if the instrument is administered individually, or after if administered to a group. It will be essential fthat the teacher ask clarifying questions to infer understanding from student responses.

Many of the items on this assessment instrument refer to a graphic. The teacher needs to know if the graphic conveys the correct meaning to the student in order for the teacher to infer correctly if the student has the knowledge and reasoning skills the item is designed to assess. Provide each student the opportunity to clarify and justify inherently ambiguous responses. Placing the graphics in front of the student as they are working on the items that refer to them should be considered. This could be accomplished by back-to-back printing.

It is important that the student's teacher be the assessor. This assessment instrument is sensitive to different meanings and to context. The teacher is the only one who knows the students and the curriculum well enough to contextualize and articulate meaningful questions and follow up on confused or ambiguous answers. Prompting, intervening, or cueing students in an offhanded way will not corrupt the test results on this assessment because without doing so the assessor will not have sufficient insight into the student's knowledge.

The specific knowledge and skills this instrument is designed to assess are outlined and explained in the teacher information section of this instrument. Correct spelling, grammar, sentence structure, etc. should not be used as an indicator of a student's scientific knowledge, however the use of precise scientific vocabulary can be. The use of the scientific terms *graph, weather, rainy, snowy, cloudy, sunny, calendar, season, tools, machines, measure, change, evidence, and safety rules* are being assessed at this level.

Scoring information is provided in the teacher information section. Analysis of the item results for an individual student will assist in the determination of that student's attainment of the objective. Analysis of the item results for a grade level will assist in the determination of a program's effectiveness in helping the student attain the objectives. If this is to be used for EMIS reporting, determination of the attainment standard for the overall assessment will be necessary for reporting data to the State Board of Education on the number and percentage of students who have not made satisfactory progress toward achieving the objectives during the previous school year.

<u>Teacher Information:</u>

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Major concept: Change

Topic: **Change** in Weather

The student's **Depth of Understanding** of the concept of **change** in weather can be assessed by the extent to which the student can:
- observe and describe the changes that occur in weather over time.
- compare weather conditions using a bar graph.

The student's **Evidence of Inquiry** of the concept of **change** in weather can be assessed by the extent to which the student can:
- use a calendar to monitor and then graph daily weather.

Scoring guide:
Information used to assess students will be based on the student's reponses to **questions 1 and 2** and the **teacher's interview** with the student.

Concept: **Change in Technology**
Topic: Tools and Machines

The student's **Depth of Understanding** of the concept of **change in technolog**y can be assessed by the extent to which the student can:
- identify tools that make changes in materials
- identify tools that measure changes in materials
- understand that tools help people accomplish tasks, solve problems, and protect themselves

The student's **Evidence of Inquiry** of the concept of **change in technology** can be assessed by the extent to which the student can:
- identify the function, or purpose, of selected tools and machines

Scoring guide:
Information used to assess students will be based on the student's reponses to **question 3** and **teacher's interview** with the student.

Concept: **Change**
Topic: Seasonal **change** in a tree

The student's **Depth of Understanding** of the concept of **change** can be assessed by the extent to which the student can:

- understand that objects can change in several ways.
- provide evidence to support a statement that something has changed.
- predict what change will occur next based on observing a pattern or a sequence of events.

The student's **Evidence of Inquiry** of the concept of **change** can be assessed by the extent to which the student can:

- observe and describe the changes that occur over time.
- be able to compare observations and decide whether a change has occurred.

Scoring guide:
Information used to assess students will be based on the student's reponses to **question 4** and the **teacher's interview** with the student.

Concept: Interactions
Topic: **Safety**

The student's **Depth of Understanding** of **safety** can be assessed by the extent to which the student can:

- suggest rules that help prevent injuries.
- understand that following safety rules helps prevent injuries.
- understand what a safety rule is.

The student's **Evidence of Inquiry** of **safety** can be assessed by the extent to which the student can:

- identify potential hazards.

Scoring criteria:
Information used to assess students will be based on the student's reponses to **question 5** and **teacher's interview** with the student.

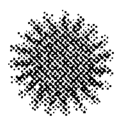
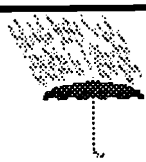
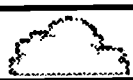
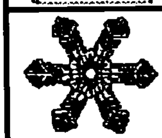
Weather Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Weather Symbols:

Sunny Rainy Cloudy Snowy

1. Look at the Weather Calendar. Make a graph showing the number of days of each kind of weather listed. The first one has been done for you.

# of days→	1	2	3	4	5	6	7	8	9	10	11
	X	X	X	X	X						
											
											
											

2. Look at the Weather Calendar and your graph. Answer these questions:

a. Were there more rainy days or sunny days this month? ____________

b. Would it be a good idea to wear a winter coat any time this month?

____

c. What other questions about the weather during this month would you ask if you needed to know if it were winter or summer?

____

____

____

3. These are pictures of some **tools** people use.
Tools with **moving parts** are **machines.**
Some tools **change** things.
Some tools **measure** things
Some tools do both,**change and measure** things.
People use some tools (and machines) to help keep them **safe**.

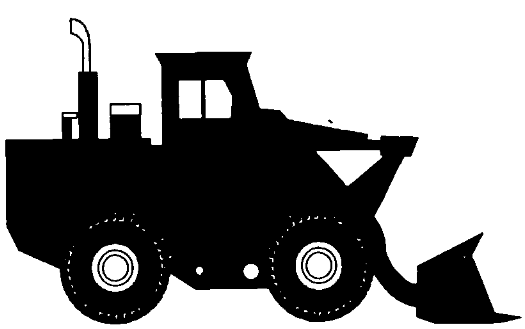
Think about these tools and what they do. Tell your teacher as much as you can about each tool. Before you talk to your teacher answer the following questions.

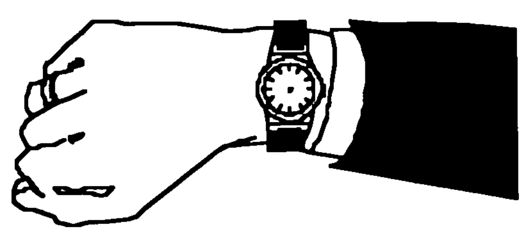
a. Which of these tools are machines? Write, "**machine**" under each tool that is a machine.

b. Which tools change things? Write, "**change**" under each tool that makes things change.

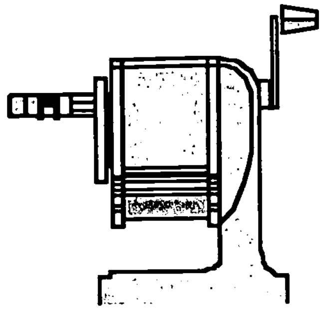
c. Which tools measure things? Write, "**measure**" under each tool that measures things.

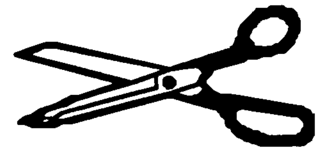
d. Do any of these tools help keep you safe? Write, "**safe**" under each tool that can help keep you safe.

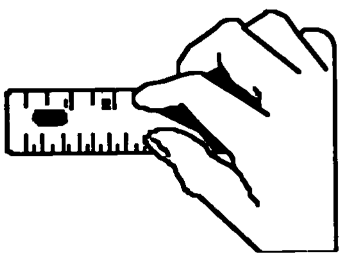


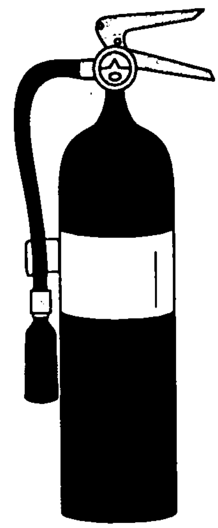


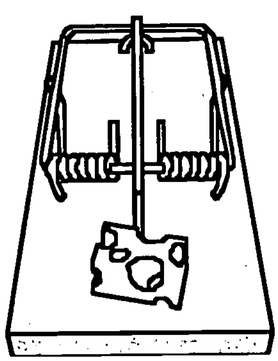
80





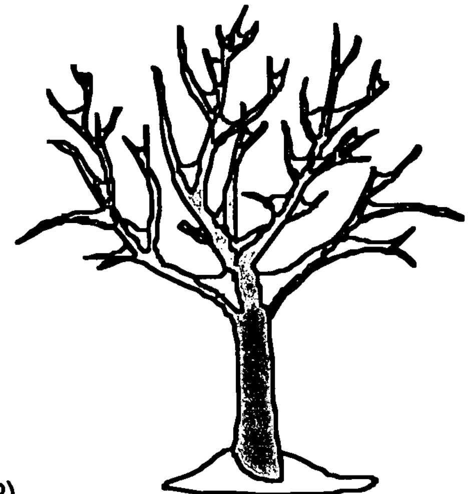


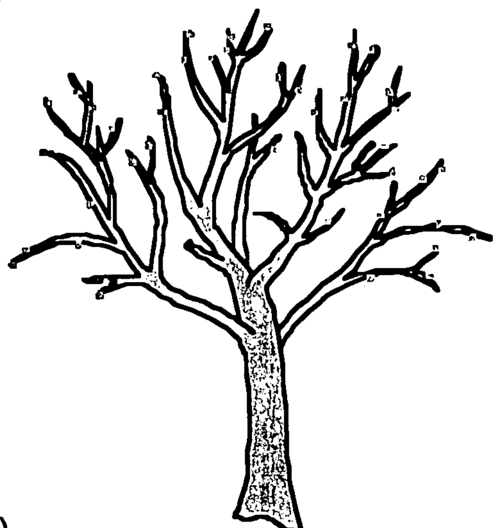


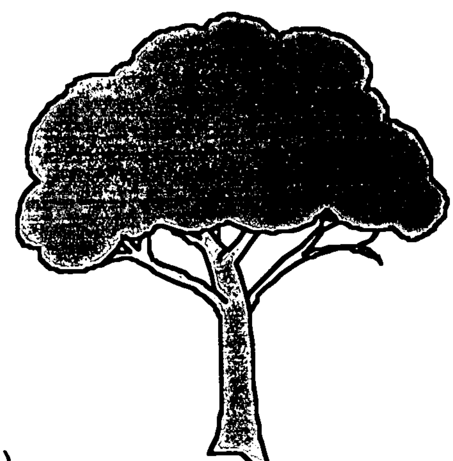


4.


(1)


(2)


(3)


(4)

a. What changed and what evidence is there that something changed?

b. How long did it take to go all the way from step **1** through step **4**?

c. New leaves are starting to grow on the tree in picture **3**. What color should they be?

d. Draw a tree that shows which season comes next after step **4**.

5.

SAFETY RULES

a. What **rules** do you know about this?

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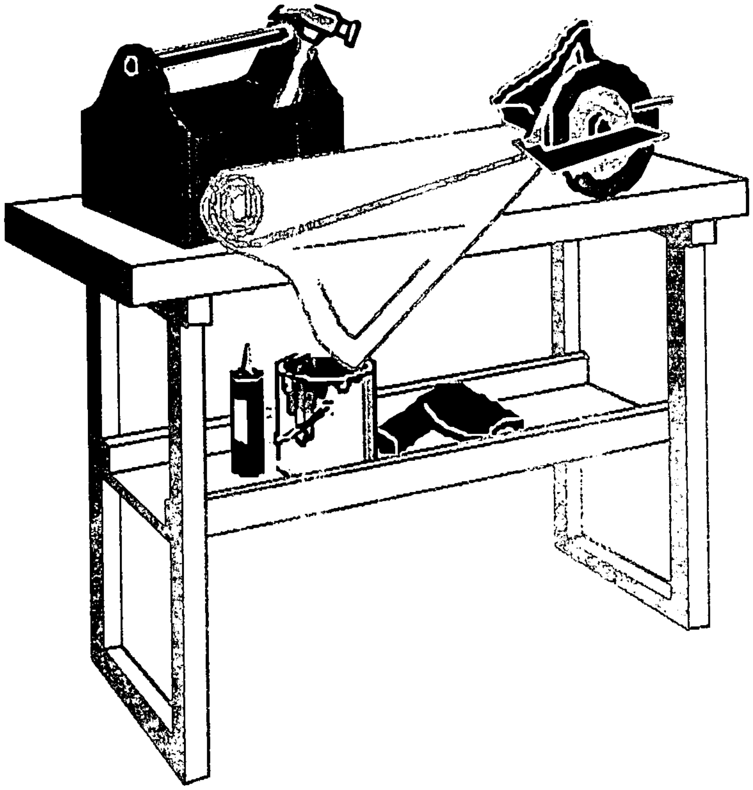


b. What **rules** do you know about this?

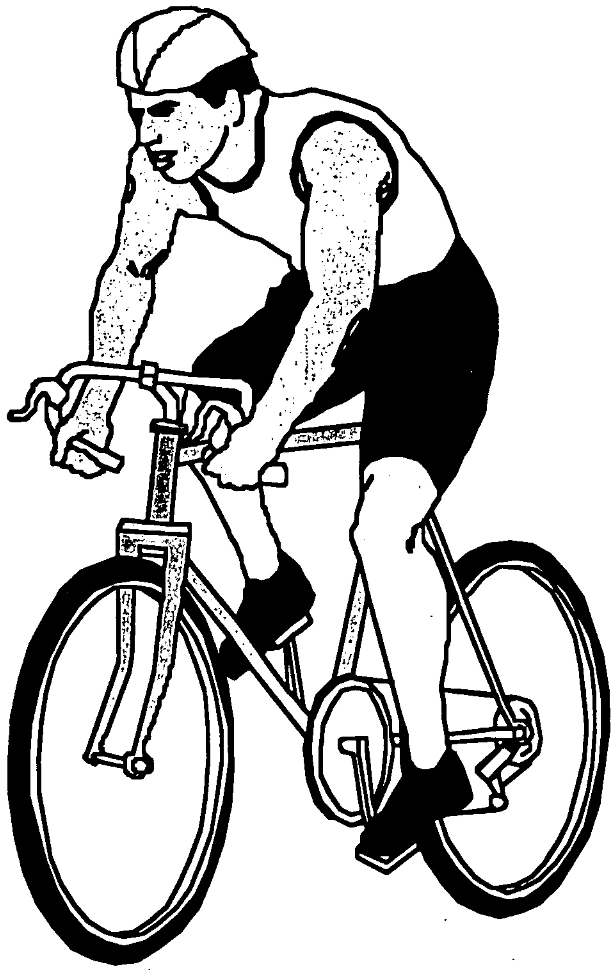
____

____

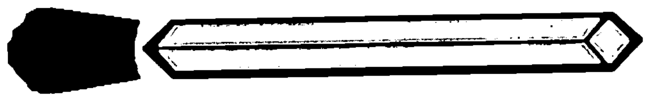
____

____

85

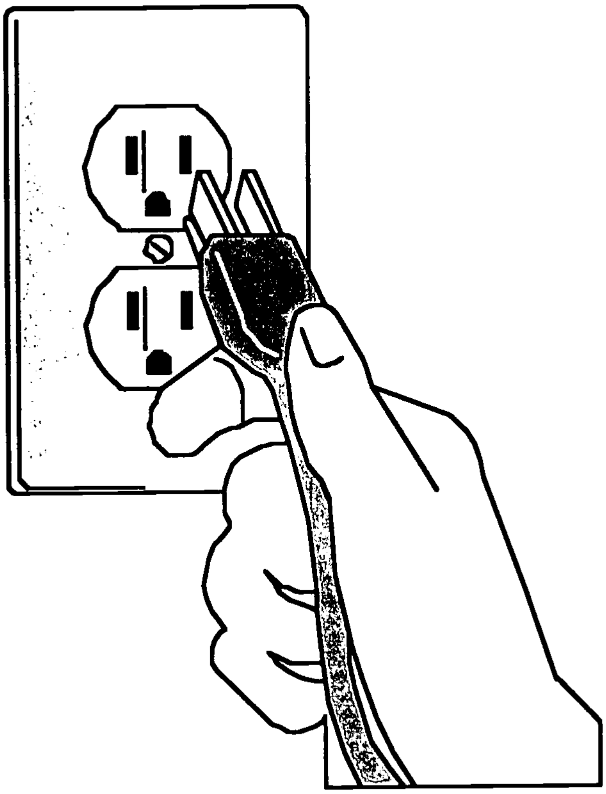


c. What **rules** do you know about this?



d. What **rules** do you know about this match?

e. What **rules** do you know about this?



f. What **rules** do you know about this?

g. **Write** an important **safety rule** for riding in a car.

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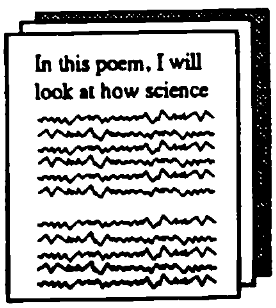
Type 3

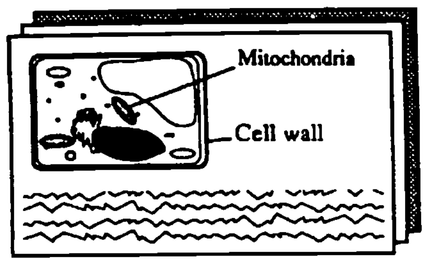
Second Grade Science

Competency-Based Education Assessment Series

SCIENCE Ohio's Model Competency-Based Program

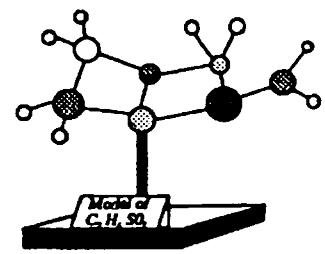


Writing



Artwork

Video



Models

Substantive Application-Based Performance Tasks

(Open-Ended)

Characteristics

- Relevant inventive and creative applications, requiring experimental research, non-experimental research, and more out-of-class preparation
- Holistic scoring (e.g., including interviews)

Item discussions provide an overview of items, pertinent content, and scoring parameters. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments reflect all performance levels, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with instructional strands and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.

• Second Grade Type 3 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	Item	Answer	Performance Level	Performance Objective(s)	Instructional Objective(s)	Unifying Concept(s)	Proficiency Test Outcome(s) Fourth Grade
Task One: Finding Evidence of Change		See Discussion	Processing and Extending	1, 2, 6 1st grade: 4, 8	I: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 K: 1, 2, 3, 4, 6, 7, 8, 9 C: 1, 3, 5, 6, 8, 9, 11, 12 A: 3, 4,	Change	N: 1, 2, 3, 4, 5, 6, 8 P: 11 E: 15 L: 17
Task Two: Plant Growth		See Discussion	Processing and Extending	1, 2, 3, 8 1st grade: 9	I: 2, 3, 4, 5, 6, 8, 9, 10 K: 1, 2, 3, 4, 5, 6, 7, 8, 9 C: 1, 2, 3, 5, 6, 7, 9 A: 1, 3	Change, Cause and Effect, Scale, Diversity	N: 2, 3, 5, 6, 7, 9 P: E: L: 16, 17, 18
Task Three: Change in Technology		See Discussion	Acquiring Processing and Extending	5, 7, 8, 9	I: 1, 2, 3, 4, 6, 7, 8 K: 1, 3, 4, 6, 7, 8, 9 C: 1, 3, 5, 6, 7, 8 A: 1, 2, 3, 4, 5	Change, Systems and Interactions	N: 1, 2, 3, 5, 6, 7, 9 P: 10, 12 E: 14 L:

• **Performance Objectives:** **Grade 2**

Ohio's Model Competency-Based Science Program

1. The learner will observe living organisms (animals or plants) in the classroom and make several predictions related to their behavior or response to a stimulus.
2. Given the results of a simple investigation, the learner will suggest several new questions to investigate.
3. The learner will discuss the basic needs of living things and describe the ways that organisms meet these needs.
4. Given a season of the year or local weather conditions the learner will predict how different organisms will react.
5. Given an array of comparative scales and objects appropriate to the scales, the learner will contrast objects and suggest improvements in the scale being used.
6. Shown a natural event, the learner will ask several questions related to what happened and what may have caused it to occur.
7. The learner will use an electronic instrument to record an event.
8. The learner will select and use appropriate materials and tools to construct a useful device.
9. The learner will compare the mass, dimensions, and volume of familiar objects and organisms using nonstandard measures.

About This Instrument

This **Type 3** assessment strategy is composed of three performance-based assessment tasks. The tasks may be administered individually to students sometimes working in pairs or small groups in whatever time frame deemed necessary.

It is important that the student's teacher be the assessor. The teacher is the only one who knows the student and the curriculum well enough to contextualize and articulate meaningful questions and follow up on confused or ambiguous answers. Sometimes a rephrasing of the question is all a student needs to recall and use what he or she "knows." Prompting, intervening, or cueing students in an offhanded way will not corrupt the results on this assessment because without doing so the assessor will not have sufficient insight into the student's knowledge.

The specific knowledge and skills these tasks (technically there is no instrument) are designed to assess are outlined and explained in the teacher information section. They are based on the Grade Two Instructional and Performance Objectives in *Science: Ohio's Model Competency-Based Program*.

Guidelines must be established by districts for the use of the assessment task scoring rubrics to insure that the student's ability to justify or clarify a response is maximized. Ample opportunity for the student and teacher to explore, clarify and justify inherently ambiguous tasks and performances must be provided.

Scoring information is provided in the teacher information section. Analysis of the results for an individual student will assist in the determination of that student's attainment of the objective. Analysis of the results for a grade level will assist in the determination of a program's effectiveness in helping the student attain the objectives. If this is to be used for EMIS reporting, determination of the attainment standard for the overall assessment will be necessary for reporting data to the State Board of Education on the number and percentage of students who have not made satisfactory progress toward achieving the objectives during the previous school year.

Teacher Information:

Major Concept: Change

Assessment Task ONE:

Concept: **Finding evidence of change**

Prepare for students to observe the following types of change:
- change in the length of a shadow
- change in an ice cube melting
- change in popcorn before and after popping
- change that wind has on leaves of trees
- apparent change in size of a finger in water
- change in an apple after a bite (immediately and then over time)

Provide the students the opportunity to:
1. Observe an object using their senses and describe changes in the physical properties of objects.
2. Provide evidence to support a statement that something has changed.
3. Understand that change occurs over time: Sequence the changes they observe in the ice experiment according to the time it took each change to occur. Do the same with the apple. Record data.
4. Know that some changes are reversible and others are irreversible: Sort objects according to whether the object underwent a reversible change or irreversible change. Yes or no: Can the objects change back ?
5. Make quantitative comparisons (length of shadow, volume of popcorn) and qualitative comparisons (the properties of a substance before and after adding water).
6. Given the results of a simple investigation, suggest several new questions to investigate.

Ask the following types of questions:
- What changed?
- What evidence do you have that something changed?
- How long did it take?
- What caused it to change?
- Can whatever changed change back?
- How could you find out?

Scoring guide:
The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- understand that objects can change in several ways, some of which are reversible and some irreversible.
- provide evidence to support a statement that something has changed.

The student's **Evidence of Inquiry** can be assessed by the extent to which the student can:

- compare measurements and decide whether a change has occurred.

Assessment Task TWO:

Topic: **Identifying requirements for plant growth**

Invite one student at a time to a quiet part of the classroom. Give the student time to examine a tray with the following materials: seeds, planter cups, water in a glass, plastic dropper, magnifier, dip net, and funnel. Tell the student you are interested in what he or she has learned about planting seeds and growing plants. First ask:

- **Which of these materials would you need if you were going to plant these grass seeds?**
  After the student answers, ask:
- **How would you use these materials** or
  Tell me how you would plant the seeds and grow plants.
  Place the bag of soil on the tray and then ask:
- **How wet should the soil be for growing plants?**
- **How deep should you plant the seeds?**
- **After planting, how long will you have to wait to see plants above the soil?**

Scoring guide:
The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- select the necessary materials for planting (seeds, soil, water, planter).
- describe the process of planting seeds.

- predict accurately the number of days required for germination based on prior experience with planting seeds.

The student's **Evidence of Inquiry** can be assessed by the extent to which the student can:

- plant the seeds at a suitable depth in the soil.
- add an appropriate amount of water to the planting cup.

Further questions:

Can an outdoor plant be grown indoors? Find a small common plant that has emerged recently from the soil outdoors. Bring it into the classroom and plant it in a container. Have students keep track of the plant's growth.

What is inside a seed? Have students soak pea seeds for 48 hours. Have students remove the outer covering (the seed coat) and carefully open the seed. The very young plant (embryo) should be visible. The rest of the seed is the food supply for the plant.

Assessment Task: THREE

Concept: **Change in Technology**

Have student teams **design a machine** with three or more moving parts that can perform a task such as break a balloon or move a marble. The students must:

- define the task to be performed
- make a drawing of their invention
- identify the parts, the tools, to be used
- perform the task

or

Have students teams **invent a tool**. The tool should perform a practical function, including but not limited to tools that mend, tools that make life easier or safer in some way, entertain, or solve an everyday problem. The students must:

- describe the function of their tool.
- describe how their tool works.

- describe what steps they used to build their tool.
- state what materials they used to build their tool and if the material is human-made or natural.
- tell who helped them build their tool.
- tell what safety problems they encountered.

Scoring Guide:

The student's **Depth of Understanding** can be assessed by the extent to which the student can:

- understand that tools help people accomplish tasks, solve problems, and protect themselves
- identify the function, or purpose, of selected tools and machines

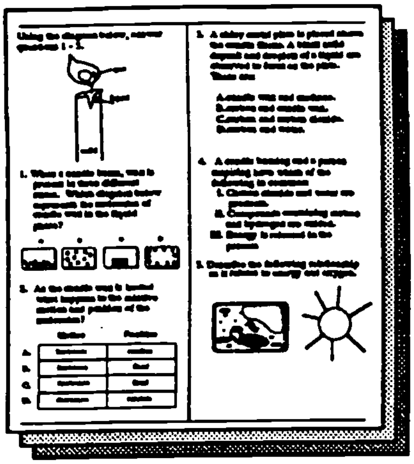
The student's **Evidence of Inquiry** can be assessed by the extent to which the student can:

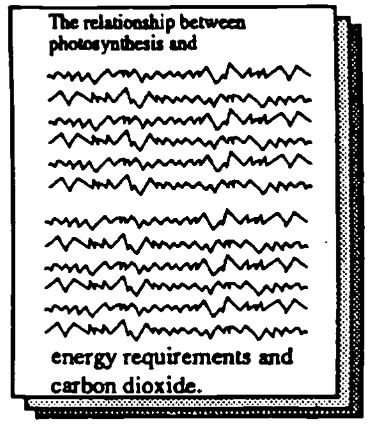
- design tools to make changes in materials
- use tools to measure changes in materials

Type 1

Third Grade Science

Competency-Based Education Assessment Series





° Multiple Choice, Short Answer and Extended Response °

(Traditional)

Characteristics

- Requiring a minimum of a session
- Scoring with answer keys in combination with (interviews and) rubrics

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments reflect all performance levels, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure district assessments reflect a coherence with instructional strands and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*

• Third Grade Type 1 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	Item	Answer	Performance Level	Performance Objective(s)	Instructional Objective(s)	Unifying Concept(s)	Proficiency Test Outcome(s) Fourth Grade
Page(s) 1 - 2							
Zoo Animals	1	A	Acquiring	3, 5	I: 7, 8, 11 K: 4, 5, 7 C: 8 A:	Change and Constancy	N: 1, 3, 4, 5, 8 P: E: L: 16, 17
	2	D	Acquiring				
	3	C	Processing				
	5	A	Processing				
	6	B	Processing				
	7	C	Extending				
	8	See Discussion	Extending				
Page(s) 3 - 5							
Gardens	1	A	Acquiring	5	I: 6, 7, 9, 11 K: 2, 3, 4, 5 C: 1, 2, 7, 8, 9 A:	Patterns	N: 1, 3, 4, 5, 8 P: E: L: 16
	2	C	Processing				
	3	B	Extending				
	4	See Discussion	Extending				
	5	C	Processing				
	6	C	Extending				
	7	See Discussion	Extending				
	8	D	Extending				
	9	See Discussion	Extending				
Page(s) 6 - 8							
Rocks and Minerals	1	C	Acquiring	4, 5	I: 1, 8, 11 K: 2, 4, 5 C: 8, 11 A: 3	Change and Constancy	N: 1, 2, 3, 4, 6, 8 P: E: 15 L:
	2	A	Processing				
	3	C	Processing				
	4	A	Processing				
	5	See Discussion	Processing				
	6	See Discussion	Extending				
Page(s) 9 - 11							
Dinosaurs	1	C	Acquiring	4, 5	I: 11 K: 4, 5 C: 10 A:	Scale/ Complexity	N: 1, 2, 3, 4, 5, 8 P: E: L: 16, 17; 18
	2	B	Processing				
	3	C	Processing				
	4	C	Acquiring				
	5	See Discussion	Processing				
	6	See Discussion	Processing				

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Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*

• Third Grade Type 1 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	Item	Answer	Performance Level	Performance Objective(s)	Instructional Objective(s)	Unifying Concept(s)	Proficiency Test Outcome(s) Fourth Grade
Page(s) 12 - 14							
Melting Candy	1	C	Acquiring	2, 3, 5	I: 7, 11 K: 2, 4, 7 C: A:	Energy	N: 1, 2, 5, 6, 7 P: 11 E: L:
	2	A	Processing				
	3	B	Processing				
	4	A	Processing				
	5	See Discussion	Extending				
	6	See Discussion	Extending				
Page(s) 15							
Which Came First	1	See Discussion	Extending	2, 3, 5	I: 4, 7 K: 1, 2, 7 C: 10 A: 3	Change and Constancy	N: P: E: 15 L:

Ohio's Model Competency-Based Science Program

• Performance Objectives: Grade 3

1. The learner will decide what information is necessary to make a simple weather report, collect the information, and make the report.
2. Given a collection of evidence resulting from an event, the learner will seek clarification, and propose an explanation for the event.
3. The learner will describe an episode (e.g., storms, rolling and bouncing balls, hatching eggs, falling maplecopters) in terms of its duration and timing.
4. The learner will use whole number counts and measures to compare and classify familiar objects.
5. Given several opportunities to observe, the learner will use both quantitative and qualitative descriptions to explain the attributes and behaviors of an object or organism.
6. The learner will choose a sense-extending device to gather information from observations of an object, event, or organism.
7. Given a diverse collection of living and non-living things, the learner will distinguish living and non-living things and provide justification for this classification.

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Instructional Strands • Grade 3•

Objectives	*Inquiry* • The learner will:	*Knowledge* •The learner will:	*Conditions* • The learner will be:	*Applications* • The learner will be:
1	search for information from multiple sources.	explore motions of objects and organisms.	working collaboratively with peers and learners of different ages and talents in various places.	obtaining information from the environment. (e.g., weather instruments, thermometers, sundials, gauges, timers).
2	select and explore the use and accuracy of a variety of measuring devices.	explore the capacity of some objects and organisms to influence other objects and organisms (e.g., air, magnets, static electricity, light and sound sources, predators, pesticides, soil, water).	exploring and investigating systematically observed natural phenomena in indoor and outdoor settings over a variety of time spans.	exploring the origins of devices found in the home or classroom setting.
3	predict what is missing and what will come next in sequences of objects and events and test his/her predictions.	explore the relative contributions of each component (part) in a system (whole).	repeating explorations and events safely.	exploring unknowns in the natural world.
4	speculate on commonly held assumptions about events and phenomena in their world.	explore qualitative and quantitative descriptions of objects and organisms.	identifying and choosing topics and units for study.	manipulating the amounts and combinations of ingredients to observe the impact of different combinations on the effectiveness of common household products and quality of foods.
5	explore the importance of various habits of mind (e.g., honesty, ethics, openness, skepticism, concern for health and safety) in making observations, reports, and decisions.	explore collections in various forms that represent the diversity of living things and non-living things.	expressing ideas and observations made in other settings in small- and large-group settings.	choosing and preparing for outdoor activities based on environmental conditions.
6	observe events and phenomena of varying duration and report occurrences accurately and ethically.	explore estimations of observable time (e.g., minutes, hours, days, weeks).	dramatizing milestones in the history of science.	contrasting the scientific ideas of many cultures.
7	explain and discuss various influences affecting observations and interpretations.	explore qualitative estimates of the rates of change (e.g., faster, slower, tone, brightness, loudness, cooling, and heating).	using constructed physical models and dioramas to express ideas and conceptions of events and phenomena.	identifying issues that affect settings larger than the immediate local area (e.g., recycling, reduced consumption, pollution, personal health).
8	apply common arithmetic operations to whole number counts and measures of concrete objects and observations to increase understanding and accuracy of descriptions and interpretations.	explore various resources for investigating questions (e.g., written materials, authorities, databases, libraries).	using mathematics and language arts as tools to build models and express ideas.	
9	seek evidence to support ideas by asking "How does it work?", "How do we know?", and "Why?"		participating in individual and group design of explorations.	
10	use computers and other technologies to express ideas and collect data.		examining and reflecting upon personal perspectives regarding natural events.	
11	use observed qualitative and quantitative attributes to describe phenomena.		using various modes of communication to effectively express their ideas.	
12	take responsibility for the care of supplies and equipment used in explorations.		writing "day in the life of..." stories about real or imaginary scientists.	
13	identify potential hazards and safely conduct explorations and activities.		engaging scientists in discussions about their occupations.	
14			exploring his/her own technological heritage from evidence found at home.	
15			constructing a portfolio of products and evaluations of his/her own abilities, skills, and experiences including self evaluations.	

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Item Discussion

Below is a summary list of certain **Multiple Choice** items from the SCIENCE TYPE 1 MODEL COMPETENCY ASSESSMENT for the **THIRD GRADE.** Items are included in this list because students are prompted to "Explain and justify..." their selected response immediately following each of these items. Certain **Multiple Choice** items are treated in this manner for various reasons, sometimes for different reasons depending on the assessment block they are a part of. In general, use of this "Explain and justify..." strategy is consistent with the questioning spirit of the Science Model (e.g., "How do we know?", "What is or reasonably can be inferred?", "How does it work?"). Secondly, this is another strategy for making a multiple choice item more interactive for students, and depending on how they respond, provide a wider window into their thinking.

The use of this strategy and the interpretation of student responses to this prompt, will depend upon numerous factors (e.g., the content of the district science program, particular emphases placed on individual topics, differing expectations for student performance on particular topics, needs of teachers and students to collect and share deeper insight). In any event, a general rubric approach that can be used to interpret student responses follows:

Criterion	**Rubric Summary**
1.	Answer in any way addresses the prompting question relative to the context of multiple choice item. Any remotely reasonable assumption and scientific response to this question is acceptable (even if incorrect).
2.	Answer presents assumption and accurate scientific explanation that accounts for and successfully connects students' selected response to the information in the context of the item.

Summary List of Multiple Choice Items With the "Explain and justify..." Prompt

• Third Grade Type 1 •

Assessment Block	*Item*	*Answer*
PP. 1 - 2		
Zoo Animals	4	C Response Varies
	8	C Response Varies
PP. 3 - 5		
Gardens	4	B Response Varies
	7	C Response Varies
	9	D Response Varies

The discussion on the following pages pertains to each of the **Short Answer** and **Extended Response** items on the SCIENCE TYPE 1 MODEL COMPETENCY ASSESSMENT for the **THIRD GRADE.** Discussion of these items include an **Item Description** which provides an overview of the item and the elements of an acceptable student response. The **Rubric Summary** further organizes these elements in a quick reference table reflective of suggested stages of an acceptable student response.

Item: Rocks and Minerals
#5 • Short Answer

Item Description: The item assesses the student's understanding of relative hardness of materials, their ability to analyze data obtained from scratching minerals with substances of different hardness, and their ability to utilize this data to place minerals in order from softest to hardest.

A good response will include correctly ordered minerals (from softest to hardest), and will include an explanation of the student's reasoning for ordering the minerals as he/she did. The explanation will be based upon the number of materials (or the types) that could scratch each mineral, and will include references to the relative or specific hardness (based upon Moh's hardness scale) of "scratching materials" (i.e., the paper clip, penny, fingernail) or the specific hardness of minerals themselves. Good responses may also include discussions of how the hardness of minerals would be different if they were or were not scratched by certain materials, or which minerals will or will not scratch other minerals.

Criterion	**Rubric Summary**
1.	Lists the minerals in some kind of order and provides a reason for that ordering of minerals (even if their explanation is weak or incorrect). Mineral order need not be correct in order to meet Criterion 1.
2.	Places all four minerals in correct order from softest to hardest. (or hardest to softest).
3.	Meet Criterion 2 and explains their ordering of minerals in terms of the number/type of materials that could scratch each mineral for at least two of the minerals.
4.	Meets Criteria 1, 2, and 3, and adequately, correctly describes the specific hardness of at least one mineral.

Item: Rocks and Minerals
#6 • Extended Response

Item Description: This item assesses the student's ability to apply what they have learned about relative hardness of minerals and testing mineral hardness to a novel situation involving an unknown mineral. It also assesses their ability to describe a procedure for testing relative hardness of mineral C and the unknown mineral.

A good response will describe a procedure that involves scratching the two minerals with a harder substance to see which one gets scratched (which will then be the softer of the two), or will describe attempting to scratch the two minerals together, recognizing that if C scratches the unknown, C is harder and vice versa.

Criterion	**Rubric Summary**
1.	Describe some process or action they will take upon mineral C or the new mineral, or discusses the hardness of mineral C or the new mineral (beyond simply stating that one mineral is harder then the other).
2.	Describe a testing process that involves scratching and/or breaking the minerals, beyond merely stating what items will or will not scratch C or the new mineral.
3.	Describe a purpose for the testing process given to meet Criterion 2 (i.e., they must have met Criterion 2). The purpose must be related to mineral hardness.
4.	Meets Criteria 1, 2, and 3, <u>and</u> states that they will scratch mineral C and new mineral together.

Item: Dinosaurs
#5 • Shorter Answer

Item Description: This item assesses the student's ability to analyze data about dinosaurs' physical characteristics and eating habits, separating relevant from irrelevant information in order to make an interpretation about an aspect of a particular dinosaur's behavior (i.e., eating habits).

A good response will select one of the large plant-eaters (i.e., Apatosaurus or Diplodocus) as the plant-eater that eats the most food, will correctly state the relationship between a dinosaur's size and its food intake, and will provide a logical explanation of why, in most cases, large-sized animals require more food than smaller animals.

Criterion	Rubric Summary
1.	Selects <u>any</u> dinosaur (from the table) as the one that ate the most food <u>and/or</u> discusses <u>some</u> relationship between plant-eaters and amount of food eaten, even if incorrect.
2.	Selects Apatosaurus or Diplodocus (they are the largest plant-eaters by weight and length respectively) as the plant-eating dinosaur that ate the most food, AND the student lists <u>at least one</u> reason for their choice that relates to size, weight, and/or energy. Note: Their reason does not necessarily have to be correct to meet Criterion 2.
3.	<u>Correctly</u> states the relationship between the size of a dinosaur and the amount of food that it eats. e.g., "Apatosaurus eats the most amount of food because of its large size."
4.	Explains <u>why</u> large amounts of food are necessary for large animals (i.e., relates food intake to energy, health, strength, keeping up with other dinosaurs, etc.).

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Item: Dinosaurs
#6 Extended Response

Item Description: This item assesses the student's ability to analyze data about dinosaurs' physical characteristics and eating habits, recognize relationships between these data, and separate relevant from irrelevant information regarding the animal's diet, in order to distinguish between illustrations of meat-eating and plant-eating dinosaurs.

A good response will correctly identify the meat-eating vs. the plant-eating dinosaur and will provide multiple criteria for their selection based upon the data provided in the table. The student will also explain <u>why</u> the criteria indicate a meat-eating rather than a plant-eating dinosaur (i.e., describe the usefulness of the criteria to the dinosaur's eating habits).

Criterion	**Rubric Summary**
1.	Describe <u>some difference</u> between meat-eaters and plant-eaters. The difference(s) listed need not be accurate.
2.	<u>Correctly</u> selected Dinosaur B as the meat-eater and/or Dinosaur A as the plant-eater <u>AND</u> offered at least <u>one</u> reason for their choice even if the reason is vague or otherwise does not meet Criterion 3 or 4.
3.	Lists <u>at least two</u> physical characteristics that may be used to distinguish between meat-eaters and plant-eaters. Characteristics other than size of skull, size/sharpness of teeth, and sharpness of claws <u>must</u> be accompanied by some explanation of their reasoning in order to count toward meeting Criterion 3.
4.	The student explains <u>why at least one</u> of the physical characteristics that <u>met Criterion 3</u> are <u>useful</u> for identifying a meat-eater based upon the meat-eaters' life.

Item: Melting Candy
#6 • Short Answer

Item Description: This item assesses the student's understanding of the relationship between temperature and melting point, and their ability to identify a method that will continue to keep chocolate from melting for a period of time on a hot summer day.

A good response will show the student recognizes how to keep chocolate from melting on a hot summer day, and can explain why the method described will work.

Criterion	Rubric Summary
1.	A description is given of a method to keep the chocolate from melting.
2.	The method will continue to keep the chocolate from melting.
3.	An explanation is given.
4.	The student shows an understanding of the connection between temperature and melting point.

Item: Melting Candy
#6 • Extended Response

Item Description: This item assesses the student's ability to describe an experiment to determine the order of the melting points, from lowest to highest, of four different kinds of candy. A good response will show that the student can describe an experiment to rank the order of melting points. The student must then be able to draw conclusions from the experiment, that the candy which melts the fastest or first at a temperature above the melting point of all four candies or at the lowest temperature has the lowest melting point and would be ranked lowest.

Criterion	Rubric Summary
1.	An experiment is described that tests a hypothesis involving temperature and/or melting point (put the candies in a car or in your pocket). The hypothesis does not need to be stated and the experiment may or may not work.
2.	An experiment is described that tests the hypothesis that the candies will melt at different rates at a temperature above the melting point of all four pieces of candy, or that the candy that melts at the lowest temperature has the lowest melting point. If the student tests the candies at different temperatures all four pieces of candy must be treated the same, e.g., place all four pieces of candy in the shade, then place all four pieces in a car, etc. The criteria is not if one piece of candy is put in the house, one piece is put outside, etc..
3.	Observations are made that show the student understands the purpose of the experiment, to see which piece of candy melts first or fastest or at the lowest temperature (watch them to see which one melts first or see which one melts fastest).
4.	Criterion #2 is met and a conclusion is stated that shows the student understands that the candy that melted first or fastest or at the lowest temperature has the lowest melting point and would be ranked lowest. It does not need to be stated that the candy that melted second is ranked second, etc..

Item: Which Came First?
#1 • Short Answer

Item Description: This item assesses the student's understanding that the earth's surface is constantly changing and some changes are due to very slow processes, the ability to identify sequences of changes and to look for patterns in these changes.

A good response will include that mountains are rounded; smaller; worn down; or smoother and that the river is bigger or wider, and has many curves or bends.

Criterion	Rubric Summary
1.	Chooses picture A without explanation or with an incorrect explanation.
2.	Chooses picture A and explains with an incomplete description of the mountain or river characteristics.
3.	Chooses picture A and explains why by referring to the river **OR** mountain only. The student includes the appropriate river or mountain attributes.
4.	Chooses picture A and explains why by is referring to the river **AND** the mountain The student describes the river and mountain with the appropriate attributes.

Zoo Animals

On a class trip to the zoo, Pat collected the following information from signs at the zoo.

Animal	Resting heart rate (beats per minute)	Body mass (kilograms)
hummingbird	250	less than 1
cat	90	5
human	70	70
elephant	25	2200

Use this information to answer the questions.

1. Based on the information that Pat collected, which animal has the fastest heart rate?

A. Hummingbird
B. Cat
C. Human
D. Elephant

2. Based on Pat's information, which animal has the greatest mass?

A. Hummingbird
B. Cat
C. Human
D. Elephant

3. A deer has a mass of 45 kilograms. Its heart rate will probably be about:

A. 10 beats per minute.
B. 50 beats per minute.
C. 80 beats per minute.
D. 150 beats per minute.

4. Explain your answer to Question 3.

____

____

____

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Zoo Animals

Animal	Resting heart rate (beats per minute)	Body mass (kilograms)
hummingbird	250	less than 1
cat	90	5
human	70	70
elephant	25	2200

5. A shrew has a heart rate of 200 beats per minute. Based on Pat's information, about what would the mass of a shrew be?

   A. About 1 kilogram
   B. About 5 kilogram
   C. About 45 kilogram
   D. About 230 kilogram

6. The information that Pat collected suggests that:

   A. all animals have 4-chambered hearts.
   B. heart rate is related to body mass.
   C. small animals need large hearts.
   D. an elephant's heart beats faster than a cat's heart.

7. Pat's heart rate is 70 beats per minute at rest and 80 beats per minute after running to catch the school bus. Based on the information that Pat collected, if a cat is chased by a dog, what would the cat's heart rate probably be?

   A. 50 beats per minute
   B. 70 beats per minute
   C. 100 beats per minute
   D. 200 beats per minute

8. Explain your answer to Question 7.

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Gardens

You and your third grade class want to plant a seasonal flower garden in the front yard of the school. You want the garden to have both red and yellow flowers during the spring, summer, and fall seasons. To help choose the right flowers for each of the seasons, you have collected the data in the chart below:

Flower Chart

Flower	Blooming season	Color	Height
tulip	spring	red	50 cm
daffodil	spring	yellow	25 cm
begonia	summer	red	40 cm
hollyhock	summer	yellow	150 cm
marigold	summer	yellow	40 cm
geranium	summer	red	65 cm
mum	fall	yellow	65 cm

Use this information to answer the following questions.

1. Which two types of flowers will bloom in red and yellow during the spring?

   A. Tulip and daffodil
   B. Daffodil and mum
   C. Begonia and hollyhock

2. You found out that a type of flower called zinnia blooms in the summer and has red flowers. If you planted zinnias in your garden, which other flowers could you plant so that the garden will be red and yellow in the summer?

   A. Daffodil and begonia
   B. Tulip and mum
   C. Hollyhock and marigold

3. Suppose you planted a red and yellow garden with only geraniums and marigolds, but all of the geraniums died. Which flower would be the best choice to replace the dead geraniums?

   A. Tulip
   B. Begonia
   C. Hollyhock

Gardens

Flower Chart

Flower	Blooming season	Color	Height
tulip	spring	red	50 cm
daffodil	spring	yellow	25 cm
begonia	summer	red	40 cm
hollyhock	summer	yellow	150 cm
marigold	summer	yellow	40 cm
geranium	summer	red	65 cm
mum	fall	yellow	65 cm

4. Explain your answer to Question 3.

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5. Look at the four lists of flowers below. Which one probably lists the flowers in the order they will bloom — from spring to fall?

A. Begonia, tulip, geranium, mum
B. Mum, begonia, geranium, tulip
C. Tulip, begonia, geranium, mum

6. Marigolds grow best when they have direct sunlight all day. Which flower would be the worst choice to plant beside the marigolds?

A. Daffodil
B. Begonia
C. Hollyhock

7. Explain your answer to Question 6.

____

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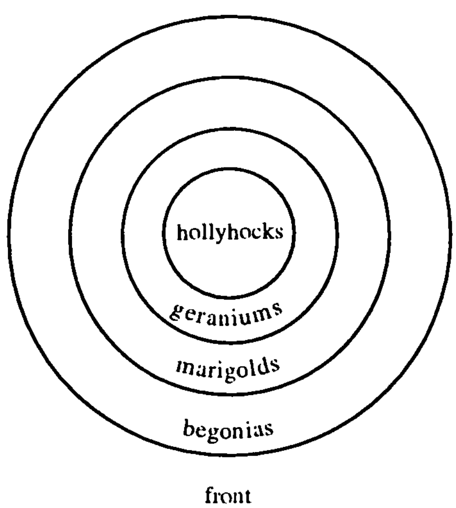
Gardens

Flower Chart

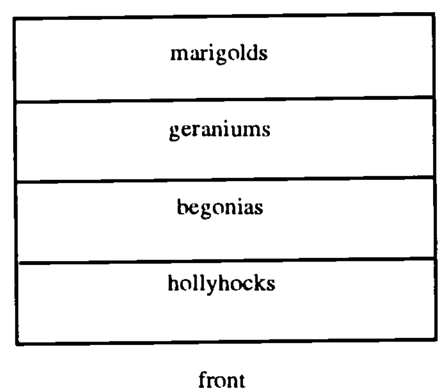
Flower	Blooming season	Color	Height
tulip	spring	red	50 cm
daffodil	spring	yellow	25 cm
begonia	summer	red	40 cm
hollyhock	summer	yellow	150 cm
marigold	summer	yellow	40 cm
geranium	summer	red	65 cm
mum	fall	yellow	65 cm

8. Your class wants to plant the summer garden so that **all** of the flowers can be seen from the front of the garden. Choose the garden design that will allow all of the flowers to be seen from the front.

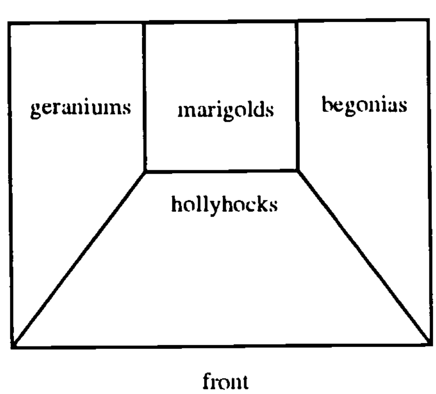
A.



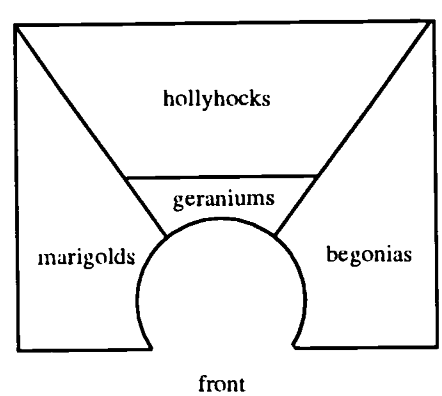
B.



C.



D.



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9. **Explain your answer to Question 8.**

Rocks and Minerals

Mrs. Smith's class tested four minerals for hardness (Mineral A, Mineral B, Mineral C, and Mineral D). The following table shows which of three items (fingernail, penny, and nail) could scratch the minerals.

- Of these three items, a fingernail is the softest and a nail is the hardest.
- The hardness scale ranges from 1 (the softest) to 10 (the hardest).
  - A fingernail has a hardness of 2.
  - A penny has a hardness of 3.
  - A nail has a hardness of 5.

Mineral sample	Scratched by fingernail	Scratched by penny	Scratched by nail
Mineral A	Yes	Yes	Yes
Mineral B	No	Yes	Yes
Mineral C	No	No	No
Mineral D	No	No	Yes

Use this information to answer the questions.

1. Which mineral is the hardest?

A. Mineral A
B. Mineral B
C. Mineral C

2. Based on the information given above, which of the following best describes the hardness of Mineral A?

A. Less than 2
B. About 4
C. About 6

3. Based on the information given above, which of the following would be the hardness of Mineral C?

A. Less than 2
B. About 3
C. Greater than 5

Rocks and Minerals

- Of these three items, a fingernail is the softest and a nail is the hardest.
- The hardness scale ranges from 1 (the softest) to 10 (the hardest).
  - A fingernail has a hardness of 2.
  - A penny has a hardness of 3.
  - A nail has a hardness of 5.

Mineral sample	Scratched by fingernail	Scratched by penny	Scratched by nail
Mineral A	Yes	Yes	Yes
Mineral B	No	Yes	Yes
Mineral C	No	No	No
Mineral D	No	No	Yes

4. Chalk can be used to write on sidewalks and chalkboards. It can also be scratched by a fingernail. Which of the minerals in the table could be chalk?

A. Mineral A
B. Mineral B
C. Mineral C

Short Answer

5. List the four materials in order from softest to hardest and explain why you placed them in this order.

Softest 1) ______________________

2) ______________________

3) ______________________

Hardest 4) ______________________

Explanation: ______________________

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Rocks and Minerals

Extended Response

6. Suppose your teacher gives you a different mineral sample (unlike the others) that cannot be scratched by any of the materials (fingernail, penny, or nail). Tell how you would decide whether Mineral C is harder or softer than the new mineral sample.

Dinosaurs

You decide to prepare your own museum display for your school. You plan to include the following information on a poster.

Dinosaur name	Time period	Food	Weight	Length	Size of skull and teeth
Plateosaurus	Triassic	plants	1 ton	16 feet	small
Heterodontosaurus	Triassic	plants	< 1 ton	3 feet	small
Apatosaurus	Jurassic	plants	30 tons	70 feet	small
Diplodocus	Jurassic	plants	11 tons	88 feet	small
Allosaurus	Jurassic	meat	3 tons	36 feet	big
Tyrannosaurus	Cretaceous	meat	7 tons	43 feet	big
Velociraptor	Cretaceous	meat	< 1 ton	6 feet	big
Triceratops	Cretaceous	plants	8 tons	30 feet	small

Note: < means "less than"

Use this information to answer the questions.

1. Which is the smallest meat-eating dinosaur?

A. Plateosaurus
B. Heterodontosaurus
C. Velociraptor

2. The longest and heaviest dinosaurs lived during which time period?

A. Triassic period only
B. Jurassic period only
C. Triassic and Cretaceous periods

3. What probably determined whether a dinosaur ate meat or plants?

A. Time period
B. Weight
C. Size of skull and teeth

4. What is the biggest change that occurred from the Jurassic period to the Cretaceous period?

A. The dinosaurs became extinct.
B. The length of many dinosaurs increased.
C. The weight of many dinosaurs decreased.

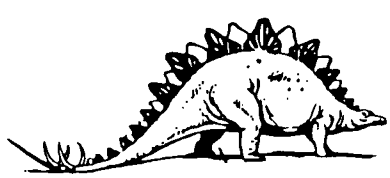
Dinosaurs

Short Answer

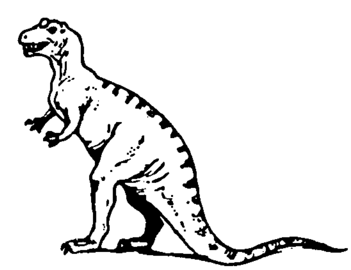
5. Of the dinosaurs that ate plants, which one probably had to eat the largest amount of food? Why do you think so?

Extended Response

6. Look at the dinosaurs below. Which one probably ate meat? Why do you think so?



Dinosaur A



Dinosaur B

Dinosaurs

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Melting Candy

Last Monday, Susan carried two pieces of unwrapped candy in her hand. Both pieces were the same size and shape. One was pure chocolate and one was chocolate covered with a candy shell. Susan opened her hand after a few minutes and saw that the pure chocolate had melted and the candy-coated chocolate had not.

Tuesday, Susan carried the same two kinds of candy. She put the candy-coated chocolate in her pants pocket and the pure chocolate in her jacket pocket. After a few minutes she checked the candy. This time, the candy-coated chocolate had melted and the pure chocolate had not.

1. When the chocolate melts, which of these changes takes place?

A. A liquid becomes a solid.
B. A liquid becomes a gas.
C. A solid becomes a liquid.

2. On Tuesday, which pocket was probably the warmest?

A. The pants pocket, because the candy-coated chocolate melted and the pure chocolate did not melt.
B. The pants pocket, because the candy-coated chocolate did not melt and the pure chocolate did melt.
C. The jacket pocket, because the candy-coated chocolate melted and the pure chocolate did not melt.

3. How did the temperature of Susan's pockets compare with the temperature of her hand?

A. The pants pocket was colder and the jacket pocket was warmer than her hand.
B. The pants pocket was warmer and the jacket pocket was colder than her hand.
C. Both the pants and jacket pockets were colder than her hand.

Melting Candy

4. If Susan puts four different pieces of candy into her hand at the same time, which one will probably finish melting first?

   A. A piece of pure chocolate taken from her refrigerator.
   B. A piece of pure chocolate taken from her freezer.
   C. A piece of candy-coated chocolate taken from her refrigerator.

Short Answer

5. It is a hot, sunny summer day and Susan is going to go outside. She wants to bring a few pieces of pure chocolate for later. What can she do to keep her chocolate from melting before she is ready to eat? Be sure to explain why this will work.

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Melting Candy
Extended Response

6. Susan is given four different kinds of candy. Describe an experiment that Susan can do to find out how the melting points of the candies rank, from lowest to highest.

Which Came First?

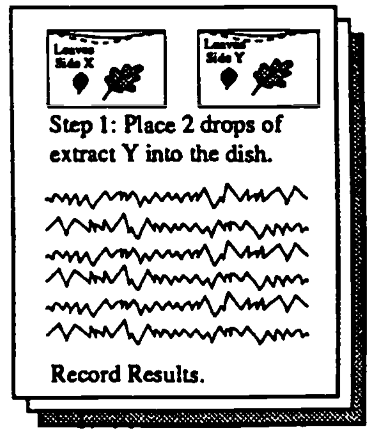
Short Answer

1. Some changes in nature may happen very slowly, but there are always changes taking place. The pictures below show the same river and mountains, but one picture shows how they looked millions of years ago, and the other picture shows how they look now. Circle the letter under the picture that shows how the river and mountains look **NOW**. Explain how you can tell this.

Type 2

Third Grade Science

Competency-Based Education Assessment Series



° On Demand Problem-Solving Events °

(Performance-Like)

Characteristics

- Experimental and non-experimental research, requiring more than a single session and some out-of-class time
- Scoring Options: Holistic scoring (i.e., portfolio scoring guide and interviews); scoring with rubrics, check-lists, and/or interviews

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart.* Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments are focused on *Science Portfolio Scoring Guide* parameters, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with *Science Portfolio Entry* types, instructional strands, and organizing concepts.

Refer to the *Content Summary Chart.* It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Third Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)* *Fourth Grade*
Page(s) 1 - 2	🗁						
Zoo Animals	1	See Discussion	Processing	4, 5	I: all K: 2, 4, 5, 7 C: 4, 5, 7, 8, 10, 11 A: 3	Change and Constancy	N: 1, 2, 3, 4, 5, 6, 7, 8, 9 P: 11 E: L: 16, 17
	2	See Discussion	Processing				
	3	See Discussion	Extending				
	4	See Discussion	Extending				
Page(s) 3 - 4	🗁						
Gardens	1	See Discussion	Extending	2, 5, 7	I: all K: 1, 2, 3, 4, 5, 8 C: 1, 2, 3, 7, 8, 9, 10, 11, 15 A: 1, 3,5, 7	Patterns	N: 1, 2, 3, 4, 5, 6, 7, 8, 9 P: E: 14 L: 16, 17, 18
	2	See Discussion	Processing				
Page(s) 5 - 6							
Minerals	1	See Discussion	Acquiring	4, 5	I: all K: 2, 4, 5 C: 1, 2, 3, 8, 10 A:	Change and Constancy	N: 1, 2, 3, 4, 7 P: 11 E: 15 L:
	2	See Discussion	Processing				
	3	See Discussion	Extending				
Page(s) 7 - 8	🗁						
Colors	1	See Discussion	Acquiring	2, 5	I: all K: 2, 4 C: 1, 2, 3, 8 A: 4	Scale/ Complexity	N: 1, 2, 4, 6, 7, 8 P: 11 E: L:
	2	See Discussion	Extending				
	3	See Discussion	Extending				
Page(s) 9 -11	🗁						
Marble Race	Table	See Discussion	Acquiring	2, 3, 5, 6	I: all K: 1, 2, 3, 4, 6, 7 C: 1, 2, 3, 8, 9, 10, 11 A:	Scale/ Complexity	N: 1, 2, 3, 5, 6, 7, 8, 9 P: 10, 12 E: L:
	1	See Discussion	Acquiring				
	2	See Discussion	Processing				
	3	See Discussion	Extending				
	4	See Discussion	Processing				
Page(s) 12-17	🗁						
Clay Boats	Table	See Discussion	Processing	2, 3, 5	I: all K: 1, 2, 4, 7 C: 2, 3, 7, 9, 10 A: 2, 3, 4, 6, 7	Models and Scale	N: 1, 2, 3, 5, 6, 7, 8, 9 P: 11, 12 E: L:
	1	See Discussion	Extending				
	2	See Discussion	Extending				

Ohio's Model Competency-Based Science Program

• Performance Objectives: Grade 3

1. The learner will decide what information is necessary to make a simple weather report, collect the information, and make the report.
2. Given a collection of evidence resulting from an event, the learner will seek clarification, and propose an explanation for the event.
3. The learner will describe an episode (e.g., storms, rolling and bouncing balls, hatching eggs, falling maplecopters) in terms of its duration and timing.
4. The learner will use whole number counts and measures to compare and classify familiar objects.
5. Given several opportunities to observe, the learner will use both quantitative and qualitative descriptions to explain the attributes and behaviors of an object or organism.
6. The learner will choose a sense-extending device to gather information from observations of an object, event, or organism.
7. Given a diverse collection of living and non-living things, the learner will distinguish living and non-living things and provide justification for this classification.

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Item Discussion

Item discussion on the following pages pertains to **THIRD GRADE** SCIENCE TYPE 2 MODEL COMPETENCY ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content. Parameters for holistic evaluation of student work are suggested in the *Science Portfolio Scoring Guide* * (*Note: NOT FOR USE AS A CHECK LIST. Each student product or demonstration need not reflect all parameters and corresponding indicators.)

Science Portfolio Framework

(Used with permission from the *CCSSO SCASS* Science Portfolio materials.)

RATIONALE. A science portfolio assessment strategy supports improved proficiency performance. A portfolio supports science program implementation, providing a framework for teacher's on-going guidance and suggestions to keep student's work manageable, productive, and relevant to the targets (objectives) for student learning. A portfolio interfaces with previous assessment development. (Note Items in TYPE 2 SCIENCE MODEL ASSESSMENTS for the **THIRD GRADE** that are examples of potential science portfolio entries are marked with a folder icon, 🗁, in the *Content Summary Chart.*) A portfolio allows holistic assessment of student's doing and knowing science.

ASSUMPTIONS. Potential science portfolio entries will result from a combination of teacher initiated and student initiated questions. Students will learn and extend self-evaluation skills. The student's **showcase science portfolio** contains his or her choices of the best four products to represent his or her science learning. These products are selected from among all the learning activities and demonstrations he or she completes in a pre-determined time period (i.e., quarter, semester, year). Each product is selected as a **portfolio entry** and placed in one of four categories of science work described below.

- 🗁 **Investigation** Experimental research: Requires students to design, carry-out, and report results of an observational, and/or experimental process.
- 🗁 **Research** Non-experimental research: Requires students to access, analyze, synthesize, evaluate, and use the kind of information the average citizen might use to investigate and solve a problem of personal or societal significance. Students also identify alternatives, trade-offs, and make a decision regarding an issue.
- 🗁 **Application** Inventive or expressive in nature: Requires students to choose a manner of demonstrating what they *can do*, what they *can apply*, and how thoroughly they *can justify* their thinking. An inventive application allows students to show how scientific information can be used to solve real-world problems. An expressive application allows students to communicate scientific information in a medium of their choosing. His or her work includes a written or verbal description of the scientific basis for the entry.
- 🗁 **Open Choice** Students may use this entry to provide further evidence of his or her science learning. This entry may be another piece of the previously described categories of science work.

Each entry is accompanied by the student's **entry summary** (self-evaluation). Students discuss how well the entry reflects the *Science Portfolio Scoring Guide's* **four parameters**

- Depth of Understanding
- Evidence of Inquiry
- Communication
- Relevance to Society

- 🗁 **Portfolio Summary** The *fifth entry* of students' final science portfolio: Each student writes their **portfolio summary** to illustrate how their four entries reflect one or more of the above **four parameters.**

Teachers, parents, and administrators can use this piece as a road map of how the student's work illustrates progress toward the targets of instruction in place of and/or in addition to all other assessment strategies.

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EXAMPLE STUDENT PORTFOLIO: Evidence, Models, and Explanations *

- 🗁 **Example Portfolio Summary Outline**

Students discuss evidence of how their individual portfolio entries illustrate functional understandings of how to collect and use evidence to understand interactions and predict changes; devise and use models to understand and explain how things work; and, incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements. Students present evidence from across their **four entries** to illustrate one or more of the **four parameters** (see *Science Portfolio Scoring Guide*). In the process they answer the following questions

- How well do I know science? ...(Depth of Understanding)
- What can I do in science? ...(Evidence of Inquiry)
- How well do I communicate what I know and can do in science? ...(Communication)
- How well do I show how science affects people's lives. ...(Relevance to Society)

- **Examples of Student Entries** (*Examples result from a combination of student and teacher generated questions*):

  🗁 **Investigation Entry** Students make observations, use tools, collect data, and use evidence to support conclusions about the floating and sinking behaviors of various materials (e.g., *Buoyancy*).

  🗁 **Research Entry** Students select a popular video tape on a scientific topic, researches and discusses the accuracy of scientific information presented (e.g., *Land Before Time, Jurassic Park, Star Wars*).

  🗁 **Application Entry** Students make use of creative and inventive strategies to construct, test, and describe a model containment system for hazardous material spills (e.g., *Boom Construction*).

  🗁 **Open Entry** Students discusses a question of personal interest illustrating relevant science knowledge pertaining to recycling pop cans and plastic bottles (e.g., *Reducing Cafeteria Waste*).

*In this example, the unifying concepts that glue the targets (objectives) of classroom instruction and learning activities are evidence, models, and explanations. These unifying concepts are not the topics of instruction. Separate topics that are taught in classrooms can be tied together with these unifying concepts.

START-UP SUGGESTIONS

DEFINE THE GOALS AND OBJECTIVES THAT YOU WANT THE PORTFOLIO TO DEMONSTRATE. Think about existing opportunities for students to become familiar with the targets of their science learning. *(In the example above, student final portfolio entries are more likely to illustrate questions, activities, processes, and products that demonstrate functional understandings of evidence, models, and explanations.)*

DECIDE ON THE LOGISTICS AND RESPONSIBILITY OF THE PORTFOLIO. Time and space needs for completion and storage of portfolios should be addressed. Also, think about existing opportunities for potential science portfolio entries to come from a combination of teacher initiated questions and student initiated questions (preferred). Teachers continue to offer on-going guidance and suggestions to make student's work manageable, productive, and relevant to the targets (objectives) for student learning. *(In the example above, most of the student final portfolio entries do not take-up much room, the exception is the Boom Construction. The Exercise Program entry reflected personal choice.)*

BE SURE TO COMMUNICATE YOUR EXPECTATIONS CLEARLY (TO STUDENTS, PARENTS AND ADMINISTRATORS). Think about existing opportunities for sharing the parameters in the Science Portfolio Scoring Guide relevant to the science program targets (objectives) for student learning. *(In the example above, student work more frequently illustrates rich connections with the district science program/Science Model Instructional Strands)*

THINK BIG; START SMALL. EXPERIMENT UNTIL YOU FIND A FORMAT AND PACE THAT EVERYONE IS COMFORTABLE WITH. Think about existing opportunities for students to start, receive feedback, revise and improve their work, and practice self-evaluation skills. *(In the example Boom Construction above, students working as part of research/investigative teams would receive feedback from peers, teachers, and experts. Confidence builds for more independent work later.)*

Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description			
	Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

Item: Zoo Animals
Representing & Interpreting Information

Item Description: This item assesses the student's ability to represent and interpret statistical information about zoo animals heart rate and weight in a graphical form. Also, this item assesses the student's ability to utilize creativity in inventing a make-believe animal, and then in describing multiple aspects of that animal related both to its physical characteristics and its lifestyle (behavior).

Good responses will describe a truly make-believe animal (not part of common fictional knowledge), and will include information related to the animal's physical characteristics and to its physiology and/or life habits.

Good responses will demonstrate students ability to identify/label points on the bar graph and interpret the bar graph of heart rate and weight (i.e., heart rate and to weight or greater weight means greater heart rate.)

Criterion	**Rubric Summary**
1.	Complete the graph AND Draw a <u>sign</u> with some zoo animal information on it and create a bar graph of heart rate and body mass information.
2.	List at least two specific pieces of information that <u>we</u> could gain about the animal by using our senses (e.g., height, color, fur, sounds made, teeth, smell, scaly); and estimates the size/weight of the animal relative to the animals in the chart included in the problem.
3.	Lists <u>at least two</u> pieces of non-sensory information [e.g., related to the animals diet, habitat, behavior, relationship to other animals, rarity, life span, physiology (e.g., cold blooded, hearing, growth rate)] and including heart-beat estimate based on approximate size of the animal.
4.	Interpret the graph and describe the relationship AND <u>Describe</u> a make-believe animal that is <u>not</u> commonly known (such as unicorns, gremlins, ewoks, Bigfoot, etc.)

Item: Gardens
1

Item Description: This item assesses the student's ability to selectively use information from a table to plan for a specific growth knowledge of a plant. It assumes that the student has a general knowledge of plant growth cycles, of light and casting shadows, and of the seasonal growth habits of plants.

A good response will show that the student found the height information in the flower chart given them and understands that the taller plants can be used to shade others. The response shows that the student considers the season of growth to be expected from the plants and uses the tallest spring-blooming plants to shade the short spring-growing bluebells. Tall summer-blooming plants are also choices for shade providers, since the prompt specifies bluebells' growing season only, not their bloom time, which by inference might be spring or later.

Criterion	Rubric Summary
1.	Provides a drawing of flowers or plants or a garden, and either explains it or provides labels explaining it.
2.	Mentions providing shade for bluebells using any means (e.g., trees, buildings, other plants).
3.	Uses at least five other flowers from the chart in the garden (e.g., tulip, daffodil, begonia, hollyhock, marigold, geranium, mum).
4.	Uses tulips and/or daffodils to shade the bluebells in the spring. A clear reference to the reason for using tulips and daffodils is given, (something to do with seasonal growth). OR Uses hollyhocks to shade bluebells because they're the tallest plants. Again, a clear statement should be made.

Item: Gardens
2

Item Description: This item assesses the student's ability to refer to a table of information, select appropriate information from the table and synthesize it. The concept addressed is the seasonal nature of plant growth, specifically blooming seasons. The item assumes that the student has a general knowledge of plant growth and of seasonal changes from her or his everyday life.

A good response will show that the student identified blooming season as the important factor and was able to deduce the time of year from the condition of the plants using the table at the beginning of the test. Response will show that the student understands that plants respond in predictable ways to the seasonal changes in such environmental factors as light, temperature and precipitation.

Criterion	Rubric Summary
1.	Gives at least one reason why a plant might look or be healthy or unhealthy. The reason need not be correct.
2.	States that marigolds and geraniums bloom in the summer or that mums bloom in the fall.
3.	States that it is the end of summer, beginning of fall, or fall. Specific fall months are acceptable.
4.	Relates the condition of plants to seasonal changes in environmental factors such as light, temperature, or precipitation.

Item: Minerals

Item Description: This event assesses the students' ability to formulate and apply rules that they can use to compare and rank things. The specific subject is the hardness and softness of minerals. It asks them to perform a scratch test on four unknown mineral samples, read a bar graph that illustrates the comparative hardness and softness of four named minerals, then combine the scratch test results with the bar graph's information to identify the four mineral samples.

The student must already know: 1) fingernails are softer than pennies and pennies are softer than nails; 2) harder things scratch softer things; 3) how to read a bar graph.

Criterion	Rubric Summary
1.	In table B: Identifies as talc whichever mineral appeared to be softest based on the results of the student's scratch test.
2.	In table B: Identifies as quartz whichever mineral appeared to hardest based on the results of the scratch test.
3.	In response to question 2: Chooses a mineral based on its hardness. Texture is not an acceptable basis for "best mineral" selection.
4.	Selects quartz as the best mineral for sandpaper, because it is hardest. OR If the student chooses a mineral other than quartz, the student clearly knows the chosen mineral is not the hardest but has a well-reasoned defense.

Item: Colors

Item Description: The exercise is intended to show the students that colors are a combination of other colors by using filter paper, three magic markers, (orange, purple and green) and a pan of water.

Question 1. To answer the question, a line could be drawn with brown magic marker on a piece of filter paper and placed in a pan of water. If done correctly the brown color should separate into the three primary additive colors, red, green and blue. Another response would describe mixing different combinations of colors together to find which ones make the color brown.

Question 2. A good response will show the student recognizes that the color orange can be made by mixing red and yellow and therefore does not need to be purchased. If the exercise was done correctly it should have shown students that the color orange separates into red and yellow.

Criterion	**Rubric Summary**
1.	Colors are listed that may make the color brown. OR Any method is described to make the color brown (question 1). OR three of the four colors of paint (red, yellow, orange, and blue or green) are listed (question 2).
2.	A method is described to determine what colors make up the color brown (question 1).
3.	The three colors chosen are red, yellow, and green or blue. (question 2).
4.	An explanation is given for choosing <u>three</u> colors that show the student understands that the fourth color can be made by mixing the other colors (question 2).

Item: Marble Race

Item Description: This event focuses on how the steepness or slope of a plane affects the acceleration of an object traveling along it. Normally an object (the marble) will roll down an inclined plane (the ruler) faster each time the steepness or slope is increased. Students get the chance to work with this concept as they place one, two, and then three books under the starting point while recording how long it takes each marble to cross the finish. Four sets of questions help determine a student's level of understanding.

Answers to the first question may be as simple as "3" or "when three books were used in the second trial."

One of the first variables to affect the concept mentioned above is how high above the floor the marble starts rolling from.

Question 2: Since the length of the ruler itself is fixed, as students add books, the steepness or slope is the most visible variable to change.

Another variable that affects the rate at which the marble rolls has to do with the amount of friction.

Question 3: Asks them how they could get the marble to go even faster. Pushing the marble would be an acceptable answer.

For Question 4, students must use a more advanced level of thinking when they answer. Again, duplication of answers is not desirable. Good responses can address multiple feasible variability factors (e.g., timing of release, release point, reading the timer, start/stopping the timer, cumulative effect of dirt and oil, effects of the floor surface due to patterns in flooring cover).

Criterion	Rubric Summary
1.	Responses identify and explain pertinent, feasible (non-repeating) cause and effect relationship.

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Item: Clay Boats

Item Description: The student is asked to make a boat out of clay. The boat is then tested by placing it in a tub of water and loading it with washers until it sinks. The student then makes changes to the boat in an attempt to increase the number of washers it can hold. The changes and number of washers for each boat are recorded in a table.

The content of this event concerns buoyancy. The principal of buoyancy is a comparison of the weight of an object to the amount of water, or other fluid, it displaces. An ideal boat would have a low weight and a large volume.

The students are asked two questions. The first concerns a change they made to improve the boat and why this helped, and the second, three questions the student could ask about a friend's boat in order to help their's hold more washers.

The content of the answers can be judged in two areas.

1. Size (mass or weight)

   The variable to look for is the amount of clay used in the boat or the actual weight of the boat. Examples: used more or less clay, made thicker or thinner walls, made boat lighter or heavier...

2. Shape (volume or displacement)

   The variable to look for are the dimensions of the boat, but not necessarily surface area. Examples: made boat deeper or shallower, wider or narrower, longer or shorter, increased or decreased volume of displacement of boat...

   NOTE: Increasing surface area doesn't necessarily increase volume.

Criterion	Rubric Summary
1.	Student refers to the shape or volume of the boat such as depth, width, length, big, small.
2.	Student refers to the weight of the boat. This can be done by describing the amount of clay used or the thickness of the walls.
3.	Student mentions relationship between increased volume/displacement and the improvement of the boat.
4.	Student mentions relationship between decreased weight and improvement of the boat.

Zoo Animals

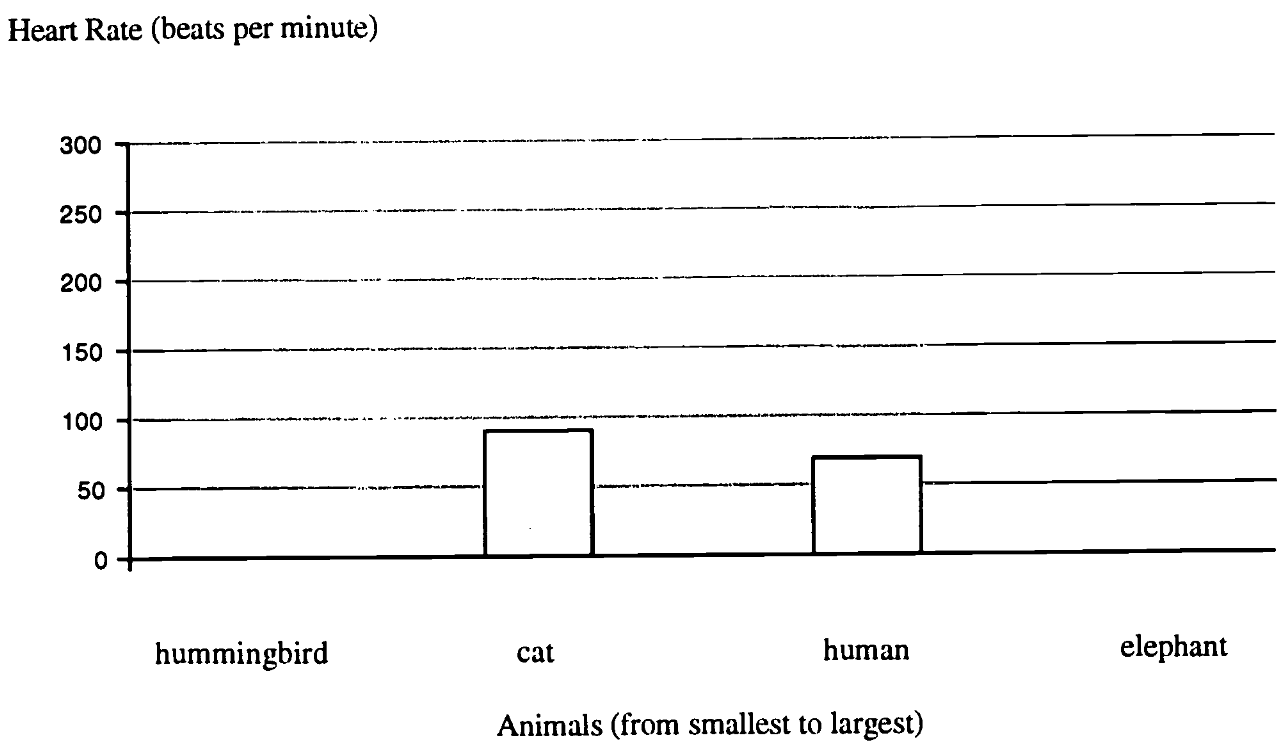
On a class trip to the zoo, Pat collected the following information from signs at the zoo.

Animal	Resting heart rate (beats per minute)	Body mass (kilograms)
hummingbird	250	less than 1
cat	90	5
human	70	70
elephant	25	2200

Table 1

Step 1. Help Pat explain the zoo animal information.

Below you see a bar chart Pat started to make for the information she collected. She wants to compare the different resting heart rates. The chart will be part of a report that Pat is working on with some classmates.



1. Using information from Table 1 above, help Pat complete the bar chart. Draw the bars for the resting heart rate of the hummingbird and the elephant.

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Zoo Animals

You may have noticed something about the bottom of the bar chart. Pat decided to put the animals at the bottom of the chart in order from smallest to largest mass.

2. Using your own words, help Pat explain this chart. Describe how the resting heart rate of animals seems to change for smaller animals compared to bigger animals?

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Step 2. Make-up and describe a zoo animal.

Zoo signs contain other information besides what Pat collected.

3. Draw a zoo sign for a make-believe animal. Put the name of the animal at the top of the sign. Under the name, include scientific information about that animal.

4. How big is your make-believe animal compared to the ones on Pat's bar chart? On the bottom line of the bar chart from smaller to larger animals, mark the place for your make-believe zoo animal. What is its heart rate? Explain why you think so.

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Gardens

You and your third grade class want to plant a seasonal flower garden in the front yard of the school. You want the garden to have both red and yellow flowers during the spring, summer, and fall seasons. To help choose the right flowers for each of the seasons, you have collected the data in the chart below:

Flower Chart

Flower	Blooming season	Color	Height
tulip	spring	red	50 cm
daffodil	spring	yellow	25 cm
begonia	summer	red	40 cm
hollyhock	summer	yellow	150 cm
marigold	summer	yellow	40 cm
geranium	summer	red	65 cm
mum	fall	yellow	65 cm

Use this information to answer the following questions.

Step 1. Help solve a planting problem using the Flower Chart information.

A new student joins your class project. They would like bluebells, another kind of flower, to be included in the class flower garden. They bloom in the spring. They reach a height of 20 cm. They need a lot of shade.

1. Suppose your class agrees to plant bluebells as well as all the other flowers shown in the chart. How could you best arrange the flower garden to protect the bluebells from the sun? Draw your garden in the space below, then tell why you set it up this way.

Gardens

Flower Chart

Flower	Blooming season	Color	Height
tulip	spring	red	50 cm
daffodil	spring	yellow	25 cm
begonia	summer	red	40 cm
hollyhock	summer	yellow	150 cm
marigold	summer	yellow	40 cm
geranium	summer	red	65 cm
mum	fall	yellow	65 cm

Step 2. Decide what's happening to your garden using the Flower Chart information.

The garden planting was a lot of fun and a huge success. It grew through the spring and everyone in the neighborhood enjoyed the variety of colors. Weeks pass by and the seasons change however.

2. You have noticed that the begonia and geranium plants in your summer garden have stopped blooming and are turning brown. The mums look very healthy. Why do you think that this is happening? Explain your answer.

Minerals

You and your classmates have just found four mineral samples. Try to identify them using a *scratch test.*

Step 1. Perform a Scratch Test

1. Students may work in groups to complete the following explorations, but each student will record the results in Table A in his or her own booklet.
   - Scratch each mineral with your *fingernail.* See if the surface of the mineral is scratched. If so, write "yes" in the table below. If not, write "no."
   - Scratch each mineral with the *penny.* See if the surface of the mineral is scratched. If so, write "yes" in the table below. If not, write "no."
   - Scratch each mineral with the *nail.* See if the surface of the mineral is scratched. If so, write "yes" in the table below. If not, write "no."

Table A

Mineral sample	Scratched by fingernail	Scratched by penny	Scratched by nail
Example	no	yes	yes
Mineral A			
Mineral B			
Mineral C			
Mineral D			

When you are done, go back to your desk. You will be asked to answer some questions.

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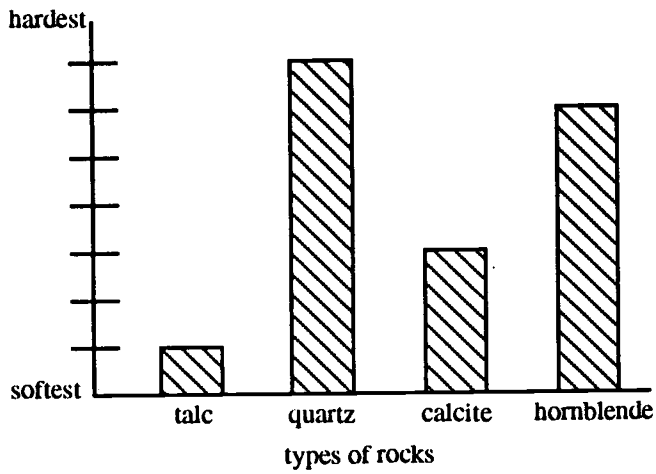
Minerals

Questions

Step 2. Identify your samples and answer the following questions by yourself.

2. The samples you were given are pieces of quartz, calcite, talc, and hornblende. Compare your results from Table A to the information on the graph below.



Try to identify your samples. Write the names in Table B.

Table B

Mineral sample	Name of mineral
Mineral A	
Mineral B	
Mineral C	
Mineral D	

3. Sandpaper is made of tiny grains of tiny hard rocks glued to paper. It is used to scratch soft materials including wood. Which one of your minerals would make the best sandpaper? Why do you think so?

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Colors

What color do you get if you mix yellow and blue paint? What colors can be combined to make orange? In this exercise you will discover how to answer these kinds of questions.

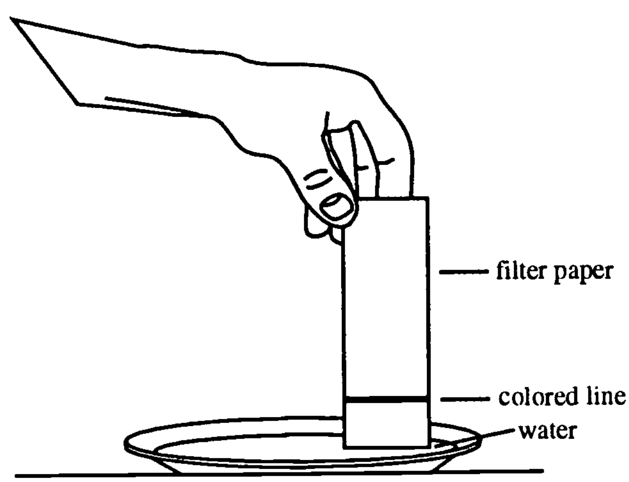
Students may work in groups, but each student will record the results in his or her own booklet.

Step 1. Prepare three strips of filter paper.

- Draw a line with the orange magic marker 1 cm from the bottom of a piece of filter paper. Use your pencil to label the top of this strip "orange."
- On another piece of filter paper, draw a line with the purple magic marker 1 cm from the bottom of the paper. Use your pencil to label the top of this strip "purple."
- On the last piece of filter paper, draw a line with the green magic marker 1 cm from the bottom of the paper. Use your pencil to label the top of this strip "green."

Step 2. Dip the three strips of filter paper in water.

- Fill the bottom of the plastic plate with water that is less than 1 cm deep.
- Put the bottom of the filter paper in the water on the plate. Make sure that the water does not touch the colored line when you dip it in the water. See the figure below:



- Three members of the group should each hold one of the filters in place in the water until the water is absorbed up past the colored line and the color stops moving up the filter. This should take about 5 minutes.

Colors

Step 3. Write down your observations.

1. Take the strips out of the water and lay each of them on the desk. What colors do you see on each strip? Record this information on the data sheet below.

Color of magic marker	Colors of the filter paper
Orange	
Purple	
Green	

Go back to your desk. You will be asked to answer some questions.

Questions

Step 4. Please answer the following questions by yourself.

2. What could you do to find out what colors are used to make the color brown? List all the steps.

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3. You want to paint a picture that has the colors red, yellow, orange, and green. You only have enough money to buy three colors of paint. Which three colors would you choose? Why?

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Marble Race

Have you ever gone down a slight hill on roller skates or on a skateboard? Does the slope of the hill affect how fast the skates or skateboard will go?

In this activity, you will study how fast things roll down hills. The marble will be like a skateboard. The ruler will be like the hill. Books will be used to change the slope of the hill.

Students may work in groups, but each student will record the results in his or her own booklet.

Step 1. Set up the materials as shown in the figure below. Start with only one book. Place the book on the floor. Lay one end of the ruler at the edge of the book. Tape the other end of the ruler to the floor. Lay the meter stick on the floor along the side of the ruler. Your setup should look like the one shown below. **Use more than one meter stick placed end-to-end if the marble rolls too quickly to time it as it rolls past one meter stick.**

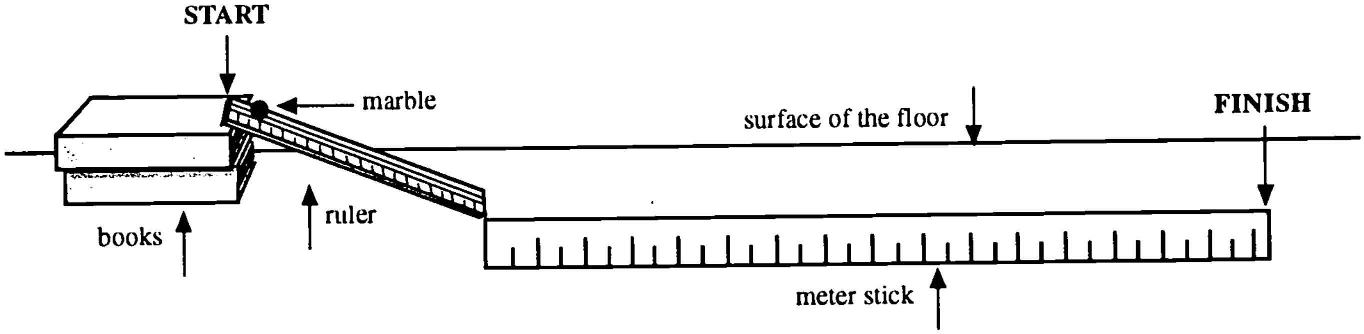

Figure 2

Step 2. Get ready to keep track of the time. You will measure how many seconds it takes for the marble to roll from the START to the FINISH.

Marble Race

Step 3. Hold the marble at the START (the top of the ruler). Let go of the marble. Keep track of how many seconds it takes for the marble to reach the FINISH (the far end of the meter stick). This is the *first* trial. Write *your result in the table below.*

Step 4. Repeat Step 3. This is the *second* trial. Write your result below.

Step 5. Add another book. Now there should be two books. Repeat Steps 3 and 4. Write your results below.

Step 6. Add another book. Now there should be three books. Repeat Steps 3 and 4. Write your results below.

Your Results

Number of books	Trial	Number of seconds for the marble to reach the FINISH
1	one	
	two	
2	one	
	two	
3	one	
	two	

When you are finished, go back to your desk. You will be asked to answer questions 1-4 by yourself.

Marble Race

Please answer the following questions by yourself.

1. When did the marble roll the fastest? With one book, two books, or three books? In which trial?

2. Why do you think the marble rolled the fastest in that case?

3. Suppose you want to get the marble to roll more quickly. Name one thing you can do. Explain why this would cause the marble to roll more quickly.

4. When the number of books is the same, the result from the *second trial* is usually different from the result of the *first trial.* Tell why this might happen.

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Clay Boats

You and your friends are watching different kinds of boats on a river. You wonder which kind of boat can carry the most weight. You decide that one way to find out is to test different kinds of boats to see which one will hold the most weight. You decide to make models from clay and float them in a container of water.

Students will work in groups of four, but each student must fill in his or her own Record Sheet.

Step 1: Work on the piece of waxed paper. Use the clay to make a boat that will float. Float the boat in the container of water.

Step 2: On the Record Sheet on page 5:

a. draw a picture of the boat;
b. measure the boat and then write a description of its size and shape;
c. put washers into the boat until it sinks;
d. record how many washers it took to sink the boat.

Step 3: Make another boat out of clay. Your second boat should be a different size and shape than your first. See how many washers it will hold before it sinks. Record the information on your Record Sheet as you did in Step 2.

Step 4: Repeat Step 3 and keep testing different kinds of boats. Record the information on your Record Sheet each time. Try to improve your design so that the next boat you try will hold more washers. Make as many different boats as you have time to make.

Step 5: Go back to your desk. You will be asked to answer some questions.

Clay Boats

Record Sheet

Drawing of boat	Written description of size and shape	Number of washers

Clay Boats

Record Sheet

Drawing of boat	Written description of size and shape	Number of washers

Clay Boats

Questions

Please answer the following questions by yourself.

1. Describe one change you made in the design of the clay boat that made it hold more washers. Explain why you think this change helped.

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Clay Boats

2. Your friend calls you at home to find out why the boat she is testing cannot hold more than six washers. You can't see the type of boat she is using. What are three things you would need to know about her boat to help you figure out what might be wrong? Explain why you need each piece of information.

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Clay Boats

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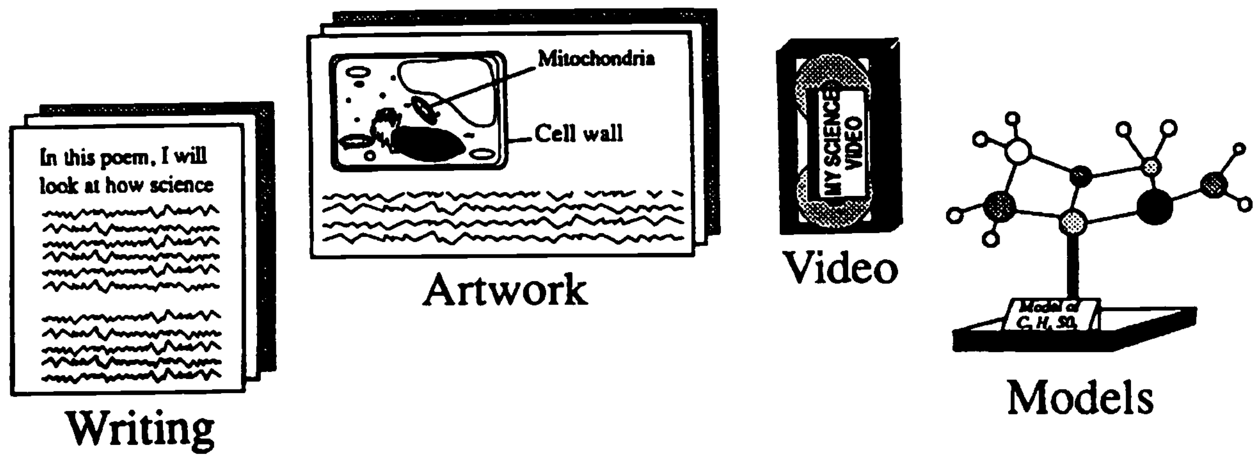
Type 3
Third Grade Science
Competency-Based Education Assessment Series



Substantive Application-Based Performance Tasks

(Open-Ended)

Characteristics

- Relevant inventive and creative applications, requiring experimental research, non-experimental research, and more out-of-class preparation
- Holistic scoring (e.g., portfolio scoring guide and interviews)

Item discussions provide an overview of items, pertinent content, and scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart.* Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments are focused on *Science Portfolio Scoring Guide* parameters, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with *Science Portfolio Entry* types, instructional strands, and organizing concepts.

Refer to the *Content Summary Chart.* It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Third Grade Type 3 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 1	🗁						*Fourth Grade*
Zoo Animals	1	See Discussion	Extending	2, 3, 4, 5	I: 1, 5, 7, 9, 11 K: 2, 3, 4, 5, 6, 8 C: 2, 7, 8, 10, 11 A: 1, 3, 7	Change and Constancy	N: 1, 2, 3, 4, 5, 6, 7, 8 P: E: L: 16, 17, 18, 19
Page(s) 2 - 4	🗁						
The Garden	1	See Discussion	Extending	2, 4, 5	I: 1, 7, 8, 9, 11 K: 2, 3, 4, 5, 6, 8 C: 8, 10, 11 A: 1, 3, 5, 7	Scale and Complexity	N: 1, 2, 3, 4, 5, 7, 8, P: E: 13, 14 L: 16, 17
	2	See Discussion	Extending				
Page(s) 5 - 7	🗁						
Keep It Cool!	Table	See Discussion		2, 3, 4, 5, 6	I: 2, 4, 7, 9, 11, 12 K: 2, 3, 4, 6, 7 C: 2, 3, 8, 10 A: 1, 4, 5	Energy	N: 1, 2, 3, 6, 7, 8, 9 P: 11 E: L:
	1	See Discussion	Extending				
	2	See Discussion	Extending				
	3	See Discussion	Extending				
Page(s) 8 - 11	🗁						
Swings	Table	See Discussion	Acquiring	2, 3, 4, 5, 6	I: all K: 1, 2, 4, 6, 7 C: 2, 3, 7, 8, 9, 10 A: .1, 3	Patterns	N: 1, 2, 3, 5, 6, 7, 8, 9 P: 12 E: L:
	1	See Discussion	Processing				
	2	See Discussion	Extending				
	3	See Discussion	Extending				

• Performance Objectives: Grade 3 ***Ohio's Model Competency-Based Science Program***

1. The learner will decide what information is necessary to make a simple weather report, collect the information, and make the report.
2. Given a collection of evidence resulting from an event, the learner will seek clarification, and propose an explanation for the event.
3. The learner will describe an episode (e.g., storms, rolling and bouncing balls, hatching eggs, falling maplecopters) in terms of its duration and timing.
4. The learner will use whole number counts and measures to compare and classify familiar objects.
5. Given several opportunities to observe, the learner will use both quantitative and qualitative descriptions to explain the attributes and behaviors of an object or organism.
6. The learner will choose a sense-extending device to gather information from observations of an object, event, or organism.
7. Given a diverse collection of living and non-living things, the learner will distinguish living and non-living things and provide justification for this classification.

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Item Discussion

Item discussion on the following pages pertains to the **Performance** and **Question** items on the SCIENCE TYPE 3 MODEL COMPETENCY ASSESSMENT for the **THIRD GRADE. Item Descriptions** provide an overview of the item and the elements of an acceptable student response. A **Rubric Summary** further organizes these elements into a quick reference table reflective of suggested stages of an acceptable student response. Or use the *Science Portfolio Scoring Guide* to holistically evaluate TYPE 3 ASSESSMENTS where appropriate.

Science Portfolio Framework

(Used with permission from the *CCSSO SCASS* Science Portfolio materials.)

RATIONALE. A science portfolio assessment strategy supports improved proficiency performance. A portfolio supports science program implementation, providing a framework for teacher's on-going guidance and suggestions to keep student's work manageable, productive, and relevant to the targets (objectives) for student learning. A portfolio interfaces with previous assessment development. (Note Items in TYPE 3 SCIENCE MODEL ASSESSMENTS for the **THIRD GRADE** that are examples of potential science portfolio entries are marked with a folder icon, 🗁, in the *Content Summary Chart.*) A portfolio allows holistic assessment of student's doing and knowing science.

ASSUMPTIONS. Potential science portfolio entries will result from a combination of teacher initiated and student initiated questions. Students will learn and extend self-evaluation skills. The student's **showcase science portfolio** contains his or her choices of the best four products to represent his or her science learning. These products are selected from among all the learning activities and demonstrations he or she completes in a pre-determined time period (i.e., quarter, semester, year). Each product is selected as a **portfolio entry** and placed in one of four categories of science work

- 🗁 **Investigation** Requires the student to design, carry-out, and report results of an observational, and/or experimental process.
- 🗁 **Research** Non-experimental research requires the student to access, analyze, synthesize, evaluate, and use the kind of information the average citizen might use to investigate and solve a problem of personal or societal significance. Students also identify alternatives, trade-offs, and make a decision regarding an issue.
- 🗁 **Application** Expressive or inventive in nature, students are required to include a written or verbal description of the scientific basis for the entry. An expressive application allows the student to communicate scientific information in a medium of his or her choosing. An inventive application allows the student to show how scientific information can be used to solve real-world problems.
- 🗁 **Open Choice** Students may use this entry to provide further evidence of his or her science learning. This entry may be another piece of the previously described categories of science work.

Each entry is accompanied by the student's **entry summary** (self-evaluation). Students discuss how well the entry reflects the *Science Portfolio Scoring Guide's* **four parameters**

- Depth of Understanding
- Evidence of Inquiry
- Communication
- Relevance to Society

- 🗁 **Portfolio Summary** The *fifth entry* of students' final science portfolio: Each student writes their **portfolio summary** to illustrate how their four entries reflect one or more of the above **four parameters.**

Teachers, parents, and administrators can use this piece as a road map of the how the student's work illustrates progress toward the targets of instruction.

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EXAMPLE STUDENT PORTFOLIO: Evidence, Models, and Explanations *

- 🗀 **Example Portfolio Summary Outline**

Students discuss example evidence of how their individual portfolio entries illustrate functional understandings of how to collect and use evidence to understand interactions and predict changes; devise and use models to understand and explain how things work; and, incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements. Students pull evidence from across their **four entries** to illustrate one or more of the **four parameters** (see *Science Portfolio Scoring Guide*). In the process they answer the following questions

- How well do I know science? ...(Depth of Understanding)
- What can I do in science? ...(Evidence of Inquiry)
- How well do I communicate what I know and can do in science? ...(Communication)
- How well do I show how science affects people's lives. ...(Relevance to Society)

- **Examples of Student Entries** (*Examples result from a combination of student and teacher generated questions*):

  🗀 **Investigation Entry** Students make observations, use tools, collect data, and use evidence to support conclusions about the floating and sinking behaviors of various materials (e.g., *Density of Medicines*).

  🗀 **Research Entry** Students select, research, and report on the work of a famous scientist (e.g., *Thomas Edison*).

  🗀 **Application Entry** Students identify and discuss the use of creative and inventive strategies to solve a problem (e.g., *Murder She Wrote*).

  🗀 **Open Entry** Students used a creative tool to illustrate relevant science knowledge (e.g., *Water Drops*).

*In this example, the unifying concepts that glue the targets (objectives) of classroom instruction and learning activities are evidence, models, and explanations. These unifying concepts are not the topics of instruction.

START-UP SUGGESTIONS

DEFINE THE GOALS AND OBJECTIVE THAT YOU WANT THE PORTFOLIO TO DEMONSTRATE. Think about existing opportunities for students to become familiar with the targets of their science learning. *(In the example above, student showcase portfolio entries are more likely to illustrate questions, activities, processes, and products that demonstrate functional understandings of evidence, models, and explanations.)*

DECIDE ON THE LOGISTICS AND RESPONSIBILITY OF THE PORTFOLIO. Time and space need to be addressed. Also, think about existing opportunities for potential science portfolio entries to come from a combination of teacher initiated questions and student initiate questions (preferred). Teachers continue to offer on-going guidance and suggestions to make student's work manageable, productive, and relevant to the targets (objectives) for student learning. *(In the example above, student showcase portfolio entries include his or her own work plus contributions to class-wide projects. The Density of Medicines entry began with a student question about why some medicines "stick" to one's throat.)*

BE SURE TO COMMUNICATE YOUR EXPECTATIONS CLEARLY TO STUDENTS (PARENTS AND ADMINISTRATORS). Think about existing opportunities for sharing the parameters in the Science Portfolio Scoring Guide relevant to the science program targets (objectives) for student learning. *(In the example above, student work more frequently illustrates rich connections with the district science program/Science Model Instructional Strands)*

THINK BIG; START SMALL. EXPERIMENT UNTIL YOU FIND A FORMAT AND PACE THAT EVERYONE IS COMFORTABLE WITH. Think about existing opportunities for students to start, receive feedback, revise and improve their work, and practice self-evaluation skills. *(In the example, students working as part of research/investigative teams would receive feedback from peers, teachers, and experts. Confidence builds for more independent work later.)*

Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description			
	Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

Item: Zoo Animals

Item Description: This item assesses the student's ability to describe a comprehensive examination of the animal that includes checking characteristics of the animal that are relevant to its health.

A good response will describe checking multiple, relevant criteria relating to external or physiological features, diet or behavior, and will include reasons for checking these characteristics, action the student will take upon making a diagnosis, and/or will describe a long-term observation they will make.

Criterion	Rubric Summary
1.	Lists at least one piece of information that they would check to see if the animal is healthy, even if the information is not particularly relevant to the animal's health.
2.	Describes <u>at least one</u> physical characteristic (besides mass, weight, and heartbeat) that they will check, <u>and</u> at least one behavioral characteristic (such as diet or exercise).
3.	Gives a <u>reason</u> for why they will check at least one characteristic (e.g., "I will check his ears for bugs." I will check to see if the animal has eaten the right food."
4.	Clearly describe a <u>course</u> of <u>action</u> they will take once they have made a <u>diagnosis</u> (such as "If he is sick, I will give him a shot.") <u>and/or</u> b) describes a long-term observation they will make.

Portfolio Scoring Parameters:

Depth of Understanding
Describes a <u>course</u> of <u>action</u> they will take once they have made a <u>diagnosis</u> (such as "If he is sick, I will give him a shot.")

Evidence of Inquiry
Describes a long-term observation they will make (such as, "I will see how much he puts on in a month." or, "I will come back in a few days to see if he still has a fever.").

Communication
Clearly describes ideas. Gives a <u>reason</u> for why they will check at least one characteristic (such as, "I will check his ears for bugs.").

Relevance to Society
Shows evidence of understanding the relevance of physical (weight, mass, heartbeat) and behavioral (diet, exercise) characteristics to health.

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Item: The Garden

Item Description: This item assesses the student's understanding of the concept "growing season," both as it relates to different locations and as a plant growth requirement.

In order to calculate the number of days in the growing season in Superior, MT, the student must be able to read a calendar and count up to at least 85, which is the number of days between the first and last frosts in Superior. Also, basic math skills are needed to compare the length of the plants' growing season with the number of frost free days available in Superior.

The seed catalog the students use should include only the name of the variety, a line drawing of the vegetable/fruit, and the days required to grow each variety to maturity, so students are not distracted by any other information about the plants.

The student is required to choose one variety each, of beans, corn, lettuce and peas, and two additional items in the catalog. There are varieties of beans, corn, lettuce, and pumpkins that require growing seasons longer than 85 days.

Therefore, a good response to Question 1 will explain bean, corn and lettuce choices based on an 85 day growing season. No pumpkins should be chosen.

A good response to Question 2 will note that Ghost Rider requires 115 days, which is 60 days longer than the growing season available. OR

The answer could be based on the fact that the first fall frost date is two months before the Ghost Riders would be ready for harvest, so the plants would die before the pumpkins fully develop.

Students who are familiar with vegetable growing might suggest that if their friend really wanted to grow Ghost Rider, the seeds could be started indoors early and row covers could be used as late season frost protection.

Criterion	Rubric Summary
1.	Indicates that the growing season in Superior, MT is 85 or 86 days.
2.	Lists at least six vegetables/fruits.
3.	All the fruits/vegetables chosen would grown in Superior, MT, because the number of days it takes to grow them is 85 or less. Acceptable varieties are listed below
4.	Advises her/his friend against planting Ghost Rider pumpkins, which need a 115 day growing season, citing either the August 30 first frost date or the too short Superior, MT growing season as the reason, OR Advises her/his friend to plant them only if the seeds are started indoors, early, or some kind of frost protection is used.

		Varieties requiring 85 days or less
Required	Beans	Blue Lake, Top Crop
	Corn	Golden Giant
	Lettuce	Salad Bowl
	Peas	Sugar Daddy, Snow Bird
Choose Two	Peppers	New Ace Hybrid, Zippy Hybrid, Bell Boy Hybrid
	Pumpkins	Both are over 85 days
	Tomatoes	Super Hybrid, Basket Hybrid, New Yorker
	Watermelon	Sweet Treat

Item: The Garden

Portfolio Scoring Parameters:

Depth of Understanding
Concept of "growing season," relates to different locations and plant growth requirements.

Evidence of Inquiry
Calculates the growing season. Selects vegetables/fruits suitable for Superior, MT.

Communication
Vegetables/fruits are organized in a list. Advice to a friend communicated clearly.

Relevance to Society
Advice to a friend is accurate and insightful.

Item: Keep It Cool

Item Description: The exercise is intended to show the students the insulating quality of various types of containers. They are asked to test a paper cup, a styrofoam cup, and a metal can of similar shape and size, to determine which type of container would be the best to use to keep drinks cool on a hot day.

Each of the three types of containers is filled with (5° C - 10°C) or (cold) water and a thermometer placed in each. Students are asked to record the temperature in each container after 30 seconds and after 15 minutes. The difference in temperature for each type of container should then be determined and recorded.

Question 1 a good response explains why they chose one of the three types of containers. Since it is a hypothetical question there really are no wrong answers.

Question 2 and Question 3 are to be answered after students finish the exercise. Question 2. A good response will show the student measured and recorded their observations correctly to determine the difference in the temperature of the water in each type of container after the fifteen minute time internal.

Question 3. A good response will show, if the exercise was done correctly, that the difference in water temperature was lowest for the styrofoam cup, and the students interpret this to mean it will keep drinks cool the longest.

Criterion	Rubric Summary
1.	(Q1) styrofoam, paper or metal is chosen AND an explanation given for the choice.
2.	(Q2) student describes if temperature changed or remained the same.
3.	(Q3) styrofoam cup OR paper or metal if these answers are based on the results of the experiment.
4.	(Q3) styrofoam cup chosen AND (Q1, Q2, or Q3) explains why styrofoam will work the best.

Portfolio Scoring Parameters:

Depth of Understanding
Concept : change in temperature is reduced by insulation.
Evidence of Inquiry
Experiment performed correctly (time and temperature recorded accurately) and conclusions are based on student data gathered.
Communication
Conclusions stated clearly, data recorded neatly. Uses the word, "insulator".
Relevance to Society
Concludes that styrofoam acts as an insulator and will be the best to keep the drinks cold.

Item: Swings

Question #1: Which two swings go back and forth the fastest? What do the fastest two swings have in common? How do the fastest two swings differ from the slowest two swings?

Question #2: Tell Jodi and Eduardo how to make Jodi's swing go faster. Tell them about the results of your experiment as you give your answer.

Item Description:

This item introduces students to the concept of a pendulum. The materials of the experiment consist of four strings (two short and two long) tied to four washers (two heavy and two light). The physical experiment itself is designed for obvious results: that is, the shorter the string, the faster the swing. The weight of the pendulum bob (the washer) bears no relation to the period of its swing, nor does the arc of the swing (how high it is held before it is dropped).

Most students perform the experiment correctly, observing that the two shorter pendulums swing faster than the two longer pendulums. The questions ask students to interpret their observations and come to the conceptual discovery of the pendulum. Due to the simplicity of the questions, the focus in scoring the item needs to be on students' interpretations.

Question number one attempts to cue the discovery, "Which two swings go back and forth the fastest?" Answer: the shorter two. "What do the fastest two swings have in common?" They are both short. "How do the fastest two swings differ from the slowest two swings?" They are shorter. The conceptual discovery comes in when students question why they obtained this result. If a student arrives at the conclusion, "the two shorter swings swung faster because they are shorter," the student has made the connection that is the implicit purpose of the question.

Question two asks students to apply the result of the experiment to the model of a tire swing. How can Jodi and Eduardo make their swing go faster? The purpose of the question is to assess the student's ability to apply what they have observed in the experiment to a hypothetical model. The answer, of course, is shorten the rope. The second part of questions two asks students to "tell them about the results of your experiment" as they give their answer. Any logical connection the student has made may be expressed here as they apply the experiment to the model to achieve the desired result. Any method of shortening the rope suggested is an acceptable answer. For instance, one student had the idea to tie knots in the rope, which, in effect, does shorten it.

To receive the highest score, a student must have come to the most complex, logical conclusion involved in the question, which is that the weight of the pendulum bob is irrelevant to the speed of the swing. This conclusion is not explicitly asked for in the question, but implied in the use of differing masses of washers.

Criterion	Rubric Summary
1.	In either question one or two, score one point for noticing that the swings with shorter strings (A and B) went faster., **OR** if the student correctly identifies the model as a pendulum.
2.	In either question one or two, score one point for a statement of the underlying concept: that shorter-stringed pendulums go faster because they are shorter.
3.	Score one point if, in question two, the student cites the result of the experiment in order to make a clear connection to the model of the tire swing.
4.	One point for coming to the logical conclusion in their question one or two that weight is irrelevant to the speed of the swing.

Item: Swings

Portfolio Scoring Parameters:

Depth of Understanding

Concepts: The shorter swings swing faster <u>because</u> they are shorter. <u>Weight is irrelevant</u> to the speed of the swing.

Evidence of Inquiry

Experiment performed correctly. Conclusions based on student data gathered.

Communication

Conclusions stated clearly, data recorded neatly.

Relevance to Society

Any logical connection the student has made may be expressed as they apply the experiment to the model of the tire swing to achieve the desired result.

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Zoo Animals

On a class trip to the zoo, Pat collected the following information from signs at the zoo.

Animal	Resting heart rate (beats per minute)	Body mass (kilograms)
hummingbird	250	less than 1
cat	90	5
human	70	70
elephant	25	2200

Performance

Suppose you are the zoo veterinarian (animal doctor) and you are asked to do a checkup of one of the animals — hummingbird, cat, or elephant. What additional scientific information would you collect to see if the animal is healthy? (Hint: think about what things determine if you are healthy.)

What would you do for the animal you selected from above to keep it healthy for a week?

The Garden

Your friend has just moved to Superior, Montana, and she wants to plant a garden in her new yard. She calls you and asks you to help her decide which vegetables and fruits to plant.

You know that the amount of time between the last frost in the spring and the first frost in the fall is called the growing season. The length of the growing season is different in different parts of the United States. The last spring frost and the first fall frost in Superior, Montana, are labeled on your map. Use the calendars on the next page figure out the growing season in Superior.

You also know that different kinds of plants need different growing seasons. Your seed catalog lists the time needed to grow each kind of plant.

To help your friend choose the best plants for her garden, first find out the length of the growing season in Superior, Montana. Then use your seed catalog to choose the following.

- one type of corn
- one type of lettuce
- one type of bean
- one type of pea
- two other types of fruits or vegetables of your choice

The Garden

1993		
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1995		
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The Garden

Questions

Please answer the following questions by yourself.

1. In the space below, write a letter to your friend. List the names of the fruits and vegetables you suggest for her garden. Explain why these are the best choices. Your friend has a copy of the same seed catalog.

2. Can your friend in Montana grow Ghost Rider pumpkins, which are ready for harvest by October 30? Explain why or why not.

Keep it Cool!

You are planning to spend the day at the park with your friends. Since it is a hot day, you want to serve drinks that will stay cool. You have three types of containers you can bring. You have paper cups, Styrofoam cups, and metal cans. You aren't sure which one to choose, so you decide to test which type of container will keep liquid the coldest for 15 minutes.

Work in groups.

Step 1: Set out the three types of containers and put a thermometer in each one.

Step 2: Using the measuring cup, put equal amounts of ice water in each container. This amount should be enough to fill each container at least three-quarter full.

Step 3: In the second column of the data sheet below, record the temperature of the water in each container after 30 seconds. Use the Celsius (°C) scale for all of your temperature measurements.

	Temperature after 30 seconds (Step 3)	Temperature after 15 minutes (Step 4)	Total difference in temperature (Step 5)
Styrofoam cup			
Paper cup			
Metal can			

Now go back to your desk and answer Question 1. After you answer the question, go back to the experiment and finish it. Look to see what time it is so you can return to your experiment when 15 minutes are up.

Step 4: After fifteen minutes have passed, record the temperature of the water in each container.

Step 5: Subtract the beginning temperature from the temperature that was taken after fifteen minutes. Record the difference. This is the amount that the temperature changed.

Go back to your desk and answer Questions 2 and 3.

Keep it Cool!

Questions

Please answer the following questions by yourself.

1. Which container do you think will keep the water coldest for fifteen minutes? Why do you think so?

Keep it Cool!

2. Describe what happened to the water temperature in all three containers. Did the temperature change? If so, describe the change.

3. Suppose you are going on a picnic and will be serving soft drinks in cups. What kind of cup would you use to keep the drinks cold? Explain why you would choose that kind of cup.

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Swings

Jodi and Eduardo like to play on swings. Jodi has a tire swing in her backyard. See Figure 1.

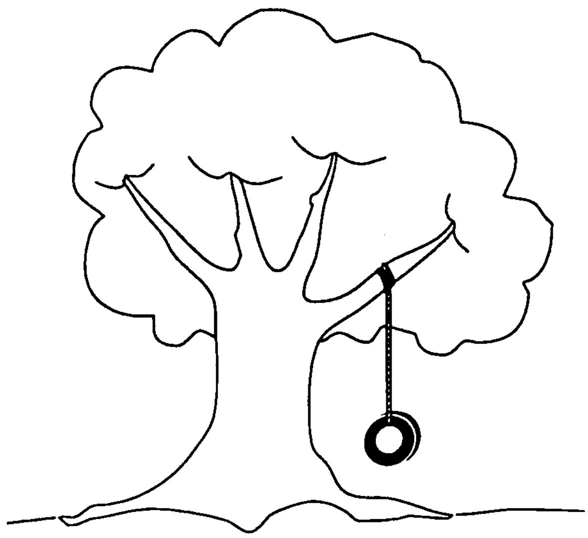

Figure 1

Jodi and Eduardo want to make the swing go faster. Can you help?

Step 1. Make four swings using the string and washers. See Figure 2. Make sure that the strings for Swing A and Swing B are the same length. Make sure that the strings for Swing C and Swing D are the same length.

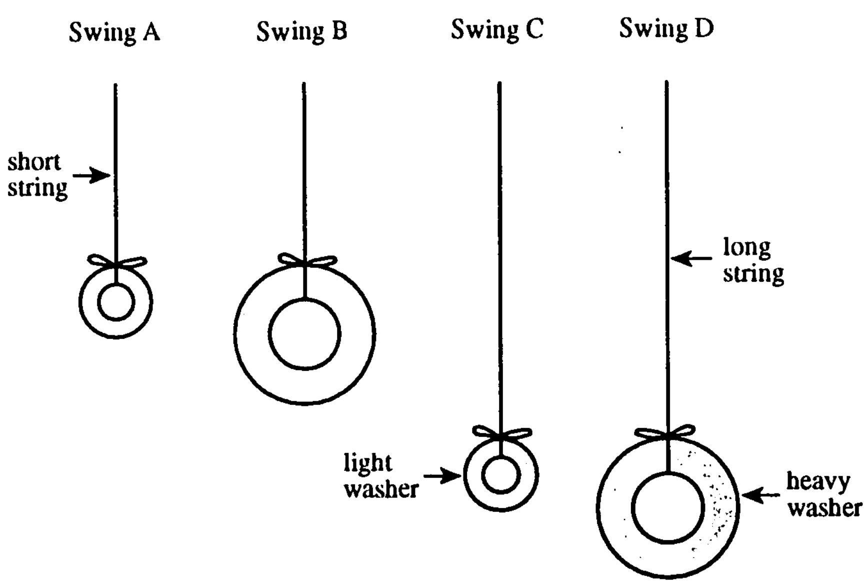

Figure 2

Step 2. Tape the top of Swing A under a desk or table. Make sure it can swing freely. One member of the group should get ready to watch the clock.

Step 3. When you are ready, pull the washer back a few inches to start it swinging back and forth. Let it swing on its own. How many times does the swing go back and forth in 15 seconds? Write your answer in the last column of the table below.

Step 4. Repeat Steps 2 and 3 for Swing B.

Step 5. Repeat Steps 2 and 3 for Swing C.

Step 6. Repeat Steps 2 and 3 for Swing D.

Students will work in groups of four, but each student will write the results in his or her own booklet.

Your Results

Swing	Length of string	Mass of washer	Number of swings per 15 seconds
A	short	light	
B	short	heavy	
C	long	light	
D	long	heavy	

Please return to your desk. You will be asked to answer some questions.

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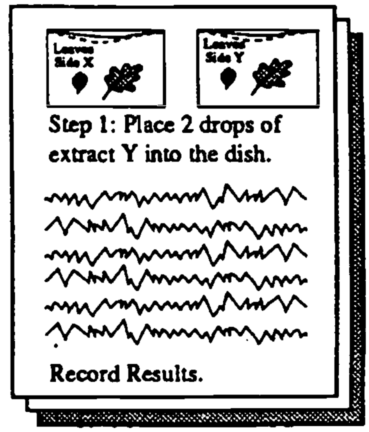
Questions

Please answer the following questions by yourself.

1. Which two swings go back and forth the fastest? What do the fastest two swings have in common? How do the fastest two swings differ from the slowest two swings?

2. Tell Jodi and Eduardo how to make Jodi's swing go faster. Tell them about the results of your experiment as you give your answer.

Type 2
Fourth Grade Science
Competency-Based Education Assessment Series



° On Demand Problem-Solving Events °

(Performance-Like)

Characteristics

- Experimental and non-experimental research, requiring more than a single session and some out-of-class time
- Scoring Options: Holistic scoring (i.e., portfolio scoring guide and interviews); scoring with rubrics, check-lists, and/or interviews

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart.* Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments are focused on *Science Portfolio Scoring Guide* parameters, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with *Science Portfolio Entry* types, instructional strands, and organizing concepts.

Refer to the *Content Summary Chart.* It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Fourth Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)* *Fourth Grade*
P. 1 - 4							
Weather Maps	1	east	Processing	1, 4, 5, 7	I: all K: 1, 7, 8, 11 C: 10, 11, 12, 13, 14 A: 1, 3, 5, 7, 9	Systems and Interactions	N: 2, 3, 4, 5, 7, 8 P: 11 E: 13, 14 L: 17
	2	March 7	Acquiring				
	3	San Francisco	Acquiring				
	4	no	Acquiring				
	5	cold & snowy	Processing				
	6	February 3	Processing				
	7	See Discussion	Processing				
	8	See Discussion	Extending				
P. 5 - 8							
Clouds	1	See Discussion	Extending	1, 4, 5, 7, 9	I: all K: 1, 7, 8, 11 C: 10, 11, 12, 13, 14 A: 1, 3, 5, 7, 9	Systems and Interactions	N: 2, 3, 4, 5, 7, 8 P: 11 E: 13 L:
	2	See Discussion	Extending				
PP. 9 - 11							
The Food We Eat	1	51-70	Acquiring	3, 4, 8	I: all K: 1, 2, 5, 7, 8, 11 C: 1, 6, 11, 14 A: 1, 2, 4, 6, 9	Patterns	N: 1, 2, 3, 4, 5, 8 P: E: L: 16, 19
	2	decreases after 16	Processing				
	3	2200	Acquiring				
	4	45	Acquiring				
	5	11-14	Acquiring				
	6	44	Acquiring				
	7	See Discussion	Extending				
	8	See Discussion	Extending				
PP. 12 - 14							
Food Pyramid	1	See Discussion	Acquiring	3, 4, 7, 8	I: all K: 1, 2, 5, 7, 8, 11 C: 1, 6, 11, 14 A: 1, 2, 4, 6, 9	Change Over Time	N: 1, 2, 3, 4, 5, 8 P: E: L: 19
	2	See Discussion	Processing				
	3	See Discussion	Extending				
PP. 15 - 17 🗁							
Physical Adaptations -Birds	1	small animals	Processing	3, 4, 6, 7, 8	I: all K: 1, 2, 4, 5, 6, 11 C: 1, 2, 11, 13, 14 A: 1, 2, 3, 4, 5	Models and Scale	N: 1, 2, 3, 4, 5, 8 P: E: L: 16, 18
	2	whip poor will	Extending				
	3	woodcock	Extending				
	4	B	Extending				
	5	small animals	Extending				
	6	C	Extending				
	7	See Discussion	Extending				
	8	See Discussion	Extending				

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Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Fourth Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	Item	Answer	Performance Level	Performance Objective(s)	Instructional Objective(s)	Unifying Concept(s)	Proficiency Test Outcome(s) Fourth Grade
PP. 18 - 20	🗁						
Physical Adaptations - Insects	1	See Discussion	Processing	3, 4, 6, 7, 8	I: all K: 1, 2, 4,5, 6, 11 C: 1, 2, 11, 13, 14 A: 1, 2, 3, 4, 5	Models and Scale	N: 1, 2, 3, 4, 5, 8 P: E: L: 16, 18
	2	See Discussion	Extending				
PP. 21 - 23	🗁						
Indicators	1	OJ	Acquiring	5, 6, 7, 8, 9	I: all K: 1, 2, 5, 7, 8, 10, 11 C: 2, 3, 5, 6, 7, 8, 9, 13, 14 A: 1, 3, 4, 5, 7, 8, 9	Patterns	N: 1, 2, 3, 4, 5, 6, 7, 8 P: 10, 11 E: 14 L:
	2	7	Processing				
	3	water	Acquiring				
	4	LJ &SA	Processing				
	5	OJ & CJ	Processing				
	6	CJ	Extending				
	7	See Discussion	Extending				
	8	See Discussion	Extending				
PP. 24 - 26	🗁						
Mystery Powders	1	See Discussion	Processing	5, 6, 7, 8, 9	I: all K: 1, 2, 5, 7, 8, 10, 11 C: 2, 3, 5, 6, 7, 8, 9, 13, 14 A: 1, 3, 4, 5, 7, 8, 9	Patterns	N: 1, 2, 3, 4, 5, 6, 7, 8, 9 P: 10, 11 E: L:
	2	See Discussion	Extending				

• Performance Objectives: Grade 4 ***Ohio's Model Competency-Based Science Program***

1. Given a repetitive pattern in nature (e.g., sound waves, seasons, phases of the moon, tree growth rings), the learner will describe the duration and timing of the pattern.
2. The learner will discuss the impact of human activity in selected natural environments.
3. Given a diverse but familiar set of objects, the learner will prepare a simple key for another learner to use to distinguish between objects in the set.
4. The learner will identify an example of an improbable, illogical event in a selected story and point out contradictions.
5. Given a series of related events, the learner will analyze the series and predict the next likely event.
6. Given a set of counts of objects or observations, the learner will construct a graphic representation and use it to make simple comparisons.
7. The learner will create and follow a simple procedure to carry out an investigation.
8. The learner will propose reasons why observations made by another learner may be different than hers/his.
9. Given a collection of working devices (e.g., scissors, shovel, crowbar, wheel, can-opener, bottler-opener), the learner will explain the function of a selected device and comment on its safe use.

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Instructional Strands • Grade 4 •

Objectives	*Inquiry* • The learner will:	*Knowledge* • The learner will:	*Conditions* • The learner will be:	*Applications* • The learner will be:
1	utilize caution and demonstrate care and concern for one's self, classmates, equipment, specimens and the environment when making observations, conducting experiments and participating in group interactions.	explore patterns in their lives (e.g., phases of the moon; the water cycle; growth; waves on water, drum heads and strings).	comparing and contrasting various accounts of historic milestones in science.	discussing the reasonableness of legends, stories, dreams, and tabloid stories presented in the mass media.
2	choose measurement methods and devices according to the level of precision demanded by the task.	explore the adaptability and reactivity of individual components of technological, social, and ecological systems to stresses on those systems (e.g., pollution and destruction of habitats, natural disasters, mechanical failures of cycles and other transportation systems).	participating in multi-age group investigations in the classroom, the home, the community, and natural environments.	determining the nutritional value of foods in his/her diet.
3	make reasonable and accurate scale readings while utilizing equipment to collect information and describe observations (e.g., simple thermometers, timers, magnifiers, rulers, measuring cups, balances, and others).	explore the diversity and scale of various objects and organisms.	collaborating with others to construct meaning.	using information found in graphs, tables, and articles in newspapers, magazines, television, and other mass media to make decisions.
4	select and use mathematics tools such as numerical manipulation (e.g., whole numbers and simple everyday fractions), geometric figures (e.g., circles, rectangles and triangles), and representational charts (e.g., simple pie and bar charts, and pictographs) to measure, count, order, sort, identify, describe, label and communicate information from observations.	explore the interactions of objects and organisms in simple systems.	participating in the selection of topics and themes for exploration.	analyzing the usefulness of information, considering the historical and cultural context of stories, theories, and accounts, regarding scientific ideas and phenomena, and technological developments.
5	make numerical estimates of answers to problems arising from investigations of natural phenomena and everyday experiences.	explore and compare the composition and level of organization of objects and organisms (e.g., tissues, organs, organisms, crystals, minerals, and rocks).	reporting with clarity and accuracy all phases of explorations.	solving problems of personal interest that can be addressed scientifically.
6	describe and order objects and events in terms relative to time and space (e.g., bigger, above, inside, older, before).	explore and construct simple keys of objects and organisms.	choosing appropriate materials for explorations.	writing and following instructions (e.g., recipes, procedures, assembly instructions, sketches).
7	consider the subjectivity of human observations (e.g., bias, opinions, preconceptions, predispositions, experience, limits of the senses).	explore the limitations and usefulness of models and other representations of objects, organisms, and phenomena.	listening to, reflecting upon, and discussing the ideas and expressions of others.	following simple procedures to create products (e.g., models, devices, events, meals, complete tasks).
8	speculate on commonly held assumptions from multiple perspectives (e.g., historical, cultural, societal, aesthetic).	explore various ways of describing and measuring rates of change and duration of phenomena.	participating in group critiques of investigative results.	designing, inventing, building and sharing projects individually and collaboratively.
9	formulate personal explanations and inferences on verifiable data.	explore mathematical expressions of quantities (e.g., sums and differences).	examining the results of explorations and repeating the explorations to verify results.	using various techniques (e.g., drawings, sketches, summaries, technology) to clarify and simplify descriptions of explorations.
10	ask "Why?" and "How do you know?"	explore the form and functions of various historically significant technologies (e.g., bicycle, wheels, balls, scissors, kite).	communicating the results of explorations to others.	

Instructional Strands • Grade 4 •

Objectives	*Inquiry* • The learner will:	*Knowledge* • The learner will:	*Conditions* • The learner will be:	*Applications* • The learner will be:
11	share results of explorations and compare investigative results with other groups.	explore the directionality of events and phenomena in terms relative to time and space (e.g., the spreading of a virus; the propagation of a wave; weathering, erosion, and plate tectonics; burning of a piece of paper; wind; diffusion of a fragrance; melting of ice; rolling a ball on various surfaces; collisions between rolling balls).	using library, distance learning, and community resources.	
12			discussing personal interests about the natural world in small- and large-group settings.	
13			spending time examining phenomena outside of the classroom setting.	
14			contributing to developing group agreement on patterns, trends, cycles and relationships by comparing and contrasting the contributions of each of the group members.	
15			exploring the interactions of technology and humans using appropriate resources and strategies (e.g., museums, interviews, written information services).	
16			using multimedia and human contacts to explore how different cultural factors influence the perceptions of science around the world.	

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Item Discussion

Item discussion on the following pages pertains to **FOURTH GRADE** SCIENCE TYPE 2 MODEL COMPETENCY ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content. Parameters for holistic evaluation of student work are suggested in the *Science Portfolio Scoring Guide* .

Science Portfolio Framework

(Used with permission from the *CCSSO SCASS* Science Portfolio materials.)

RATIONALE. A science portfolio assessment strategy supports improved proficiency performance. A portfolio supports science program implementation, framing teachers' on-going guidance and suggestions to keep students' work manageable, productive, and relevant to the objectives for student learning. A portfolio interfaces with previous assessment development*. A portfolio allows holistic assessment of students' doing and knowing science. (*Note: Examples of potential science portfolio work included in the **FOURTH GRADE** TYPE 2 MODEL ASSESSMENTS are marked with a folder icon, 🗁, in the accompanying *Content Summary Charts*.)

ASSUMPTIONS. Potential science portfolio entries will result from a combination of teacher initiated questions and student initiated questions. Students will learn and extend self-evaluation skills. The student's **final science portfolio** contains his or her choices of the best four products, with revisions, to represent his or her science learning. These products are selected from among all the learning activities and demonstrations he or she completes over a set time period (i.e., quarter, semester, year). Products are selected as **portfolio entries** and placed in one of the four categories of science work described below.

- 🗁 **Investigation** Experimental research: Requires students to design, carry-out, and report results of an observational and/or experimental process.
- 🗁 **Research** Non-experimental research: Requires students to access, analyze, synthesize, evaluate, and use the kind of information the average citizen might use to investigate and solve a problem of personal or societal significance. Students also identify alternatives, trade-offs, and make a decision regarding an issue.
- 🗁 **Application** Inventive or expressive in nature: Requires students to choose a manner of demonstrating what they *can do*, what they *can apply*, and how thoroughly they *can justify* their thinking. An inventive application allows students to show how scientific information can be used to solve real-world problems. An expressive application allows students to communicate scientific information in a medium of his or her choice. His or her work includes a written or verbal description of the scientific basis for the entry.
- 🗁 **Open Choice** Students may use this entry to provide further evidence of his or her science learning. This entry may be another piece of the previously described categories of science work.

Each entry is accompanied by the student's **entry summary** (self-evaluation). Students discuss how well the entry reflects the *Science Portfolio Scoring Guide's* **four parameters**

- Depth of Understanding
- Evidence of Inquiry
- Communication
- Relevance to Society

- 🗁 **Portfolio Summary** or The *fifth entry* of the students' final science portfolio: The students write his her **portfolio summary** to illustrate how the final portfolio entries reflect one or more of the above **four parameters.**

Teachers, parents, and administrators can use the Portfolio Summary as a road map of the how students' final portfolios demonstrate progress toward the objectives of instruction. The act of scoring students' final science portfolios may be mediated by teachers (and others) holistically comparing students' final portfolios to the suggested parameters in the *Science Portfolio Scoring Guide*. In this process take into consideration that each student entry need not reflect all parameters or all indicators for all parameters in the *Science Portfolio Scoring Guide* (i.e., the *Guide* is not intended for use as a checklist).

EXAMPLE STUDENT PORTFOLIO: Evidence, Models, and Explanations *

- **Example Portfolio Summary Outline**

Students discuss examples from his or her portfolio entries that demonstrate their understandings of those processes in which some properties and behaviors of things change while other properties and behaviors remain constant. In this discussion, students present evidence from across his or her **four entries** to illustrate one or more of the **four parameters** (see *Science Portfolio Scoring Guide*). In the process students answer the following questions

- How well do I know science? ...(Depth of Understanding)
- What can I do in science? ...(Evidence of Inquiry)
- How well do I communicate what I know and can do in science? ...(Communication)
- How well do I show how science affects people's lives. ...(Relevance to Society)

- **Examples of Student Entries** (*Examples result from a combination of student and teacher generated questions*):

  Investigation Entry Students make observations, use tools, collect data, and use evidence to support conclusions about the floating and sinking behaviors of various materials (e.g., *Buoyancy*).

  Research Entry Students select a popular video tape on a scientific topic, researches and discusses the accuracy of scientific information presented (e.g., *Land Before Time, Jurassic Park, Star Wars*).

  Application Entry Students make use of creative and inventive strategies to construct, test, and describe a model containment system for hazardous material spills (e.g., *Boom Construction*).

  Open Entry Students discusses a question of personal interest illustrating relevant science knowledge pertaining to recycling pop cans and plastic bottles (e.g., *Reducing Cafeteria Waste*).

*In this example, the unifying concepts that glue the objectives of classroom instruction and learning activities are evidence, models, and explanations. These unifying concepts are not the topics of instruction. Separate topics that are taught in classrooms can be tied together with these unifying concepts.

START-UP SUGGESTIONS

DEFINE THE GOALS AND OBJECTIVES THAT YOU WANT THE PORTFOLIO TO DEMONSTRATE. Think about existing opportunities for students to become familiar with the targets of their science learning.

DECIDE ON THE LOGISTICS AND RESPONSIBILITY OF THE PORTFOLIO. Time and space needs for completion and storage of portfolios should be addressed. Also, think about existing opportunities for potential science portfolio entries to come from a combination of teacher initiated questions and student initiated questions. Teachers continue to offer on-going guidance and suggestions to make student's work manageable, productive, and relevant to the objectives for student learning.

BE SURE TO COMMUNICATE YOUR EXPECTATIONS CLEARLY TO STUDENTS, PARENTS, AND ADMINISTRATORS. Think about existing opportunities for sharing the parameters in the Science Portfolio Scoring Guide relevant to the science program objectives for student learning.

THINK BIG; START SMALL. EXPERIMENT UNTIL YOU FIND A FORMAT AND PACE THAT IS COMFORTABLE FOR EVERYONE. Think about existing opportunities for students to start, receive feedback, revise his or her work, and practice self-evaluation skills.

Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description			
	Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections.are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

Item: Weather Map Item #7

The Item: The following map shows a cold front and a warm front moving across the country. Identify two cities where the weather is about to change. Describe each change.

Item Description: This item assesses the student's ability to apply what he/she has learned from the multiple choice questions about the direction of frontal movement and weather changes associated with fronts. Given a weather map with two frontal systems, the student must predict which cities are about to experience weather changes and must correctly describe these changes.

A good response will correctly identify Denver and Washington D.C. as the cities that are about to experience a weather change, and will correctly describe the expected weather changes. The best responses will also offer weather information beyond temperature changes and/or will offer additional information related to frontal movement.

Short Answer Rubric

Criterion Rubric Summary

Criterion 1:

- The student names at least one city that will experience weather <u>change</u> (their selection need not be correct), <u>and/or</u> discusses frontal movement specifically.

Criterion 2:

- The student <u>clearly</u> identifies both Denver and Washington D.C. as the cities about to experience weather changes.

Criterion 3:

- The student correctly describes the weather <u>changes</u> that will occur (or that have occurred) at the cities they selected.

Criterion 4:

- The student offers additional (correct) information that goes beyond the requirements of the question.

Item: Weather Map Item #8

The Item: In general, why is it useful to know about the movements of weather fronts?

Item Description: This item assesses the student's ability to generate multiple reasons for the usefulness of weather prediction to everyday life.

A good response will discuss short-term planning needs, such as what to wear on a given day or what road conditions would be like, and long-term planning needs (i.e. several days in advance), such as planning for an upcoming event or checking the weather in cities of travel destination.

Long Answer Rubric

Criterion Rubric Summary

Criterion 1:

- The student discusses some reason why it is useful to predict the weather that at least mentions some aspect of weather (such as fronts, temperature, storms, etc.)

Criterion 2:

- The student relates weather prediction to clothing needs and/or taking a trip or making other plans (such as a party).

Criterion 3:

- The student discusses prediction of severe weather (storms, snow, ice, etc.), discusses road conditions, and/or discusses equipment needed.

Criterion 4:

- The student specifically refers to planning an event that will occur at least a couple of days in the future, and/or discusses needing to know about weather conditions in specific cities of travel destination.

Item: Clouds #1, 2

Item Description: This event is designed to demonstrate fundamental principles of condensation and cloud formation. These principles are illustrated by comparing 2 jars - one containing hot water, the other containing cold water. An ice cube is placed over the mouth of each jar. The student is asked to observe each jar and record observations in a data table.

Question #1 assesses the student's ability to discern that jar **A** (with hot water) is more cloudy than jar **B** (with cold water), and explain why in terms of water condensation and the factors which contribute to its formation.

Question #2 assesses the student's ability to understand that a drop in temperature below the freezing point is required to produce snow and to correspondingly adjust the given experiment to produce snow in the jar.

A good response clearly demonstrates knowledge and understanding of the critical factors in the formation of condensation and cloud formation. The student responds that jar **A** is cloudier than jar **B** and explains that jar **A** contains more water vapor or has warmer air that mixes with cooler air in the jar. Consequently, more condensation (or clouds) form due to the abrupt drop in temperature at the surface of the ice cube. The student should correctly suggest a method to bring the temperature within jar **A** to below freezing so that snow will form.

Rubric

Criterion Rubric Summary

Criterion 1:

- Table of results or response to question #1 indicates that the student noticed more condensation (or cloudiness) in jar **A** than in jar **B** (e.g. "more and larger drops of water appear on the side of the container," "jar **A** is more cloudy," etc.).

Criterion 2:

- Response indicates that differences in amount of condensation formed or cloudiness results from jar **A** having higher water vapor content

OR

from the air (or H_2O vapor) in jar **A** encountering a more severe temperature drop (e.g. "hot contacts cold air," "hot air mixes with cold air in jar **A**").

Criterion 3:

- Students respond correctly to "What caused the cloud to form?" Student correctly explains that the immediate reason that clouds formed is because H_2O vapor rising from hot water at the bottom of jar hits a colder surface, (the ice cube) at the top of the container.

Criterion 4:

- Response gives an appropriate method that will bring the temperature outside the jar down below the freezing point so that snow will form inside the jar (e.g. "place the jar in a freezer").

Item: The Food We Eat #7

The Item: Draw a bar graph that shows the amount of protein males need each day. Draw one bar for each age group shown in Table 1. Also draw another bar that shows how much protein is needed each day for men who are from 71 to 90 years old.

Item Description: This item assesses a student's ability to read data from a table, extrapolate a data point not given in the table, and accurately graph data.

A good response will produce a conventional bar graph that accurately reflects the values given in the data table and also reflects the correct value for a data point not given.

Short Answer Rubric

Criterion Rubric Summary

Criterion 1:

- The student has attempted to draw a graph. The graph need not be a bar graph and need not reflect information given in Table 1. Acceptable responses may include curved lines connecting points on the two axes, a point graph, a random assortment of points plotted within the field of the graph, or a graph of the data on female protein needs. An "X" drawn in the field defined by the axes does not fulfill this criterion.

Criterion 2:

- The student has drawn a bar graph that accurately plots all data given in Table 1. All bars for Table 1 data must be of the correct height, but the graph may be unconventional in form. For example, the student may draw bars that are not clearly located over their respective age groupings, but are instead clustered together in the middle of the X-axis. Similarly, the student may have drawn lines instead of actual bars.

Criterion 3:

- The student has drawn a conventional bar graph that:
  - accurately plots all data given in Table 1
  - includes a bar for the 71-90 age group that reflects either a correct value (56) or a value higher than 56.

Criterion 4:

- The student has drawn a conventional bar graph with all data (that from Table 1 and the 71-90 value) plotted accurately.

Item: The Food We Eat #8

The Item: The amount of protein and energy that a person needs depends on the person's age. It also depends on whether the person is male or female.

Name two other things that might affect how much protein and energy a person needs. Explain why each one is important.

Item Description: This item assesses the student's understanding of how protein and calories are used by the human body.

A good response will list two factors, other than a person's age and sex, that influence protein and energy needs. It will provide an accurate, logical explanation for the effect of each factor on protein and energy needs. The explanations will not merely state whether the factor increases or decreases needs, but will explain why need is influenced in that direction.

A basic understanding of human protein and energy needs is required to assess the accuracy of some responses. Protein is a nutrient that provides the material for the growth, maintenance, and repair of the body. Protein is also a source of calories, or food energy, used as fuel for basic body processes and physical activity. The body stores excess food energy as fat.

Larger people need more protein and calories to maintain their bodies. Active people need more protein and calories because they use more energy. People who are growing need protein and calories to make biological materials. If they consume, over time, fewer calories than they use for body functions and physical activity, their bodies will use fat stores for energy and they will lose weight. In case of starvation, the body will also begin burning its own protein as energy. The bottom line is that eating too much protein and too many calories can make you fat, and eating too little can make you weak and sick.

Many students cite illnesses as a factor affecting protein and energy needs. This response is acceptable because some illnesses are caused by protein and energy shortages and can be treated by correcting the deficiency. It is also logical to assume that some illnesses will cause a decrease in activity level and resultant decrease in protein and energy needs.

Many students also provide answers that are some variation on, "if you aren't strong, you need more protein." These reflect a common misconception that "eating protein builds muscle and makes you strong." This is not an acceptable response.

SCORING GUIDELINES

Some scoring criteria demand that responses provide "satisfactory explanations" for the effects of certain factors on protein and energy needs. A satisfactory explanation meets the following requirements:

1. It must be **ACCURATE and LOGICAL**
2. It must **EITHER**
   - **a.** Explain why protein needs will increase or decrease as a result of that factor.

     OR

   - **b.** Tell what the consequences will be if too little or too much protein and energy are consumed. "They won't be healthy" does not satisfy this requirement. Responses that indicate that person might get "sick" as a result of having too little protein and energy fulfill this requirement, but those that claim people will get sick if they have too <u>much</u> protein and energy do <u>not</u> fulfill the requirement.

Long Answer Rubric

Criterion Rubric Summary

Criterion 1:

A. Response mentions 1 factor, other than a person's age or sex, that may affect how much protein and energy that person needs.

OR

B. Response explains how a person's age or sex influence how much protein and energy that person needs.

Criterion 2:

A. Response mentions 2 factors, other than age or sex, that affect how much protein and energy a person needs.

- "Weight" and "size" shall not be counted as separate factors.
- "What they eat" and "what they drink" shall not be counted as separate factors.

OR

B. The response mentions 1 factor, other than a person's age or sex that affects protein and energy needs and provides a satisfactory explanation for the impact of that factor.

Criterion 3:

A. The response mentions 2 factors, other than a person's age or sex, that influence protein and energy needs **AND** provides a satisfactory explanation for the effect of 1 of those factors.

Criterion 4:

A. The response mentions 2 factors, other than age or sex, that influence a person's protein and energy needs **AND** provides satisfactory explanations for **BOTH** factors.

B. The response displays an understanding that total protein and energy needs depend on an interplay of several factors. For example, a small, active person might have the same protein and energy needs as a large, sedentary person. Given the grade level of the students, responses that imply an understanding of this concept are acceptable. For example, one student wrote that a 257 lb. weight lifter might need more protein than an "everyday person" but added, "size...does not always mean that you take a different amount. But you usually do." This response satisfies the criterion.

Item: Food Pyramid

The Item: #1, 2, 3

Item Description: The student is given a diagram of the food pyramid, which is the updated summary of dietary recommendations that replaces the old standard "four food groups" chart. The food pyramid shows six food groups and the number of servings from each group that a person should eat every day in order to maintain a healthy diet.

Question #1 the student is asked to transfer the information from the food pyramid into a chart. This is a simple reading and copying exercise that forces the student to focus on the food pyramid information.

Question #2 requires the student to draw on knowledge gained outside this assessment. Each of the six food groups is the best source of some essential nutrient. Variety in diet is the best way to assure oneself of obtaining essential nutrients. Most students realize that a varied diet is a healthy one, and some are aware that you must eat different types of foods to get different types of vitamins, minerals, and macronutrients (carbohydrates, fats, proteins).

Question #3 asks the student to write out one day's meal plan using the food pyramid information. The five major food groups should be represented, but the fats/oils/sweets group need not be specified. Since the students are not given any ideas of serving sizes, the meal plans are likely to list one food as one serving. If the student indicates how many servings of a food are to be eaten, servings may be totaled.

Variety, or representation of many food groups, is more important than exact number of servings. The minimum number of foods/servings listed should be fifteen, exclusive of fats/oils/sweets.

Criterion Rubric Summary

Criterion 1:

- The student's response (to question #2) alludes to the healthfulness of a varied diet, or the unhealthfulness of a diet that is not varied.

Criterion 2:

- The student's response (to question #2) shows that the student understands that each food group is considered the best source of a different set of nutrients. Specific nutrients need not be named, but it must be clear that the food contains something our body needs.

  Example: "Fruits give you vitamins."
  "Each food group has something you need for your body."
  "If you only ate 2 or 3 foods, you'd miss some vitamins you need."

Criterion 3:

- In the meal plan (question 3), each of the five following groups are represented at least once:

  bread/cereal/rice/pasta group
  vegetable group
  fruit group
  milk/yogurt/cheese group
  meat/poultry/fish/dry beans/eggs/nuts group

Criterion 4:

- In the day's meal plan (question 3), each of the food groups are represented in at least the minimum amounts given in the food pyramid. If serving numbers are not provided by the student, assume that each time a food is mentioned = one serving.

  bread/cereal/rice/pasta: 6
  vegetable: 3
  fruit: 2
  milk/yogurt/cheese: 2
  meat/poultry/fish/dry beans/eggs/nuts: 2
  fats/oils/sweets: need not be counted

Item: Physical Adaptations - Birds #7

Item Description: Students have been asked the following question: *Some rabbits that live in cold areas have fur that turns brown in the summer and white in the winter. Describe why this change in fur color might help the rabbit stay alive.*

Content Definition: Blending with the environment is one of many ways that animals are adapted. "Blending in" is called *camouflage*. In cold areas where it snows in the winter, turning white would help the rabbit blend into the environment. In the summer, when the snow melts, being brown would help it blend in better. These color changes would make it more difficult for predators to locate the rabbit. If rabbits are harder to locate, they are less likely to be caught and killed.

Scoring Parameters:

- In the winter the land would be white due to snow and in the summer darker due to lack of snow.
- The color change will act as camouflage for the rabbit.
- Camouflage helps the rabbit hide from predators and avoid being eaten.

note: Scoring rubrics have not been included for the remainder of the items.

Item: Physical Adaptations - Birds #8

Item Description: Students have been asked the following question: *Predators are animals that hunt and eat other animals in order to stay alive. Name a predator. Describe at least three ways that its body is specially built. Tell how these special features make the animal you chose better able to catch, kill and/or eat its prey.*

Content Definition: Predators are animals that hunt and eat other animals in order to stay alive. Some excellent examples are snake, hawk, eagle, tiger, lion. They are all meat eaters and all kill the animals they eat (i.e., a vulture is not a predator, it is a scavenger because it eats animals that are already dead). When in doubt, give the benefit to the student. For example, if the student says "bear" the answer is acceptable. Some bears are predators, even though not all of them are. Please note, behavioral adaptations are acceptable <u>even though</u> the question isn't aimed at them.

Here are some ways that a predator might be specially built.

Speed: to outrun its prey.
Agility: to follow and chase its prey.
Strength/endurance: to outlast or overpower its prey in a chase and capture.
Camouflage: to hide while hunting prey.
Heightened senses: hearing, eyesight, smell to better locate prey
Claws/talons: to grab, crush and hang onto prey.
Teeth: to bite and kill prey.
Tongue (frogs, lizards): to be able to capture prey from a distance.
Poisonous/stinging: to immobilize/stun and kill prey.
Building webs/traps (predatory insects): to catch prey.

Students may come up with additional examples if they are logical and scientifically sound.

Scoring Parameters:

- An appropriately identified predator.
- At least three accurate features (see list above).
- An explanation of how each feature makes the predator better able to catch, kill and/or eat its prey.

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Item: Physical Adaptations - Insects #1

Item Description: Students are given a kit to build insect parts. They are asked to design an insect that is specially adapted to the desert environment.

Materials in Kits: 4 blocks of modeling clay per group
1 box of toothpicks
Bundle of pipe cleaners
Posterboard
Scissors

Content Definition:

- Insects have a body that is separated into three segments *(head, thorax and abdomen)*. They have three pair (6) of jointed legs that are attached to the central insect body segment or thorax.
- Any additional body parts *(wings or antennae)* should come in pairs. These parts should be placed symmetrically on the insect body with a line of symmetry that runs head to abdomen.
- *Wings* should be attached to the thorax and antennae should be attached to the head. Because of the high winds in the desert night, insects with wings should have wings that lay flat against their bodies or be diurnal.
- *Mouth parts* (i.e., tongue) may be singular but should protrude from the front of the insect head. Because of the extremely dry conditions, mouth parts should have fluid gathering functions.
- *Stingers* can also be singular but should protrude from the back of the abdomen section.

Scoring Parameters: Student responses should include the following information:

- Drawing has three *body parts.*
- Insect has *six jointed legs.*
- Parts are labeled and in logical positions or those described in *Content Definition* above.

Item: Physical Adaptations - Insects #2

Item Description: Students are asked to fill in a chart to tell how their insect is specially designed. To answer this question students will have to apply what they know about the desert, as presented in the introduction to the event. The following information was given.

In this desert the following conditions are present:

- Daytime Temperature: 50°C (122° F), sunny and very day.
- Night Temperature: -4°C (25° F), windy and blowing sand.

Given daytime and night temperatures, students need to propose a strategy for their insect's survival.

Content Definition: Some possible answers that would appear on a student chart are as follows:

How is your insect specially designed to do each of these?	Write Your Answers Below
Find Food	Large eyes, antennae, wings to cover large area (daytime only), digging structures on feet/mouth to burrow through sand.
Get/Preserve Water	Any of the above adaptations for finding food, hard shell to prevent evaporation, tongue/mouth parts to suck water from plants/animals, live underground to avoid sun and wind.
Move	Wings (daytime only), legs and climbing, attaching, or digging parts.
Hide	Underground, protective coloration/adaptations (i.e. spines to look like cactus).
Protect Itself	Stinger, biting mouth parts, poisonous to predators, bad tasting, mimicry.

While this is a fairly exhaustive list of answers, consideration should be given to student answers that do not appear on this table but are both logically stated and scientifically sound.

Scoring Parameters: Determined by the following:

- The quantity of complete answers in the table.
- The degree of complexity for the answers given.

Item: Indicators #7

Item Description: Students are asked the following question: *When an acid and base are mixed together, they balance or* ***neutralize*** *each other. People often take milk of magnesia if they have a stomachache due to too much acid. Why might milk of magnesia help reduce stomach acid?*

Content Definition: The question provides a clue to this answer by indicating that acids and bases *neutralize* one another. From the chart, students can determine that stomach acid has a pH of 1.6 and that milk of magnesia has a pH of 10.5. Since you are trying to alleviate an acidic condition, adding a base will help to bring the pH towards a more *neutral* level. Milk of magnesia would *neutralize* the acid in the stomach and make a person feel better.

Scoring Parameters

- Milk of magnesia is a base.
- The stomach is acidic.
- If a base is added to an acid, the condition is neutralized. In this specific case the stomach acid would be reduced.

Item: Indicators #8

Item Description: In many large cities today, pollution from smoke stacks has created a condition called acid rain. The pH of acid rain is < 5.7. Remember that anything that is an acid or a base tends to corrode, or eat away at, other objects. Describe three different effects acid rain might have on the environment.

Content Definition: Acid rain can affect:

- plant growth (retarded growth, damaged plant, inedible product)
- soil pH (many plants can't grow in overly acidic soil)
- land features (erosion), limestone, weathering
- water runoff patterns (flooding, drought)
- man-made structures (buildings, cars, streets, etc.) weathering
- water table (contaminated - unfit to drink)
- people and animals (require uncontaminated food sources for good health; rain's direct effect on the skin over time)

This list is by no means exhaustive. Environment is stated generally within the question, leaving the interpretation open for discussion. No differentiation is made between natural and man-made environment so a wide variety of responses may be anticipated.

Scoring Parameters: Student responses should include the following information:

- Student cites three effects of acid rain.
- Effects cited are specific rather than vague.

Item: Mystery Powders #1

Item Description: Students are supplied with two substances. The one labeled **A** should be salt. The one labeled **B** should be sugar. The student is unaware of which is which. They have been given the following directions: *Draw both substances here. Be sure to get the correct one in box A and the other in box B. Be sure to draw them as they look through the hand lens. From what you have seen, compare and contrast the two substances. Write at least 3 ideas on each side of the chart.*

Content Definition: Sugar and salt are two substances that appear at a glance to have many similarities. Upon closer observation, they also have many differences. Students are limited in the use of their senses to those of touch, hearing, and sight. Answers are nearly unlimited and should be accepted if logical. Students should not be penalized for creative, yet logical, responses. Even though directed to not taste or smell samples, accept observations that would result from tasting and smelling samples, i.e., sweet, salty, Sample A is Salt and Sample B is sugar.

Also, watch for pairs of differences that describe one characteristic (example: B *is bigger.* A is *smaller).* This describes relative size in both samples, but is only one characteristic. Do not accept, *they are clear*, as a similarity. Do not accept overly vague descriptions (example: *They are like snow),* because the specific characteristic is not clear. Is it the shape of the crystal, the compacting of the substance, or the color that makes them look *like snow* ?

Scoring Parameters:

- The student identifies three similarities.
- The student identifies three differences.
- The similarities and differences identified are reasonable and/or useful for identification.

Item: Mystery Powders #2

Item Description: Students are asked to answer the question: *The sand on the beach is formed from shells and different types of rocks that have been broken up and worn down by the ocean. Describe, as completely as you can, how you think sand would look under a hand lens.*

To answer this question, students will need some sort of visual concept of sand and be able to describe it as they believe it would look under a hand lens.

Content Definition:

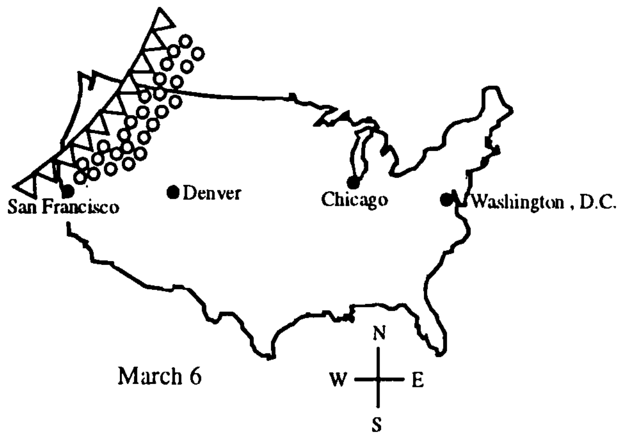
- Size - a variety of sizes present, but usually smaller than a pea.
- Color - variety, reflecting the variety of original sources.
- Shape - irregular, but generally rounded because of wear caused by water.
- Texture - variety, but generally smoothed somewhat.
- Reminds them of.... - looks like that from which it came; like little rocks and shells.
- Mass - less than a raisin (1 g).

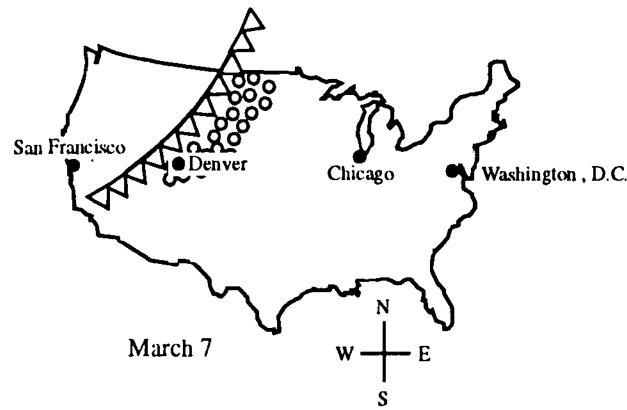
Scoring Parameters

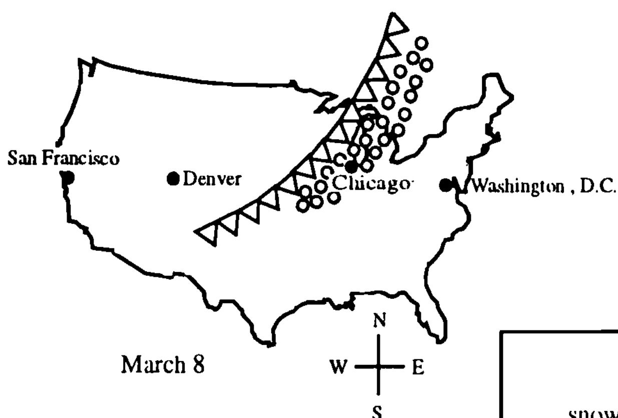
- Student draws a comparison between proposed characteristics of sand and observed characteristics of salt and sugar.
- Student proposes a description of sand, describing several visual or tactile characteristics.

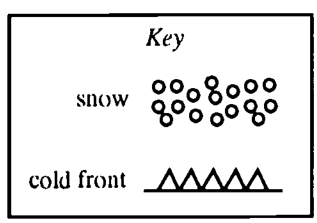
Weather Maps

Suppose it is March 5. Your class is going on a trip to Chicago on March 8. The maps below show the weather predictions for March 6, 7, and 8. (Assume the predictions are correct.) Look at the maps and answer the following questions.









1. In which direction is the cold front moving?

2. When will it probably snow in Denver?

Weather Maps

3. In which city will it probably snow on March 6?

4. When you visit Chicago on March 8, will you wear sandals and shorts?

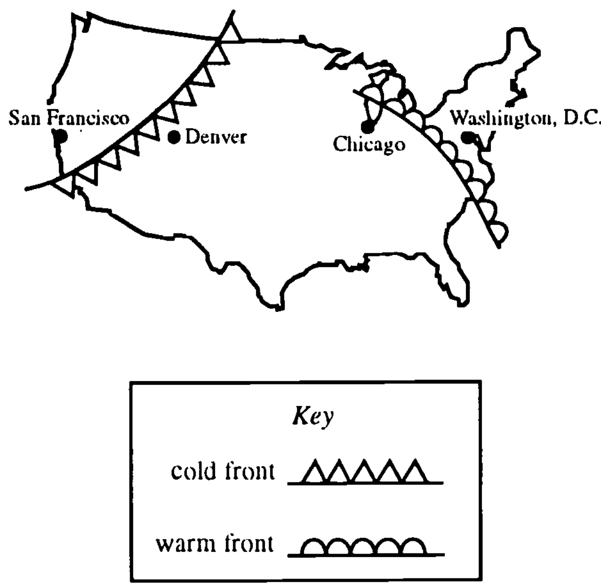
5. On March 9, what will the weather be like in Washington, DC?

6. A cold front passed over San Francisco on February 1. Then it passed over Denver on February 2. When did it probably pass over Chicago?

Weather Maps

Short Answer

7. The following map shows a cold front and a warm front moving across the country eastward. Identify two cities where the weather is about to change. Describe each change.



Weather Maps

Long Answer

8. In general, why is it useful to know about the movement of weather fronts?

Clouds

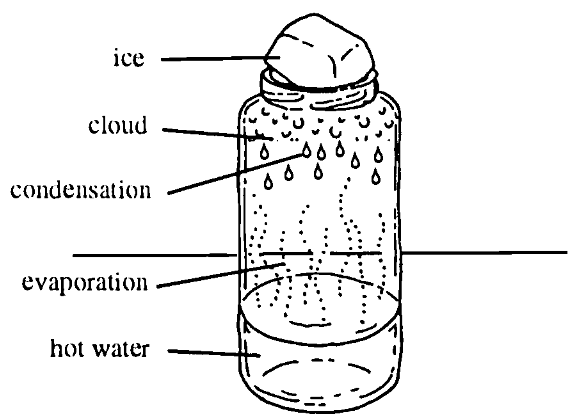
Have you ever wondered what causes rain? Do you know why clouds form?

Water is in the air around us as invisible water vapor. When enough water is in the air, and it cools, the water condenses (turns to liquid) to form tiny droplets. These droplets get bigger and bigger as more water condenses out of the air. Finally, when they are too heavy, they fall to the ground as rain.

You and your classmates will perform an experiment to learn more about how clouds and rain form.

Students will work in groups of four, but each student will record the results in his or her own booklet.

Step 1. You have been given two jars. Use strips of masking tape to label them Jar A and Jar B. Put some hot water in Jar A. The water should be about 2 inches deep. See Jar A in the figure below. Put an equal amount of cold water in Jar B.



Jar A

Step 2. Carefully place an ice cube at the top of each jar. *Do not let the ice cube fall inside the jar.*

Step 3. Watch what happens inside each jar. Observe the jars for 5 minutes. Then write down what you see. Use the table on the next page.

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Clouds

Your Results

Describe what happened inside Jar A.	Describe what happened inside Jar B.

When you are done, go back to your desk. You will be asked to answer some questions.

Clouds

Questions

Please answer the following questions by yourself.

1. Which jar is more cloudy? Why is this jar more cloudy than the other? What caused the clouds to form?

Clouds

2. Water vapor is invisible. Clouds are seen as water condenses and forms droplets. These droplets get larger as more water condenses. It rains when these droplets get so big and heavy they fall toward the ground. If condensation happens when it is very cold out, it will snow instead of rain. How could we change this experiment to make snow instead of rain in the jar?

The Food We Eat

Food contains protein and energy. People need to eat food every day to remain healthy. The amount of food a person needs depends on the person's age. It also depends on whether the person is male or female. Table 1 shows how much protein (in grams) and energy (in Calories) different people need each day.

Table 1

Age (years)	Protein (grams)		Energy (Calories)	
	females	males	females	males
7-10	34	34	2,400	2,400
11-14	46	45	2,200	2,700
15-16	46	56	2,100	2,800
19-22	44	56	2,100	2,900
23-50	44	56	2,000	2,700
51-70	44	56	1,800	2,300

Use this information to answer the following questions.

1. Which age group needs the LEAST amount of energy each day?

2. How does a female's need for protein change as she gets older?

3. A 12-year-old female needs about how much energy each day?

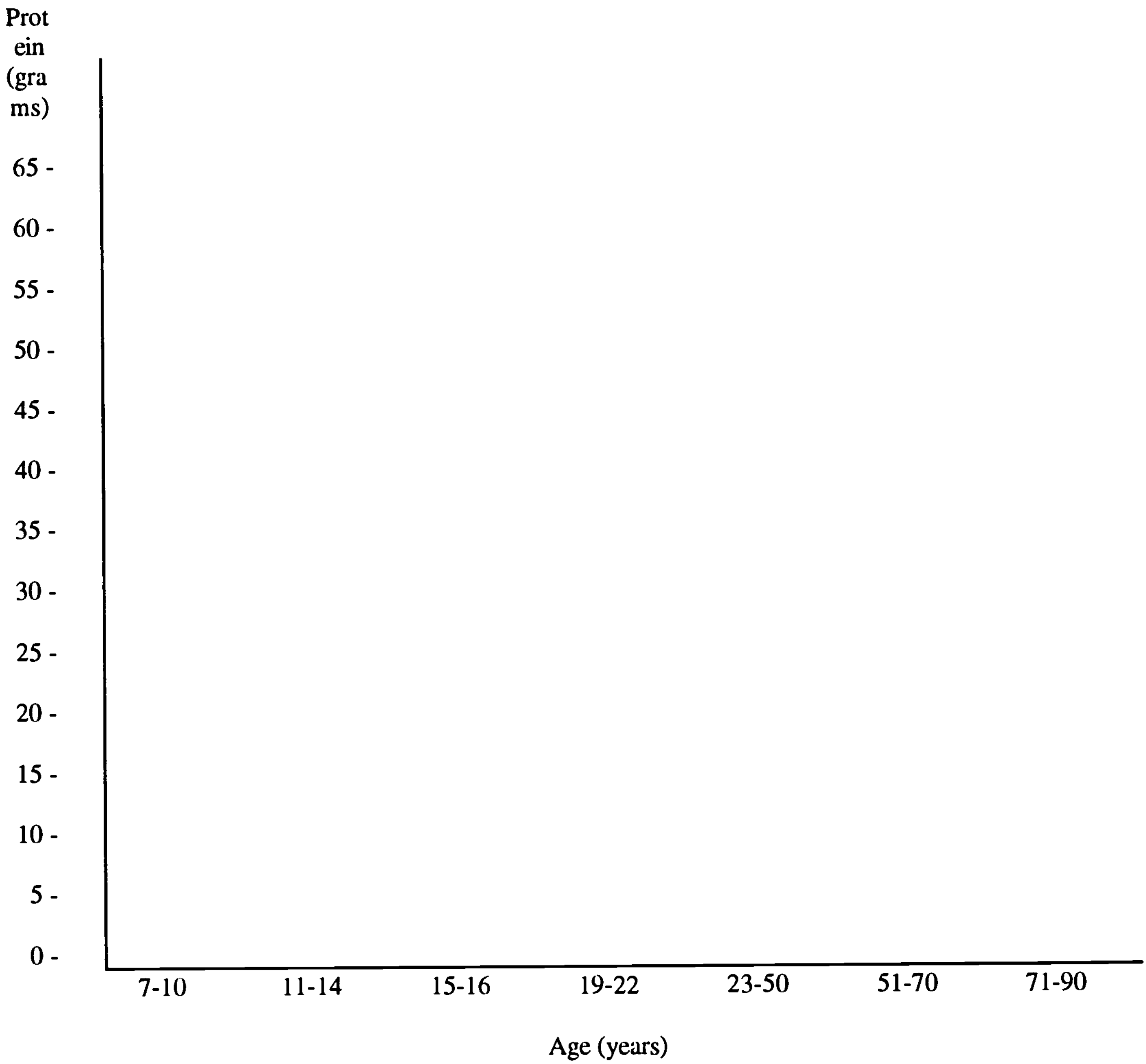
4. A 13-year-old male should eat about how much protein each day?

5. At what age do females need more protein than males?

6. A 75-year-old female probably needs about how much protein each day?

Short Answer

7. Draw a bar graph that shows the amount of protein males need each day. Use the axes below. Draw one bar for each age group shown in Table 1. Also draw another bar that shows how much protein is needed each day for men who are from 71 to 90 years old.



The Food We Eat

Long Answer

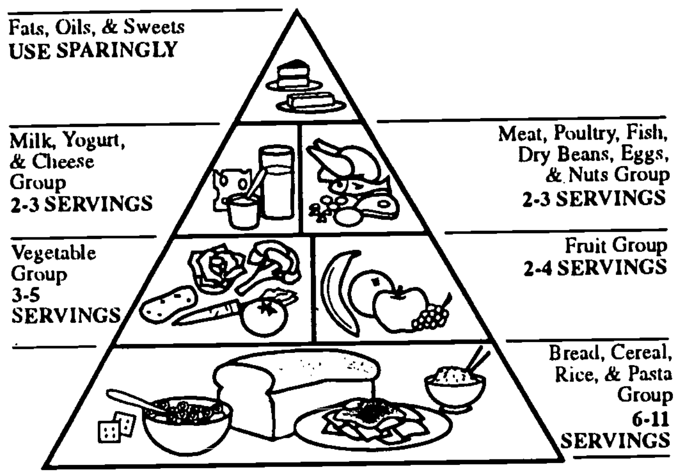
8. The amount of protein and energy that a person needs depends on the person's age. It also depends on whether the person is male or female.

Name two other things that might affect how much protein and energy a person needs. Explain why each one is important.

Food Guide Pyramid

Do you know which foods are good for you? How many servings of fruit should you eat each day? How much bread should you eat? In this exercise you will find out about these things.

Look at the Food Guide Pyramid below. This pyramid shows different groups of foods. For each group, the pyramid tells how many servings a person should have each day.



Questions

Please answer the following questions by yourself.

1. How many servings from each food group should you eat each day?

Food group	Number of servings
milk, yogurt, cheese	
vegetables	
meat, poultry, beans, eggs, nuts	
fruit	
bread, cereal, rice, pasta	

Food Guide Pyramid

2. Explain why you think people should eat foods from several of the food groups each day?

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Food Guide Pyramid

3. Use the information in the pyramid to plan your meals for a whole day. Be sure to make a healthy plan. Include the correct number of servings from each food group. Describe what you will eat and when in the day you will eat it. Write down everything you will eat. Write in the table below.

Time of day	What you will eat

Physical Adaptations - Birds

Each day, animals must find enough food to eat without being eaten by something else! This can be very tricky. Often animals' bodies are specially built to help them with this task. Think about the different animals you know and the different ways that their bodies are built to help them survive. For example, the birds in Figure 1 have differently-shaped beaks depending on what each bird eats. Table 1 lists some characteristics of some bird beaks and the diet each is adapted to.

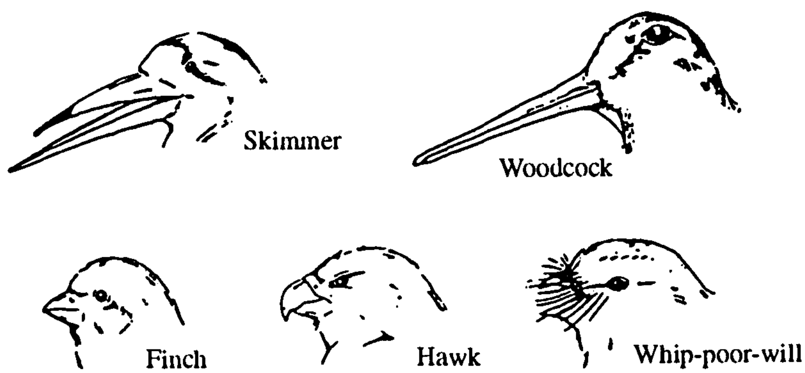

FIGURE 1

TABLE 1

Characteristics of Beak	Diet
short and strong for cracking	seeds
flat and wide for skimming	small fish, floating insects
feather basket for catching	flying insects
long and pointed for probing	insects and worms
curved and sharp for ripping	small animals

Now answer questions 1-3 using both Figure 1 and Table 1.

1. Looking at Figure 1 and Table 1, what would a hawk most likely eat?

2. Looking at Figure 1 and Table 1, which bird's beak looks like it would be used by a bird who eats small **flying** insects like mosquitoes?

3. Which bird would most likely have a beak used to bore (dig) into soil to eat insects and worms?

For questions 4 to 6 look at the following pictures of bird feet in Figure 2:

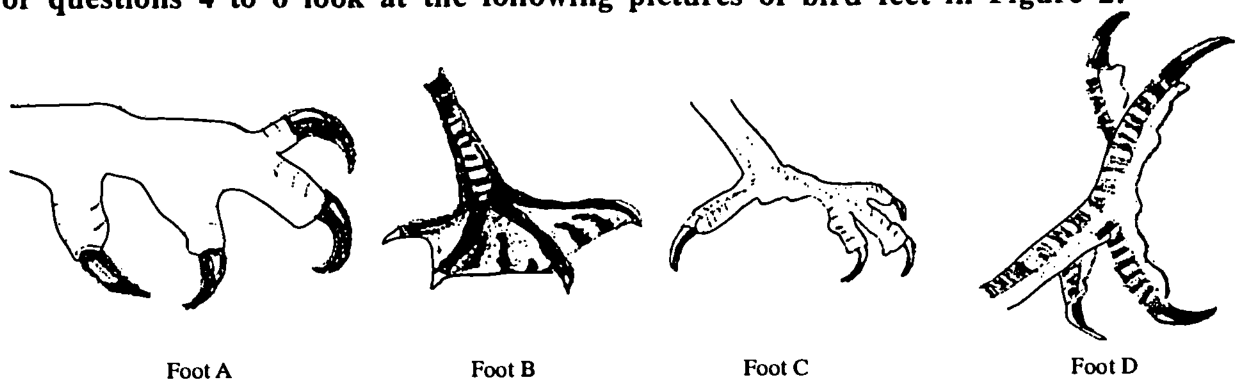

FIGURE 2

4. Which of the feet in Figure 2 look best suited for swimming?

5. What would the bird with foot A in Figure 2 most likely eat?

6. Woodpeckers are birds which climb up and down the sides of trees to find wood-eating insects. Which foot from Figure 2 would most likely belong to a woodpecker?

Short Answer

7. Some rabbits that live in cold areas have fur that turns brown in the summer and white in the winter. Describe why this change in fur color might help the rabbits stay alive.

Physical Adaptations - Birds

Extended Response

8. Predators are animals that hunt and eat other animals in order to stay alive. Name a predator. Describe **three** ways that its body is specially built. Tell how these special features make the animal you chose better able to catch, kill, and/or eat its prey.

Physical Adaptations - Insects

Insects are very specialized animals. Almost all insects have 3 pairs (six) of jointed legs, and 3 main regions of the body called the:

- **head,** which is the front part of an insect that usually includes eyes, antennae, and mouthparts;

- **thorax,** which is the middle part of an insect that usually includes the 3 pairs of legs and sometimes 1 or 2 pairs of wings;

- **abdomen,** which is the rear part of an insect.

Even though most insects have these parts, insects come in an incredible variety. Insects live in nearly every environment in the world. No matter where an insect lives, its body is highly suited for that place and helps it survive.

Use the kit to build an insect specially designed to live in a desert environment.

In this desert the following conditions are present:

- Daytime: temperature = 50° C (122° F), sunny and very dry.
- Night: temperature = –4° C (25° F), windy with blowing sand.

Your insect should be designed to handle all of these extremes. Think about the following things when you build your insect. They would all be important to its survival.

- Eating: How/where does it find and take in food?
- Drinking: How/where does it get/preserve water?
- Protection: How does it keep from getting eaten?
- Movement: How/when does it travel?
- Shelter: Where does it live/hide?

Use the clay to form the body parts of your insect. Hold them together with the toothpicks. Make the eyes, antennae, mouth parts, legs, wings and other parts of your insect from the pipe cleaners and poster board.

Physical Adaptations - Insects

Questions

Please answer the following questions by yourself.

1. In the space below, draw your insect as if you were looking down on it from above. Label all of its parts. Remember that your drawing should show the three body parts you made from clay and that it should have six legs. All of these legs should be jointed and attached to the center body section. You should draw and label **ALL** of the pieces that you added to your insect's clay body.

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Physical Adaptations - Insects

2. Fill in the chart below to tell how your insect is specially designed.

How is your insect specially designed to do each of these?	Write your answers here
Find food	
Get/preserve water	
Move	
Hide	
Protect itself	

Indicators

The pH scale is used to determine whether a substance is neutral, acidic, or basic. A substance is neutral if it has a pH of 7. A substance with a pH below 7 is acidic and the lower the pH, the more acidic the substance. A substance with a pH above 7 is basic and the higher the pH, the more basic the substance. Knowing the pH of a substance can be useful because substances that are acidic or basic can break down some other substances. When an acid and a base are mixed together, they may balance or *neutralize* each other. The table below gives the pH of some common substances.

Substance	pH
stomach acid	1.6
lemon juice	2.0
vinegar	2.8
apple juice	3.0
orange juice	3.5
carrot juice	5.0
milk	6.5
pure water	7.0
sea water	8.0
baking soda in water	9.0
soap	10.0
milk of magnesia	10.5
ammonia in water	11.0
lye	14.0

1. Which of the substances in the table has a pH of 3.5?

2. Remember that acids have a pH below 7, bases have a pH above 7, and anything with a pH of 7 is neutral. How many substances in the pH table are acids?

3. Which of the substances is neutral?

4. Which substances are more acidic than vinegar?

5. Tomatoes have a pH of 4. This would put them between which two substances on the chart?

6. Baking soda in water is basic. Which substance would you predict to be equally as acidic as baking soda is basic?

Indicators

Short Answer

7. Some people take *nilk of magnesia* if they have a stomachache due to too much acid. Based on the information in the passage and table, how might taking *milk of magnesia* help reduce stomach acid?

Indicators

Extended Response

8. Pollution from smoke stacks and cars can create a condition called **acid rain.** The pH of acid rain is between 3 and 5, which is more acidic than regular rain water. Describe three different effects acid rain might have on an environment.

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Mystery Powders

Scientists use physical properties to describe different substances. They determine these by observing with some of their senses (seeing, hearing, smelling, feeling, tasting). You should first fold the piece of black construction paper as instructed by your teacher, and label one half **Substance A**, and the other half **Substance B**. Your teacher will place a small amount of **Substance A** and **Substance B** on the appropriate side of the paper. Examine closely the two substances that your teacher gives you. Use all of your senses **EXCEPT TASTE AND SMELL.** Use the hand lens to observe 5 particles of the substance more closely. Try to find ways they are the same and ways they are different. Be very observant!

Draw both substances here. Be sure to get Substance A in box A and Substance B in box B. Be sure to draw them as they look through the hand lens.

Substance A	Substance B

Mystery Powders
Questions

Please answer the following questions by yourself.

1. From what you have seen, how are the two substances alike and different? Write at least three ways on **each** side of the chart.

Ways they are the same:	Ways they are different:

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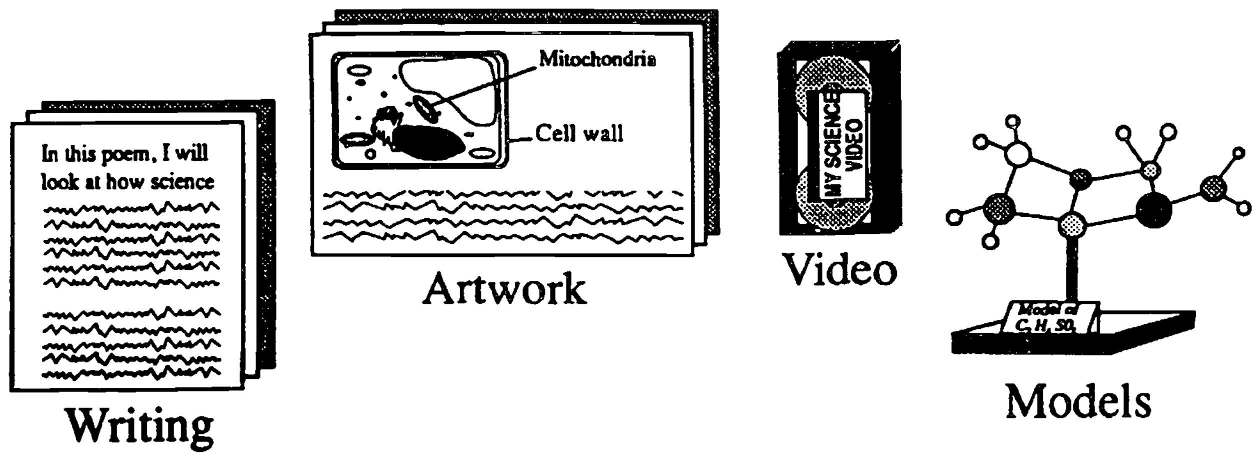
2. Unlike Substances A and B, the sand on a beach is formed from shells and different types of rock that have been broken up and worn down by the ocean. Describe, as completely as you can, how you think sand would look under a hand lens.

Type 3
Fourth Grade Science
Competency-Based Education Assessment Series



Substantive Application-Based Performance Tasks

(Open-Ended)

Characteristics

- Relevant inventive and creative applications, requiring experimental research, non-experimental research, and more out-of-class preparation
- Holistic scoring (e.g., portfolio scoring guide and interviews)

Item discussions provide an overview of items, pertinent content, and scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart.* Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments are focused on *Science Portfolio Scoring Guide* parameters, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with *Science Portfolio Entry* types, instructional strands, and organizing concepts.

Refer to the *Content Summary Chart.* It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Fourth Grade Type 3 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)* *Fourth Grade*
Weather	🗁	See Discussion	Extending	1, 4, 5, 7	I: all K: 1, 7, 8, 11 C: 10, 11, 12, 13, 14 A: 1, 3, 5, 7, 9	Systems and Interactions	N: 2, 3, 4, 5, 7, 8 P: 11 E: 13 L:
Sleepy After Lunch	🗁	See Discussion	Extending	3, 4, 8	I: all K: 1, 2, 5, 7, 8, 11 C: 1, 6, 11, 14 A: 1, 2, 4, 6, 9	Patterns	N: 1, 2, 3, 4, 5, 8 P: E: L: 19
Robots	🗁	See Discussion	Extending	3, 4, 6, 7, 8	I: all K: 1, 2, 4, 5, 6, 11 C: 1, 2, 11, 13, 14 A: 1, 2, 3, 4, 5	Models and Scale	N: 1, 2, 3, 4, 5, 8 P: E: L: 16, 18
Mystery Powders	🗁	See Discussion	Extending	5, 6, 8, 7, 9	I: all K: 1, 2, 5, 7, 8, 10, 11 C: 2, 3, 5, 6, 7, 8, 9, 13, 14 A: 1, 3, 4, 5, 7, 8, 9	Patterns	N: 1, 2, 3, 4, 5, 6, 7, 8, 9 P: 10, 11 E: L:

Ohio's Model Competency-Based Science Program

• Performance Objectives: Grade 4

1. Given a repetitive pattern in nature (e.g., sound waves, seasons, phases of the moon, tree growth rings), the learner will describe the duration and timing of the pattern.
2. The learner will discuss the impact of human activity in selected natural environments.
3. Given a diverse but familiar set of objects, the learner will prepare a simple key for another learner to use to distinguish between objects in the set.
4. The learner will identify an example of an improbable, illogical event in a selected story and point out contradictions.
5. Given a series of related events, the learner will analyze the series and predict the next likely event.
6. Given a set of counts of objects or observations, the learner will construct a graphic representation and use it to make simple comparisons.
7. The learner will create and follow a simple procedure to carry out an investigation.
8. The learner will propose reasons why observations made by another learner may be different than hers/his.
9. Given a collection of working devices (e.g., scissors, shovel, crowbar, wheel, can-opener, bottle-opener), the learner will explain the function of a selected device and comment on its safe use.

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Item Discussion

Item discussion on the following pages pertains to **FOURTH GRADE** SCIENCE TYPE 3 MODEL COMPETENCY ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content. Parameters for holistic evaluation of student work are suggested in the *Science Portfolio Scoring Guide*.

Science Portfolio Framework

(Used with permission from the *CCSSO SCASS* Science Portfolio materials.)

RATIONALE. A science portfolio assessment strategy supports improved proficiency performance. A portfolio supports science program implementation, framing teachers' on-going guidance and suggestions to keep students' work manageable, productive, and relevant to the objectives for student learning. A portfolio interfaces with previous assessment development*. A portfolio allows holistic assessment of students' doing and knowing science. (*Note: Examples of potential science portfolio work included in the **FOURTH GRADE** TYPE 3 MODEL ASSESSMENTS are marked with a folder icon, 🗁, in the accompanying *Content Summary Charts*.)

ASSUMPTIONS. Potential science portfolio entries will result from a combination of teacher initiated questions and student initiated questions. Students will learn and extend self-evaluation skills. The student's **final science portfolio** contains his or her choices of the best four products, with revisions, to represent his or her science learning. These products are selected from among all the learning activities and demonstrations he or she completes over a set time period (i.e., quarter, semester, year). Products are selected as **portfolio entries** and placed in one of the four categories of science work described below.

- 🗁 **Investigation** Experimental research: Requires students to design, carry-out, and report results of an observational and/or experimental process.
- 🗁 **Research** Non-experimental research: Requires students to access, analyze, synthesize, evaluate, and use the kind of information the average citizen might use to investigate and solve a problem of personal or societal significance. Students also identify alternatives, trade-offs, and make a decision regarding an issue.
- 🗁 **Application** Inventive or expressive in nature: Requires students to choose a manner of demonstrating what they *can do*, what they *can apply*, and how thoroughly they *can justify* their thinking. An inventive application allows students to show how scientific information can be used to solve real-world problems. An expressive application allows students to communicate scientific information in a medium of his or her choice. His or her work includes a written or verbal description of the scientific basis for the entry.
- 🗁 **Open Choice** Students may use this entry to provide further evidence of his or her science learning. This entry may be another piece of the previously described categories of science work.

Each entry is accompanied by the student's **entry summary** (self-evaluation). Students discuss how well the entry reflects the *Science Portfolio Scoring Guide's* **four parameters**

- Depth of Understanding
- Evidence of Inquiry
- Communication
- Relevance to Society

- 🗁 **Portfolio Summary** The *fifth entry* of the students' final science portfolio: The student writes his or her **portfolio summary** to illustrate how the final portfolio entries reflect one or more of the above **four parameters.**

Teachers, parents, and administrators can use the Portfolio Summary as a road map of the how students' final portfolios demonstrate progress toward the objectives of instruction. The act of scoring students' final science portfolios may be mediated by teachers (and others) holistically comparing students' final portfolios to the suggested parameters in the *Science Portfolio Scoring Guide*. In this process take into consideration that each student entry need not reflect all parameters or all indicators for all parameters in the *Science Portfolio Scoring Guide* (i.e., the *Guide* is not intended for use as a checklist).

EXAMPLE STUDENT PORTFOLIO: Evidence, Models, and Explanations *

- 🗀 **Example Portfolio Summary Outline**

Students discuss examples from his or her portfolio entries that demonstrate their understandings of those processes in which some properties and behaviors of things change while other properties and behaviors remain constant. In this discussion, students present evidence from across his or her **four entries** to illustrate one or more of the **four parameters** (see *Science Portfolio Scoring Guide*). In the process students answer the following questions

- How well do I know science? ...(Depth of Understanding)
- What can I do in science? ...(Evidence of Inquiry)
- How well do I communicate what I know and can do in science? ...(Communication)
- How well do I show how science affects people's lives. ...(Relevance to Society)

- **Examples of Student Entries** (*Examples result from a combination of student and teacher generated questions*):

  🗀 **Investigation Entry** Students make observations, use tools, collect data, and use evidence to support conclusions about the floating and sinking behaviors of various materials (e.g., *Density of Medicines*).

  🗀 **Research Entry** Students select, research, and report on the work of a famous scientist (e.g., *Thomas Edison*).

  🗀 **Application Entry** Students identify and discuss the use of creative and inventive strategies to solve a problem (e.g., *Murder She Wrote*).

  🗀 **Open Entry** Students use a creative tool to illustrate relevant science knowledge (e.g., *Water Drops*).

*In this example, the unifying concepts that glue the objectives of classroom instruction and learning activities are evidence, models, and explanations. These unifying concepts are not the topics of instruction. Separate topics that are taught in classrooms can be tied together with these unifying concepts.

START-UP SUGGESTIONS

DEFINE THE GOALS AND OBJECTIVES THAT YOU WANT THE PORTFOLIO TO DEMONSTRATE. Think about existing opportunities for students to become familiar with the targets of their science learning.

DECIDE ON THE LOGISTICS AND RESPONSIBILITY OF THE PORTFOLIO. Time and space needs for completion and storage of portfolios should be addressed. Also, think about existing opportunities for potential science portfolio entries to come from a combination of teacher initiated questions and student initiated questions. Teachers continue to offer on-going guidance and suggestions to make student's work manageable, productive, and relevant to the objectives for student learning.

BE SURE TO COMMUNICATE YOUR EXPECTATIONS CLEARLY TO STUDENTS, PARENTS, AND ADMINISTRATORS. Think about existing opportunities for sharing the parameters in the Science Portfolio Scoring Guide relevant to the science program objectives for student learning.

THINK BIG; START SMALL. EXPERIMENT UNTIL YOU FIND A FORMAT AND PACE THAT IS COMFORTABLE FOR EVERYONE. Think about existing opportunities for students to start, receive feedback, revise his or her work, and practice self-evaluation skills.

Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description			
	Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

Item: Weather

Item Description:

This item assesses the student's understanding of weather phenomena. This performance task focuses on the development of basic weather instruments and data collection activities.

Parameters

- Made two instruments.
- Illustrated instruments (drawing, photo, etc.).
- Correct statement of purpose of instruments.
- Explanation of method of use of instruments.
- 10 days' recording of measurements.
- 10 days' recording from newspaper.
- Comparison via chart/graph/discussion of student and newspaper recordings.
- Organized presentation of information.
    - Labels on graphs/charts
    - Page numbers on unbound sheets.
    - No unnecessary duplication of information.
- Did they speculate on causes of differences between their own and the newspaper reports?
- Did they know they were using predictions? Did they use printed records or predictions?

Criterion Rubric Summary

Criterion 1:

- Made and used a weather instrument
- Unorganized presentation of information
- Incomplete information.

Criterion 2:

- Made and used two instruments.

  For at least one:

- Recordings from instrument are charted.

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- Purpose of instrument is stated.
- Illustrations provided of instrument.
- Minimally supplies information asked for,
- with low level of organization.

Criterion 3:

- Two instruments made, used, illustrated, and recordings charted.
- Purpose for each is stated.
- For at least one, instructions on its use are given.
- 5 days' comparative records (original and newspaper) are provided.
- Moderately organized.

Criterion 4:

- 2 instruments: both made, used, illustrated, purpose stated, and instructions for use provided.
- 10 days' records compared with newspaper reports using chart, graph, table or statements.
- High level of organization in manner of presentation.

Item: Sleepy After Lunch

Item Description:

This item assesses student's understanding of the digestive process and experienced drowsiness. The performance task focuses on observations and understanding of the drowsiness that occurs after eating.

Parameters

- How well is the information presented organized?
- How complete is the meal plan, and do they record how they felt after the meal?
- How relevant are the questions on the student questionnaires (i.e. do they relate to the type of food eaten, what time of day people eat, when they feel sleepy)?
- How well are the data from their survey recorded?
- Is a summary of the questionnaire data included and how well does this summary reflect the questionnaire response?
- Are conclusions drawn from the compiled data from the individual meal plans?
- How well do the conclusions drawn reflect the students' compiled data?
- Can the students provide a reasonable explanation for why people get sleepy after eating certain foods or at certain times of the day?

Criterion Rubric Summary

Criterion 1:

- A genuine attempt was made at answering some of the questions asked in the packet.
- The project is incomplete. It may have only one part complete or have all parts present, but incomplete.
- There is a minimal attempt made to complete the project.

Criterion 2:

- At least 3 of the basic elements (questionnaire, log of what they ate, questions answered, conclusions) were attempted. They may be fairly incomplete.
- The questions on the questionnaire must be relevant to the project.

Criterion 3:

- At least 3 of the basic elements (questionnaire, log of what they ate, questions answered, conclusion) of the project were completed.

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- The information is fairly well organized.
- The questions on the questionnaire must be relevant to the project.

Criterion 4:

- All of the elements (questionnaire, log of what they ate, questions answered, conclusion) of the project are present and complete.
- The information is well organized.
- The meal plan must include how they felt after they ate a certain food.
- The questions on the questionnaire must be relevant to the project.
- The summary must include an analysis of the data compiled from the questionnaires.

Item: Robots

Item Description: Students are asked to design a robot that is specially designed to explore a shallow lake and then build a prototype of the robot.

Content Definition: The specific design of robots will vary markedly from one group of students to the next. Creativity is encouraged.

Robots should be drawn to scale (unless otherwise indicated). The scale should be specified (with actual units given). Since the robot will spend a large amount of time in or on the water, it should be constructed out of water-resistant, water-repellent, or water-proof materials.

The robot should be large enough to contain the equipment that it needs to carry (i.e., video cameras, tape recorders, buckets, etc.). Examples of possible equipment and how the equipment works are given in the table below.

Function of Robot:	Tell what equipment you added to your robot to perform this function.	Tell how this equipment will work.
How does your robot get to the center of the lake and back again?	• Fins, flippers, paddle wheels, motor etc. • Jets • Rotary blades, propellers.	• Physical propulsion via pushing. • Thrust by taking water or air in and pushing out the back.
How does your robot measure the depth of the center of the lake?	• Tape measure with weight, depth gauge. • Sonar	• Drop to bottom, measure distance. • Bounce sound waves off the bottom.
How does your robot measure the temperature of the water at the center of the lake?	• Thermometer	• Drop into water, measure temperature.
How does your robot record the types of wildlife found at the center of the lake?	• Video cameras, computer sensors, tape recorders, photographs.	• Record sights and sounds while at the center of the lake.
How does your robot gather and return with a sample of the water from the center of the lake?	• Plastic squeeze bottle with a straw-like tube on top.	• Squeeze bottle under surface of water, then relax the grip as the bottle fills with water.
How does your robot gather and return with a sample of soil from the bottom of the center of the lake?	• Small scoop, storage container.	• Lower to bottom of lake, scoop up some of the soil, return to storage container.

NOTE: The above examples assume an at or above water surface approach. The robot could go to the center of the lake while submerged and send sensors **up** from bottom as needed.

Robots

Scoring Parameters:

- **Part 1: Drawing of robot**
  - draw to scale
  - include scale
  - label materials - students don't think to say "glass thermometer in metal mount" so use judgment.
  - label parts/equipment
  - describe special moving parts that cannot be drawn

- **Part 2: For each function listed in the table**
  - list names of special equipment
  - describe special equipment in some detail

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Item: Mystery Powders

Item Description: Students will be involved for several days in lab activities. They will test six different known powders so that they can come up with initial data, properties of these powders when tested in four situations: a visual test, water test, vinegar test, and iodine test. Resulting data will help them to identify mystery powders made from combinations of these original powders, based on the information yielded separately in original experimentation with each powder.

Content Definition: Part 1 of the lab should have yielded charts similar to those pictured below. While students are not being scored on these charts, they should use the information gathered in this portion of the test to assist them in determining the composition of the mystery powders. Errors on these initial experiments will lead to errors in their hypotheses about the unknown powders. Student logic about mystery powder ingredients can be checked by looking at the data included in the initial charts.

POWDER	VISUAL TEST	WATER TEST	VINEGAR TEST	IODINE TEST
SALT	Pure white in color. Grainy, crystals of uniform size. Rough feeling, kind of rolls between fingers. Not finger printable.	Soaks up water. Crystals sit on the bottom of the water and then dissolve when saturated.	Soaks up vinegar. Little bubbles are created and crystals dissolve. I can hear it bubbling.	Soaks up iodine. Stains the salt a brownish red color. If left long enough the edges turn black.
SUGAR	White but with a shiny appearance in the light. Crystals are small but appear to be different sizes. Scratchy when rolled between fingers. Not finger printable.	Soaks up water. Crystals sit on the bottom of the water and then dissolve when saturated.	Soaks up vinegar. Crystals sit on the bottom of the vinegar and then dissolve when saturated. Dissolves faster than water	Soaks up iodine. Stains the salt a brownish red color.
FLOUR	Yellowish-white in color. Fine powder that feels really smooth. Finger printable.	Water rolls right off. It takes a little of the flour with it.	Vinegar rolls off. It takes more of the flour with it than water did. If dropped just right it appears to curl up on the edges where it stays on the flour.	Turns a deep purple or black immediately on contact.
BAKING SODA	Very white. Powder feels a little rough between my fingers. Finger printable.	Water soaks in. Appears to dissolve it but no bubbling.	Violent bubbling occurs. The reaction is very fast and rapid. Sour smell but very slight.	Iodine soaks in but remains a reddish brown.

POWDER	VISUAL TEST	WATER TEST	VINEGAR TEST	IODINE TEST
BAKING POWDER	Pure white in color. Smooth powder that feels soft. Finger printable.	Bubbles in water. Some small bubbles and some large bubbles. I can hear it bubbling.	Bubbles in vinegar. Some small bubbles and some very large bubbles. I can hear it bubbling louder than the water.	Turns black and bubbles up. It bubbles more slowly than the others.
CORN STARCH	Pure white in color. Very smooth powder. Makes my fingers feel slippery.	Water rolls off but then soaks back in. Makes the powder appear to melt.	Vinegar rolls off but then soaks back in. Makes the powder appear to melt.	Iodine turns black immediately. Rolls off but then soaks back in.

The mystery powders section of the lab is the portion of this test that will be scored. Students' charts should have the following information. The correct ingredients are also listed. To check the logic section of student presented evidence, refer to the chart included above from the initial experiments. Answers should be representative of data included in the chart.

POWDER	VISUAL TEST	WATER TEST	VINEGAR TEST	IODINE TEST
MYSTERY POWDER #1	Has partial grainy feeling. Crystals appear shiny and irregular. Has a yellow color to it.	Water ran off if too much was applied. Some did soak in. No reactions.	Some vinegar soaked in but most rolled off. No reactions.	Turned black immediately.

A hypothesis of sugar and flour should be given.

POWDER	VISUAL TEST	WATER TEST	VINEGAR TEST	IODINE TEST
MYSTERY POWDER #2	Has partial grainy feeling. Crystals are very small and have regular shapes. Powder feels soft and is pure white.	Bubbles in water. Some small bubbles and some large bubbles. I can hear it bubbling.	Bubbled in vinegar.	Turned black and bubbled slowly.

A hypothesis of baking powder and salt should be made.

POWDER	VISUAL TEST	WATER TEST	VINEGAR TEST	IODINE TEST
MYSTERY POWDER #3	Rough grains in it. No shine. Rolls like salt.	Water soaked in and made some of the powder appear to melt.	Violent bubbling. Very fast.	Turned black but didn't bubble. Iodine just soaked in and some of the powder appeared to melt.

A hypothesis of salt, baking soda and cornstarch should be made.

Scoring Parameters:

- Charts containing detailed observations of the 3 different mystery powders.
- A correct identification of each substance in the mystery powder.
- Evidence provided to support identification of each mystery powder.

Score Level Descriptions:

NS

1 The student demonstrates a minimal understanding of inference based on direct observations. Charts contain some relevant information **AND/OR** attempts are made to identify each powder **AND/OR** *some* evidence is given supporting the identification of powders.

2 The student demonstrates some understanding of inference based on direct observations. All three charts are partially or fully completed **AND** one or more of the powders are identified accurately.

3 The student demonstrates an adequate understanding of inference based on direct observation. All three charts are partially or fully completed **AND** at least three substances are correctly identified with specific test results cited as evidence.

4 The student demonstrates a full understanding of observations and making correct inferences. Response should deal fully with all of the parameters of the problem. Charts should be completed similarly to the example given.

All three charts are fully completed **AND** five of the seven mystery substances are correctly identified **AND** specific test results are properly cited as evidence to support each mystery powder identification.

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Weather

During the next few weeks, your team will study the weather. You will build two instruments to gather information about the weather where you live. For example, you may decide to make a rain gauge. Also, you will study local weather reports in the newspaper. Afterwards, your team will prepare a report.

The report should include the following information:

- A drawing of each weather instrument that you make
- Readings from your weather instruments for the next ten school days
- A weather report from the newspaper for the same ten school days

1. Before building your instruments, you should read about the weather. Learn about the instruments that are used to gather information about the weather. You can use any books that you find helpful.
2. Build two instruments that can be used to gather information about the weather. For example, you may decide to measure rainfall or snowfall. You may decide to measure the speed or direction of the wind.
3. Draw a picture of each instrument. Tell what it will be used to measure. Tell how you will use it.
4. Use your instruments to record the weather conditions at school. Do this for ten consecutive school days. Also observe what the weather is like. Keep track of this information.
5. Check the local weather reports for each day that you take your readings. See if the readings from the newspaper match your readings. Keep track of this information.
6. For each day, present your results in a chart, table, or graph. See the example on the next page.

Weather

Here is an example of how you can present your results.

October 15 Weather Report

	Our readings and observations	The newspaper's readings and comments
Rainfall	1 inch	1.5 inches
Wind direction	southeast	southeast
Observations	The sky was partly cloudy in the morning. The rain started at lunch time. By 3:00 PM the rain had stopped and the sun had come out.	Partly cloudy in the morning, scattered showers in the afternoon. Highs in the upper 40s. Lows in the low to mid 30s.

Sleepy After Lunch

Some people get very sleepy after they eat a big meal. Does this ever happen to you? Does this ever happen to someone you know? Do you ever take a nap after lunch? Do you ever have trouble staying awake even when you got lots of sleep the night before?

What factors affect whether a person gets sleepy after a meal? Is it the type of food a person eats? Is it the amount of food a person eats? Is it the time of day?

During the next few weeks, your group will try to answer these questions. You will keep track of what you eat and how you feel after each meal. Also, you will prepare a list of questions (a questionnaire) to ask other people what they think. When you are done, you will prepare a report with your findings.

Your group will have three weeks to work on this project. At the end of three weeks, your teacher will collect your group's report. Your report should answer the following questions.

1. When and why do you get sleepy?

   For the next seven days, keep track of everything you eat. Also keep track of when you feel sleepy. Look for a pattern. When do you usually get sleepy? Do you get sleepy at a certain time of day? If so, when? Do you get sleepy after eating certain types of food? If so, what? Why do you think you get sleepy? Make a list of your ideas. Include the list in the report.

2. When and why do other people get sleepy?

   Prepare a questionnaire that you can ask ten people. Interview these people. Find out when and why they get sleepy. Do they get sleepy at certain times of the day or after eating certain types of food? Include a copy of your questionnaire and a summary of the all the answers.

3. Have you noticed any patterns?

   Think about what you noticed during Step 1. Also think about what the people you interviewed have said. Are there certain times of day that almost everyone gets sleepy? If so, when and why do you think this happens? Are there certain types of food that make almost everyone get sleepy? If so, what do you think happens and why? Based on all the information you collected, explain when and why you think you and the people you interviewed get sleepy.

Robots

Introduction

You are a member of a scientific team. Your team wants to study a shallow lake that you have just discovered. Your team has decided that it may be too dangerous to send humans into the environment. Instead, your team will build a robot to gather the information for you.

Your team wants to gather information from the very center of the lake. It is your job to design a robot that can do this. The robot must be able to get to the center of the lake, collect the data and samples, and return to the laboratory at the edge of the lake.

Procedure

Over the next several weeks, your team will be responsible for creating detailed drawings for your robot and building a model of it. Your model will be built out of cardboard or any other raw materials you can find around your house and school. Your drawings may be adjusted as you complete your model if you find that you change your robot as you construct it.

You will need to consider the following ideas when creating your design.

1. How does your robot move (i.e., walk, fly, burrow, swim)? Show how your robot is specially designed to be able to do this.

2. From what materials will your robot be built? Be sure to consider that it will spend most of its time in the lake. Your model does not need to be built from the actual material, but you will need to explain this on your drawings.

3. Your robot will need to be able to gather:
   - data about the depth at the center of the lake.
   - data about the temperature of the water.
   - data about the types of wildlife that live there.
   - water samples and soil samples from the center of the lake.

Label on your drawings what special equipment you will include on your robot so that it will be able to do all of these things. Be sure this equipment ALL currently exists in our world. Be sure to tell what size the actual robot would be.

On the table located in this booklet, describe each piece of equipment and tell in detail how it will operate to perform its function.

Robots

Assignment

At the end of this task, you will be asked to turn in the following assignment. Be sure to review both parts of the assignment before you design your robot.

Part 1. Make a detailed drawing of your robot. The drawing should include a sketch or drawing of the real robot, not the model that you made in class.

- The robot should be drawn to scale. The scale should be indicated on the drawing.
- List all the materials you would use to make the robot.
- Label all the parts of the robot.
- Describe any special moving parts that cannot be drawn very well. Tell how the parts move and what they do.

Part 2. Complete the table below that asks you to describe the special equipment on your robot. Be sure to answer every question the best you can.

Function of Robot:	Tell what equipment you added to your robot to perform this function	Tell how this equipment will work
How does your robot get to the center of the lake and back again?		
How does your robot measure the depth of the water at the center of the lake?		
How does your robot measure the temperature of the water at the center of the lake?		
How does your robot record the types of wildlife found at the center of the lake?		
How does your robot gather and return with a sample of water from the center of the lake?		
How does your robot gather and return with a sample of soil from the bottom at the center of the lake?		

Mystery Powders

Scientists use physical properties to gather information about objects and to determine what unknown objects are. You will be placed with a team of scientists. Your team is going to be observing and performing tests on several different powders. In the beginning, you will know what those powders are. It will be very important that each of you observe and record their properties very carefully. You will have several days to perform this task.

Later, you will be given mystery powders that will be combinations of the powders that you have tested. It will be your job as a scientific team to try to determine what makes up these mystery powders. You will do this by running the same tests on them and comparing the results to your previous results.

Your team will run the following tests.

- Visual Test
- Water Test
- Vinegar Test
- Iodine Test

Each test will use a little powder and a piece of wax paper. Cover your desk with newspaper each day. Be sure to keep your lab area clean and return materials to their proper location to avoid contamination.

Your teacher has demonstrated the procedure for each of these tests for you. Be sure that you follow your teacher's directions exactly! Write down everything you see, hear, feel or smell. NEVER TASTE ANYTHING IN THIS EXPERIMENT! Your observations are incredibly important. Write down everything, no matter how small it may seem at the time. The following chart will help you ask questions to get better results. Refer to it often while you are performing your tests:

Things to notice:	Questions to ask:
Color	Is white always the same color? Are there any changes during the tests?
Texture	What does it feel like? Is it lumpy, smooth, rough?
Particle size	Are there small grains or is it a very fine powder? What do they look like? What happens to the particles during the tests?
Finger printable	When you push your finger into it do you see your fingerprint?
Smell	Waft the air above the material. Is there a smell before, during or after a test?
Sound	Do you hear anything before, during or after the tests?
Liquids	Do they soak in, run off, change color or cause any bubbling?
Time	How long do reactions take? Do things happen right away or do they take a longer time?

Mystery Powders

Part 1: Days 2–10

Record all of the results of this lab on the following charts:

Salt

Test	Results
Visual	
Water	
Vinegar	
Iodine	

Sugar

Test	Results
Visual	
Water	
Vinegar	
Iodine	

Mystery Powders

Flour

Test	Results
Visual	
Water	
Vinegar	
Iodine	

Baking Soda

Test	Results
Visual	
Water	
Vinegar	
Iodine	

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Mystery Powders

Baking Powder

Test	Results
Visual	
Water	
Vinegar	
Iodine	

Cornstarch

Test	Results
Visual	
Water	
Vinegar	
Iodine	

Mystery Powders

Part 2: Days 11–12

Today your teacher will place a mystery powder on the front table. It is made from combinations of the powders you have already tested. You will run the same tests on these powders that you have on the other powders. Compare your results with the results of the other tests you have run. It is your job to identify what is in the mystery powders. Run each test several times to be sure that your results are accurate.

Record your results here:

Mystery Powder #1

Test	Results
Visual	
Water	
Vinegar	
Iodine	

Mystery Powder #1 is made from two powders that you already studied. Which two powders make up Mystery Powder #1?

Powder A: ____________________________
Powder B: ____________________________

What evidence do you have to support your idea? Be sure to refer to specific test results.

Mystery Powders

Part 2: Days 13–14

Today your teacher will place a mystery powder on the front table. It is made from combinations of the powders you have already tested. You will run the same tests on these powders that you have on the other powders. Compare your results with the results of the other tests you have run. It is your job to identify what is in the mystery powders. Run each test several times to be sure that your results are accurate.

Record your results here:

Mystery Powder #2

Test	Results
Visual	
Water	
Vinegar	
Iodine	

Mystery Powder #2 is made from two powders that you already studied. Which two powders make up Mystery Powder #2 ?

Powder A: ___________________________
Powder B: ___________________________

What evidence do you have to support your idea? Be sure to refer to specific test results.

2C5

Mystery Powders

Part 2: Days 15–16

Today your teacher will place a mystery powder on the front table. It is made from combinations of the powders you have already tested. You will run the same tests on these powders that you have on the other powders. Compare your results with the results of the other tests you have run. It is your job to identify what is in the mystery powders. Run each test several times to be sure that your results are accurate.

Record your results here:

Mystery Powder #3

Test	Results
Visual	
Water	
Vinegar	
Iodine	

Mystery Powder #3 is made from two powders that you already studied. Which two powders make up Mystery Powder #3 ?

Powder A: ____________________________
Powder B: ____________________________

What evidence do you have to support your idea? Be sure to refer to specific test results.

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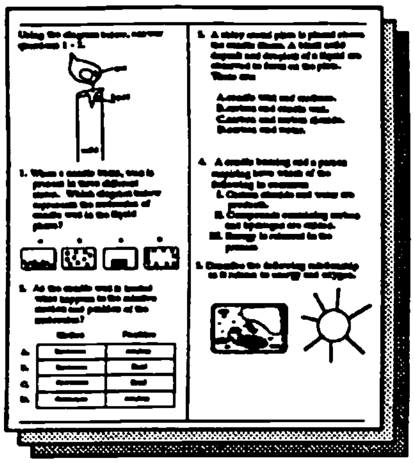
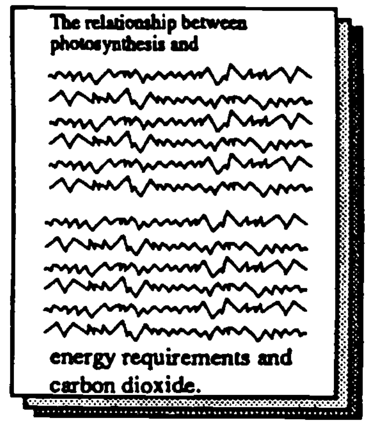
Type 1

Fifth Grade Science

Competency-Based Education Assessment Series





° Multiple Choice, Short Answer and Extended Response °

(Traditional)

Characteristics

- Requiring a minimum of a session
- Scoring with answer keys in combination with (interviews and) rubrics

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments reflect all performance levels, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure district assessments reflect a coherence with instructional strands and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*

• Fifth Grade Type 1 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 1 - 2							*Sixth Grade*
Food Web	1	C	Acquiring	2, 8	I: 1, 3, 6	Systems and Interactions	N:
	2	C	Acquiring		K: 4, 5, 6, 7, 10		P:
	3	A	Processing		C: 8		E:
	4	See Discussion	Processing		A:		L: 14, 15
	5	A	Acquiring				
	6	A	Processing				
	7	See Discussion	Processing				
	8	See Discussion	Extending				
	9	See Discussion	Extending				
Page(s) 3 - 4							
Batteries and Bulbs	1	C	Acquiring	2, 6, 8	I: 1, 3, 6	Change Over Time	N:
	2	A	Acquiring		K: 1, 4, 7, 10		P: 9
	3	See Discussion	Acquiring		C: 8, 13		E:
	4	D	Acquiring		A: 4		L:
	5	B	Acquiring				
	6	See Discussion	Processing				
	7	C	Processing				
	8	See Discussion	Processing				
	9	See Discussion	Processing				
Page(s) 5 - 6							
Playground	1	C	Processing	2, 4, 8	I: 1, 6	Models and Scale	N:
	2	C	Acquiring		K: 1, 2, 4, 8, 9, 10		P: 7, 9
	3	See Discussion	Acquiring		C: 8, 13		E:
	4	C	Processing		A: 4		L:
	5	C	Processing				
	6	See Discussion	Extending				
	7	See Discussion	Processing				
Page(s) 7 - 9							
What's The Solution?	1	A	Acquiring	1, 3, 5	I: 1, 3, 5, 6	Change Over Time	N: 3, 5
	2	A	Acquiring		K: 1, 6, 7, 9		P: 8, 9
	3	A	Acquiring		C: 8, 13		E:
	4	D	Processing		A: 8, 9		L: 16, 17
	5	C	Processing				
	6	See Discussion	Extending				
	7	See Discussion	Extending				

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Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*

• Fifth Grade Type 1 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 10 - 12							*Sixth Grade*
The Sun and Earth Through the Seasons	1	C	Acquiring		I: 1, 6, 8 K: 2, 4 C: 1, 8, 11, 13 A:	Systems and Interactions	N: 3, 5 P: E: 11 L:
	2	B	Processing				
	3	A	Acquiring				
	4	D	Acquiring				
	5	See Discussion	Acquiring				
	6	B	Acquiring				
	7	See Discussion	Processing				
	8	See Discussion	Extending				
Page(s) 13							
What Does It Tell Us?	1	A	Acquiring		I: 6 K: 5, 7 C: 1, 11 A:	Change Over Time	N: 1 P: E: L:
	2	C	Acquiring				
	3	See Discussion	Processing				

• Performance Objectives: Grade 5 ***Ohio's Model Competency-Based Science Program***

1. Using sense-extending devices, the learner will describe an object or organism not easily observed in terms of its attributes and behaviors.
2. Given data from a simple mechanical or biological system, the learner will describe how changing one component impacts the other components of the system.
3. The learner will propose 'What if...?' questions regarding a simple physical change, design and test his/her questions, and cite and justify appropriate safety precautions.
4. The learner will choose a simple technological device and describe the advantages and disadvantages to the user.
5. Given a question about a natural phenomenon, the learner will propose several sources of information that may assist in addressing questions about the phenomenon.
6. The learner will choose and use appropriate tools to assemble and disassemble a simple mechanism or model.
7. Given data on the performance of consumer products, the learner will choose and defend their choice of a product based on performance data.
8. The learner will trace the transmission, transformation, and conservation of various forms of energy in a simple system (e.g., food web, bicycle, kite, scissors, human body).

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Objectives	*Inquiry* • The learner will:	*Knowledge* •The learner will:	*Conditions* • The learner will be:	*Applications* • The learner will be:
1	perceive and describe complex structures and events using appropriate concepts (e.g., geometric configuration, duration, rate of change, limit, cause and effect, and constancy).	investigate the impacts of various forms of mechanical and electromagnetic waves on various organisms and objects.	gathering and evaluating information related to science topics from multiple sources.	assessing potential hazards and take appropriate actions to ensure the safety of himself/herself, and others.
2	take responsibility for the care of supplies and equipment used in investigations.	investigate the regularity of motion found in the interactions in the solar system (e.g., seasons, tides, planets, moons).	using reading, writing, and mathematics as tools for learning.	selecting consumer products based on performance evaluations using appropriate criteria (e.g., nutrition, safety, energy consumption, environmental impact, essentiality).
3	determine the likelihood of event outcomes, by identifying the causal factors and speculate what additional factors may contribute to a more accurate prediction.	investigate conditions that affect the motions of objects and organisms.	communicating and conducting investigations through global networks.	exploring the impact of the uses of technology on the environment.
4	report findings on the variability of observations accurately and ethically while engaged in scientific inquiry (e.g., controlled experiments and naturally occurring events).	investigate the consequences of changes in roles and contributions of various components of technological, social, and ecological systems.	constructing a portfolio of products and self-evaluations of his/her own abilities, skills, and experiences.	explaining the operation of everyday devices based upon scientific principles.
5	describe investigative findings to classmates and support the findings with evidence.	investigate the diversity of methods by which living things meet their needs (e.g., food, shelter, protection, respiration).	contributing to and maintaining a safe, healthful, and efficient learning environment.	proposing alternatives regarding community issues.
6	analyze "How do you know?" inquiries in appropriate situations by formulating and investigating reasonable "What might happen if...?" inquires about everyday experiences.	investigate the composition and level of organization of objects and organisms (e.g., crystals, minerals, rocks, tissues, organs, organisms).	using technologies to collect and store information.	analyzing and cooperatively working toward resolution of disagreements (e.g., results, procedures, interpretations) during learning activities.
7	invent, describe and carry out simple sampling investigations.	investigate various properties of groups of objects and organisms.	optimizing the individual contributions made by cooperative group members.	participating actively in dialogue about community issues.
8	consider and discuss over time observations and investigations in terms of how they conflict, support, refine, and extend his/her constructed understandings.	investigate easily measured distances and rates of change and their implications in technological and natural systems.	examining and refining personal understanding of scientific concepts.	undertaking assembly, disassembly, adjustment, and modification activities in the context of the physical setting and living environment.
9	observe discrepant events and propose and test explanations of what happened.	investigate the history and function of various techniques and technologies (e.g., sanitation, nutrition, hygiene, friction reduction, erosion control, crop rotation, agriculture).	collaborating to prepare and perform individual and group presentations of explorations.	taking time to access and effectively using tools, instruments, community resources and devices that will enable investigations to proceed more efficiently.
10		investigate the transmission and conservation of various forms of energy through biological and physical systems (e.g., electricity, weather, agriculture).	familiarizing himself/herself with the investigations performed by the global scientific community.	
11			accepting and generalizing results of investigations based upon repeated observations and multiple sources.	
12			considering risks and benefits before collecting, displaying, and maintaining organisms in the classroom.	
13			investigating living and nonliving things holistically through models, simulations, multimedia, technologies.	
14			maintaining journals of observations and inferences over long periods of time.	

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Item Discussion

Below is a summary list of items from the SCIENCE TYPE 1 MODEL COMPETENCY ASSESSMENT for the **FIFTH GRADE** that begin with the "Explain and justify..." stem and immediately follow a related selected response item. In general, use of this "Explain and justify..." strategy is consistent with the questioning spirit of the Science Model (e.g., "How do we know?", "What is or reasonably can be inferred?", "How does it work?"). Secondly, this is another strategy for making a multiple choice item more interactive for students, and depending on how they respond, provide a wider window into their thinking.

The use of this strategy and the interpretation of student responses to this prompt, will depend upon numerous factors (e.g., the content of the district science program, particular emphases placed on individual topics, differing expectations for student performance on particular topics, needs of teachers and students to collect and share deeper insight). In any event, a general rubric approach that can be used to interpret student responses follows:

Criterion	**Rubric Summary**
1.	Answer in any way addresses the prompting question relative to the context of multiple choice item. Any remotely reasonable assumption and scientific response to this question is acceptable (even if incorrect).
2.	Answer presents assumption and accurate scientific explanation that accounts for and successfully connects students' selected response to the information in the context of the item.

Summary List of Multiple Choice Items With the "Explain and justify..." Prompt

• Fifth Grade Type 1 •

Assessment Block	*Item*	*Answer*
PP. 1 - 2		
Food Web	4	Responses Varies
	7	Responses Varies
PP. 3 - 4		
Batteries and Bulbs	3	Responses Varies
	6	Responses Varies
P. 5 - 6		
Playground	3	Responses Varies
P. 9 - 11		
Sun and Earth	5	Responses Varies

The discussion on the following pages pertains to the **Short Answer** and **Extended Response** items on the SCIENCE TYPE 1 MODEL COMPETENCY ASSESSMENT for the **FIFTH GRADE**. Discussion of these items include an **Item Description** which provides an overview of the item and the elements of an acceptable student response. The **Rubric Summary** further organizes these elements in a quick reference table reflective of suggested stages of an acceptable student response.

Item: Food Web
#8 • Short Answer

Item Description:

This item assesses the student's ability to imagine circumstances under which an unlikely natural event might occur.

A good response will describe circumstances under which it might be possible for an arctic fox to eat a polar bear, given that grown polar bears are much larger, stronger and faster than grown arctic foxes.

Suggestions will take into account the ordinary obstacles to arctic foxes eating polar bears and overcome them in a feasible way; e.g., a juvenile somehow incapacitated.

Criterion	Rubric Summary
1.	Response is on topic; it addresses the issue of arctic foxes eating polar bears.
2.	Suggests one unlikely circumstance or situation in which an arctic fox might eat a polar bear OR States that it is unlikely that an arctic fox could eat a polar bear.
3.	Suggests at least one feasible and one unlikely circumstance or situation in which an arctic fox might eat a polar bear OR States that it is unlikely that an arctic fox could eat a polar bear, AND States one feasible circumstance or situation in which the event might occur nevertheless.
4.	Suggest at least two feasible situations or circumstances in which an arctic fox might eat a polar bear.

#9 • Extended Response

Item Description:

This item assesses the student's understanding of food webs and ability to predict how a dramatic change in one portion of the web will affect another portion of the web.

A good response will predict and explain the consequences for an island's polar bear population when one of the bears' food sources is eliminated.

Criterion	Rubric Summary
1.	Addresses the prompt with a simple "yes" or "no" OR Addresses the question "What would happen to the polar bears," even if the answer is incorrect.
2.	Response makes an assertion without explanation (e.g., polar bears will die; polar bears will be affected but will not die; polar bears will not be affected).
3.	Describes or explains a negative effect on the polar bears other than death of the entire population AND recognizes that the bears will have to turn elsewhere for food OR Recognizes that the death of the fish will affect the seal population and that problems for the seals mean problems for the polar bears.
4.	Accomplished both parts of Criteria 3.

Item: Batteries and Bulbs
#8 • Short Answer

Item Description:

This item assesses the student's understanding of electrical circuits and measures the student's ability to illustrate a complete workable circuit.

A good response shows a drawing including all electrical components required by the prompt within a closed circuit in a configuration which will lead to both bulbs being lit. Components within the diagram should be clearly drawn with battery polarities indicated.

Criterion	Rubric Summary
1.	Figure includes at least one battery, one bulb and wire AND at least one battery pole is designated.
2.	Diagram includes at least one battery and one bulb AND a closed complete circuit is drawn.
3.	Circuit shown will lead to at least one bulb being lit.
4.	All of the electrical parts required by the prompt are present in one complete circuit AND the circuit depicted leads to both bulbs being lit. (Note that responses which fulfill criterion 4 also fulfill criteria 2 and 3.)

#9 Extended Response

Item Description:

This item assesses a student's ability to properly diagram how a flashlight is assembled from its component batteries, bulb, switch and wires.

A good response correctly depicts the two batteries oriented properly and connected to a bulb with copper wires. The response should show these components within a complete electrical circuit which includes a switch. Turning the switch "on" should lead to the bulb being lit. The entire assemblage can be enclosed within the cardboard tube. The response should include appropriate labels for each component and correctly indicate at least one pole of each battery.

Criterion	Rubric Summary
1.	Presents and clearly labels all electrical components specified by the prompt AND at least one pole of one battery is indicated.
2.	Depicts two properly aligned batteries and a bulb in the correct linear order found in a working flashlight (circuit does not have to be complete or correct).
3.	Shows a complete circuit that includes at least one battery and a bulb.
4.	Shows all electrical components specified by the prompt correctly aligned within a complete workable circuit which will lead to the bulb lighting up when the switch is "on".

Item: Playground
#6 • Short Answer

Item Description:

The student is asked to help Maggie use the equipment available to design an experiment, of sorts, to determine which of two skateboards goes fastest. The student will propose a procedure that will enable Maggie to make an accurate comparison of the two skateboards, either by testing both skateboards at once or by testing them one at a time. Ideally, the student will propose either (1) releasing the skateboards simultaneously and seeing which one gets to a particular point (such as the bottom) first or (2) releasing them in any order and comparing how far each skateboard goes until it stops.

The student should specify how the available equipment (wooden ramp and meter stick) can be used to determine which skateboard goes fastest or farthest.

Criterion	Rubric Summary
1.	Explicitly describes how Maggie can use either the ruler or ramp or both -- even if the information is irrelevant to solving the problem of which skateboard goes faster.
2.	Describes at least one observation or procedure that can be used to test the skateboards -- either both skateboards at once or one skateboard at a time. The procedure/observation may be flawed.
3.	Describes at least one procedure that will enable Maggie to compare the skateboards and determine which one goes fastest (or farthest). For this grade level, we can assume that the one that goes furthest is the one that is fastest.
4.	Anticipates a particular result or outcome and describes how a particular outcome can be interpreted to determine which skateboard goes fastest OR shows an understanding of the importance of controlling extraneous variables and/or making repeated observations.

#7 • Extended Response

Item Description:

In the passage the student is given background information about *Kinetic energy*. To successfully answer this question, the student will apply this information to the situation described in question 6 and will see the connection between the kinetic energy (KE) and speed of the ball.

A good response will demonstrate an understanding of how and why the KE decreases then increases as the ball is tossed from Susan to John, along the path A to B to C, which includes a discussion of the effect of air resistance (friction) on the changes in the ball's energy.

Criterion	Rubric Summary
1.	Specifies, correctly or incorrectly, whether the ball has the most, least, or intermediate amount of KE or energy at the selected position.
2.	Correctly identifies the relative amount or change in KE or energy along the path by satisfactorily completing a comparison.
3.	Explains why the ball has more KE or energy at Point A than at Points B and/or C. (Or student explains why ball loses KE or energy as it travels -- implying more KE at A than at B or C.
4.	Explains why the ball has less KE or energy at Point B than at Point A and/or C.

Item: What's the Solution?
#6 • Short Answer

Item Description:

This item assesses the student's understanding of the concept of dissolved solids, and the ability to describe a process for separating undissolved solids from water.

A good response will include a logical description of a process that would remove an undissolved solid (sand) from a cup of water, and will demonstrate an understanding of the concept of dissolved solids (sugar).

Criterion	Rubric Summary
1.	Responses to the subject matter of the question AND discusses some operation they will perform on the sand, water, and/or cup.
2.	Describes a process for removing the sand that in some way involves "pulling" or "scooping" sand from the water and/or "draining" or "straining" the water or sand AND DOES NOT refer to the sand being "dissolved".
3.	Describes a process for removing sand that meets Criterion 2 AND the process is logical (i.e., makes sense, would work) AND relevant (i.e., with respect to a cup of water).
4.	Explicitly demonstrates an understanding that the sugar is dissolved (i.e., by stating it is dissolved, or mentioning that the sugar is not removed by a strainer, etc.).

#7 • Extended Response

Item Description:

This item assesses the student's ability to list multiple criteria for distinguishing what's in the muddy water, and assesses the student's understanding of scientific testing and safety precautions related to making the water clear and safe to drink.

A good response will include multiple observations (excluding taste) that go beyond the color of liquid and that will distinguish between the possible dissolved/undissolved material, an explanation of the student's reasoning involved in the tests, safety considerations, and may include an understanding of scientific confirmation of results through repeated testing and expert evaluation.

(Consider holistically evaluating the complex response to this open-ended item using the parameters for Depth of Understanding, Communication, and Relevance to Society from the Science Portfolio Scoring Guide and/or refer to the Rubric Summary below.)

Criterion	Rubric Summary
1.	Responds to the subject matter of the question AND attempts to describe some potential different types of stuff in the muddy water.
2.	Lists at least one observation they could make of the liquid (excluding taste, labels, or information not gained from liquids themselves), including asking about where the water came from OR suggests an acceptable, safe, procedure to begin cleaning the water.
3.	Describes more than one acceptable distinct observation they could make (e.g., texture or smell) OR describes an advanced testing/cleaning procedure (e.g., microscope, magnifying glass, strainer (for "lumpiness"), shining light on the liquids, allowing mud to settle out).
4.	Explains why they will follow at least one of their listed higher order, safe, observations/procedures AND states that they or someone else (an expert) will re-test the procedure, and check the results of the procedure with a teacher/expert.

Item: The Sun and the Earth Through the Seasons
#7 • Short Answer

Item Description: This item is designed to assess students' abilities to describe arrangements of the earth and sun during seasonal cycles related to the amount of sunlight hours in a day. Students need to acquire information from the story and the models provided to describe EQUINOX in their own words, using the observable characteristics (i.e., amount of sunlight and earth/sun arrangement).

A successful response will accurately describe EQUINOX sunlight patterns (e.g., equal amount of daytime and nighttime hours) and logically connect the pattern with the corresponding earth/sun arrangement. The response should include reference to information/models included in the item to support (provide evidence) for the explanation. The response should be clear, focused, and organized.

Criterion	Rubric Summary
1.	The student makes an sincere attempt to respond
2.	The reader can infer that the response describes observable EQUINOX characteristics (i.e., amount of sunlight and earth/sun arrangement) and contains some inaccuracies and is incomplete.
3.	The response explicitly describes observable EQUINOX characteristics (i.e., amount of sunlight and earth/sun arrangement) and contains some inaccuracies or is incomplete.
4.	The response is accurate, complete, clear, focused, and organized. The description of the EQUINOX sunlight patterns (e.g., equal amount of daytime and nighttime hours) are logically connected with the corresponding earth/sun arrangement.

#8 • Extended Response

Item Description: This item is designed to assess students' abilities to use a creative/inventive communication strategy to describe arrangements of the earth and sun during seasonal cycles related to the amount of sunlight hours in a day. Students need to acquire information from the story and the models and clearly focus this information and use a medium/mode of expression to be understandable by younger students.

A successful response would include references to personal experiences and/or observation of seasonal cycles related to the amount of sunlight hours in a day (e.g., more time to play outside in the summer than in the winter) combined with a creative/inventive communication strategy (e.g., using common objects - finger puppets, toys, balls, globe, flip books - to simulate position of earth and sun, and corresponding changes in sunlight patterns) to demonstrate how it works.

Parameters Rubric Summary

Consider holistically evaluating the complex response to this open-ended item using the parameters for Depth of Understanding, Communication, and Relevance to Society from the Science Portfolio Scoring Guide.

Item: What Does It Tell Us?

#3 • Short Answer

Item Description:

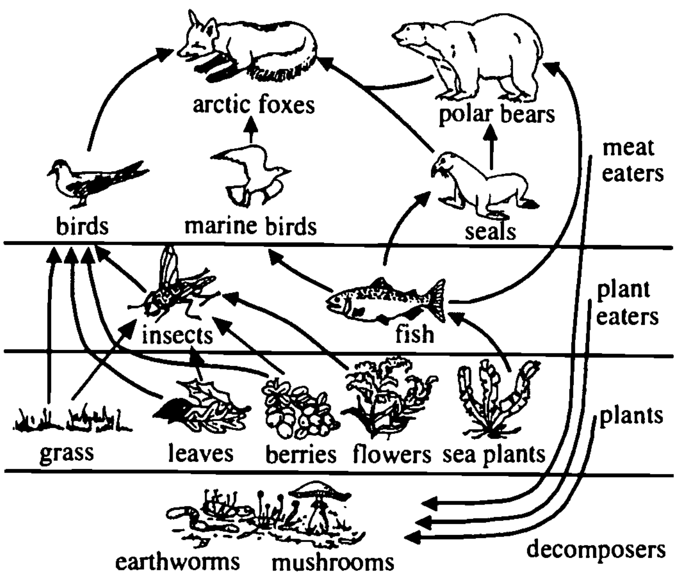
This item assesses students' ability to identify things using a simple key.

A successful response will lead to the student writing a description that contains the observable characteristics of the seed at point 'A' using the words in the flow chart - (i.e., the seed is fuzzy, two-colored, not oval, and not wrinkled). The order.

Criterion	Rubric Summary
1.	The student makes an sincere attempt to respond
2.	The response contains some inaccuracies and is incomplete.
3.	The response contains characteristics only from the Right side of the flowchart and contains some inaccuracies or is incomplete.
4.	The response is accurate and complete. The description of the seed at point 'A' contains all of the possible observable characteristics and clearly focused on the seed characteristics language in the chart.

1. Food Web

Look at Figure 1 below. It shows some of the animals that live on and around an island.



In Figure 1 above, the arrows show who depends on whom. For example, the arrow pointing from the fish to the seal shows that seals eat fish.

Use this information to answer the following questions.

1. What do marine birds eat?

- **A.** Berries
- **B.** Leaves
- **C.** Fish
- **D.** Mushrooms

2. According to the figure, what do insects and fish in this food web eat?

- **A.** Meat-eaters
- **B.** Plant-eaters
- **C.** Plants
- **D.** Decomposers

3. In this food web which of the following is probably found in the greatest number?

- **A.** Insects
- **B.** Arctic foxes
- **C.** Seals
- **D.** Polar bears

4. Explain and justify your answer to **Question 3.**

Food Web

5. Arctic foxes eat:

   A. seals.
   B. flowers.
   C. insects.
   D. grass.

6. Bears and foxes that live in warm areas have dark-colored fur. Polar bears and arctic foxes have white fur because it helps them:

   A. to hunt seals.
   B. find berries.
   C. hide from decomposers.
   D. swim fast.

7. Explain and justify your answer to **Question 6.**

Short Answer

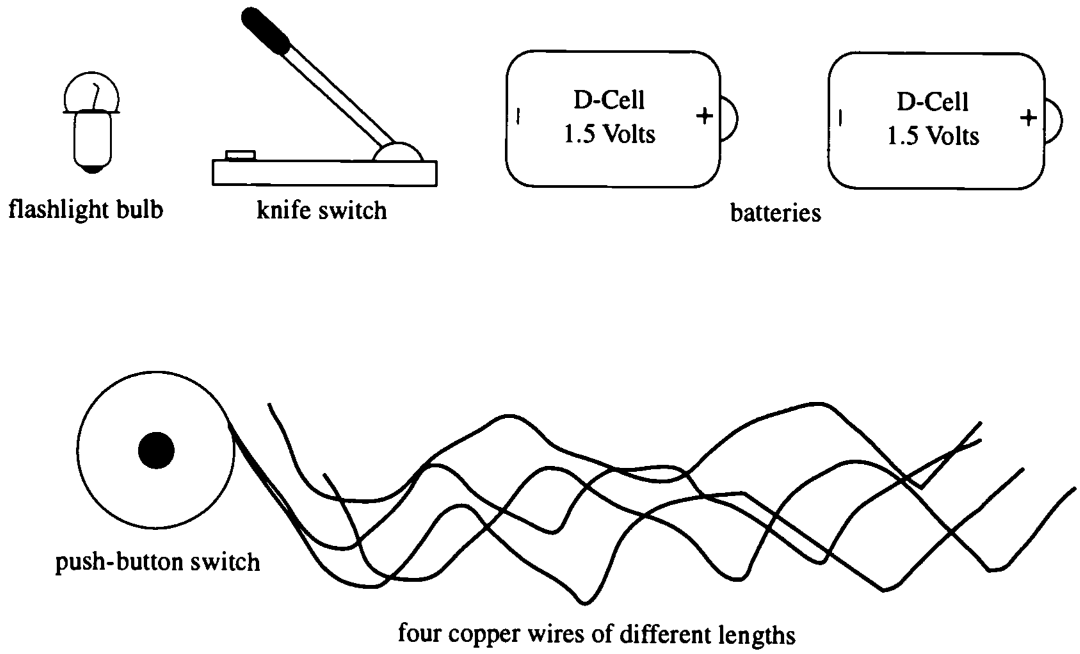
8. According to Figure 1, arctic foxes eat polar bears. Describe situations in which an arctic fox is likely to eat a polar bear.

Extended Response

9. If all the fish died, would the polar bears be affected? What would probably happen to the polar bears? Why?

Batteries and Bulbs

The teacher gave Julie and Scott some tape and the materials shown below.

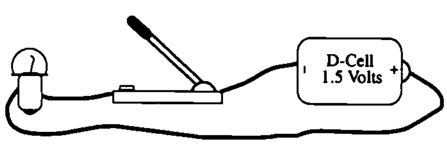


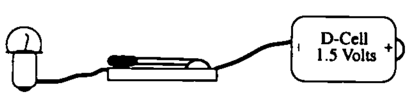
She asked them to build circuits.

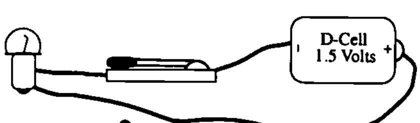
When a circuit is complete with a battery, an electrical current flows. If a flashlight bulb is added, the bulb lights up. If the circuit is broken, the current cannot flow and the bulb will not light up.

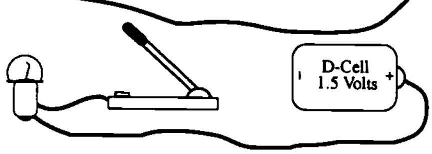
Use this information to answer the following questions.

1. When the arm of the knife switch is down, the circuit is complete. When the arm is raised, the circuit is broken. In which of the following setups will the flashlight bulb be lit?

A. 

B. 

C. 

D. 

2. The arm of the knife switch is probably made of which material?

   A. Iron
   B. Wood
   C. Plastic
   D. Cardboard

3. Explain and justify your answer to **Question 2.**

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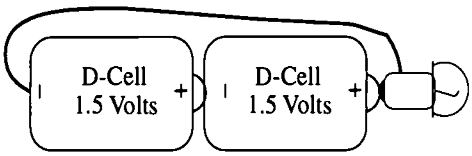
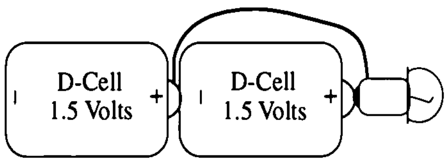
Batteries and Bulbs

4. In which of the following cases will the flashlight bulb NOT light up?

A.


B.


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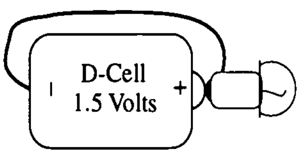

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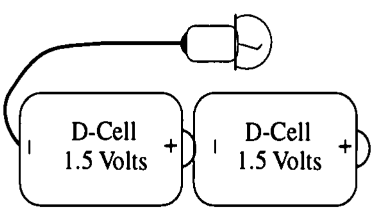
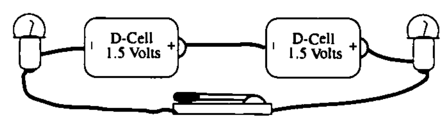


5. Scott and Julie made a complete circuit using the flashlight bulb and one battery. Then they added the other battery. When the second battery was added, what happened to the bulb?

A. It became dimmer.
B. It became brighter.
C. It flashed on and off.
D. It stopped shining.

6. Explain and justify your answer to **Question 5.**

7. In which case illustrated below will only one flashlight bulb shine?

A.


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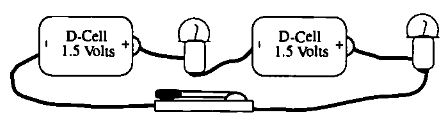

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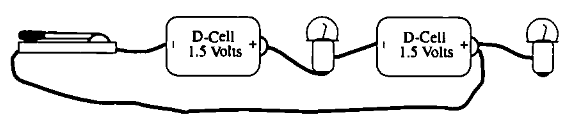
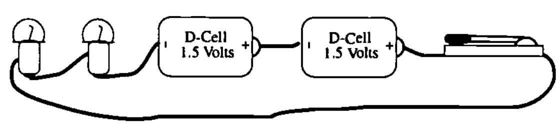


D.


Short Answer

8. Draw a complete circuit using two batteries, two bulbs, and as much wire as you need. Both batteries should be in the circuit and both bulbs should be lit. Label each part of your drawing.

Extended Response

9. Julie and Scott were asked to a build a flashlight using a push-button switch, two copper wires, two batteries, one flashlight bulb, and a cardboard tube. Make a drawing that shows how everything can be put together. Label each part.

Playground

Kinetic energy is energy of motion. As speed increases, kinetic energy increases. For example, kinetic energy is greater when a person runs than when a person walks.

Answer the following questions about motion on playgrounds.

1. Carlos decides to play on a slide. He has the greatest kinetic energy when he is:

   A. stepping on the first step of the ladder.
   B. sitting at the top of the slide.
   C. sliding down the slide.
   D. standing at the bottom of the slide.

2. George is at the top of the slide. He has four different items on which he could sit to go down the slide. Which item will help George slide down the fastest?

   A. A rubber bath mat
   B. A piece of foam rubber
   C. A piece of cardboard
   D. A large piece of sandpaper

3. Explain and justify your answer to **Question 2.**

4. Jane is wearing roller skates. She will travel fastest when she rolls:

   A. on a flat sidewalk.
   B. on the grass.
   C. down a wooden ramp.
   D. in the sand.

5. Maria has a basketball. The ball has the greatest amount of kinetic energy when she:

   A. fills it with air.
   B. puts it on her lap.
   C. tosses it to her friend.
   D. stores it in the toy box.

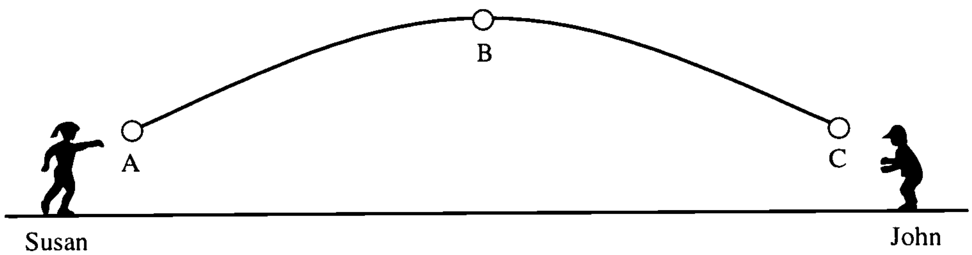
Playground

Short Answer

6. Maggie has two skateboards, a wooden ramp, and a meter stick. She wants to know which skateboard goes fastest. She does not have a clock or a stopwatch. Help Maggie figure out which skateboard goes fastest.

Extended Response

7. Susan and John like to play catch with a baseball. When Susan throws the ball to John, it moves along the path shown in the figure below. Make a list showing the point when the ball had the most kinetic energy, the least kinetic energy, and the point between greatest and least. Explain your reasoning.



What's the Solution?

William is studying the behavior of various materials placed in water. William bought a bag of clear hard candy to observe its behavior in water. (The candy is made of sugar.) He took 3 pieces of hard candy out of the bag.

He weighed each piece of candy. Each piece weighed 12 grams.

He labeled three cups. Then he added cold water to Cup 1, warm water to Cup 2, and hot water to Cup 3.

William put one piece of candy into the water in each cup. After 10 minutes, he took the candies out of the water and weighed each piece again. William's results are shown below.

Table 1

	Temperature of water	Weight of candy after 10 minutes
Cup 1	0 °C	10 grams
Cup 2	40 °C	6 grams
Cup 3	80 °C	4 grams

1. According to William's results, as the temperature of the water gets hotter, what happens to the candy?

   A. More candy dissolves.
   B. Less candy dissolves.
   C. The candy weighs more.
   D. The candy stays the same size.

2. Suppose the hot water had been at 100° C rather than 80° C. How much candy might have been left after 10 minutes?

   A. Less than 4 grams
   B. About 6 grams
   C. About 8 grams
   D. More than 10 grams

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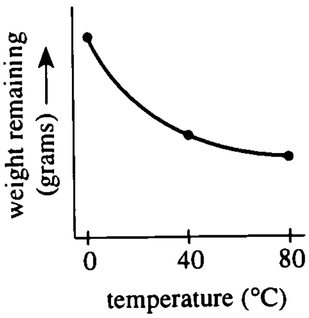
3. Which of these graphs shows how temperature affects the weight of candy that remains after being in the water for 10 minutes?

A.



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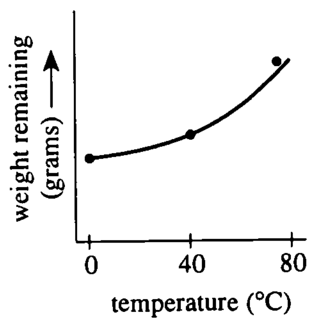
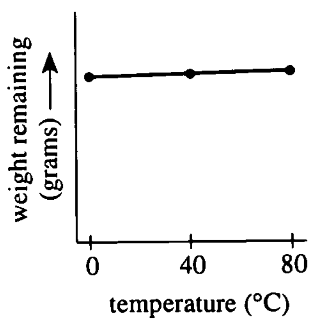
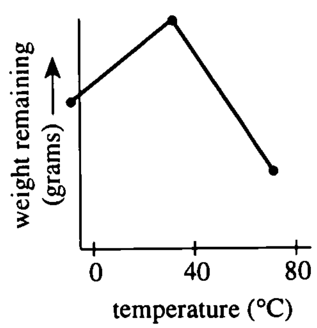


C.



D.



4. Suppose that William had left the candies in the cups for only 5 minutes rather than 10 minutes. What would have been the mass of candy from Cup 1?

A. Less than 4 grams
B. About 6 grams
C. About 8 grams
D. More than 10 grams

5. Suppose William takes another piece of hard candy and puts it into a cup of hot water. He heats the water gently until all the water evaporates. When the water is gone the candy sticks to the bottom of the cup. What will be the mass of candy left in the cup?

A. 6 grams
B. 8 grams
C. 12 grams
D. 15 grams

Short Answer

6. William put sand into cups of water at different temperatures, following the procedures described above. Compare what happens to sand when sand is placed in water to what happens to the candy when the candy is placed in water. Include in your comparison a graph to represent the effects on the weight of sand remaining after being in the water for 10 minutes. What would you do to get the sand out of the water?

Long Answer

7. Water from a variety of sources it is not always perfectly clear. William has a sample of muddy water in a jar. Using your knowledge of science, design and describe procedures that he should follow to make the water clear and safe for drinking, including safety precautions to consider and follow in the procedure? Explain why.

The Sun and Earth Through the Seasons

Since ancient times, earth's inhabitants have noted features of the sun's apparent motion that change and other features that stay the same from season to season. One feature that changes is the sun's apparent path through the daytime sky.

Now think about changes in the amount of daylight hours during the seasons. Sometimes the amount of hours it's daylight is greater than, equal to, or less than the amount of hours it's nighttime. Figure 1 shows the sun's position in the sky for each daylight hour during the different seasons.

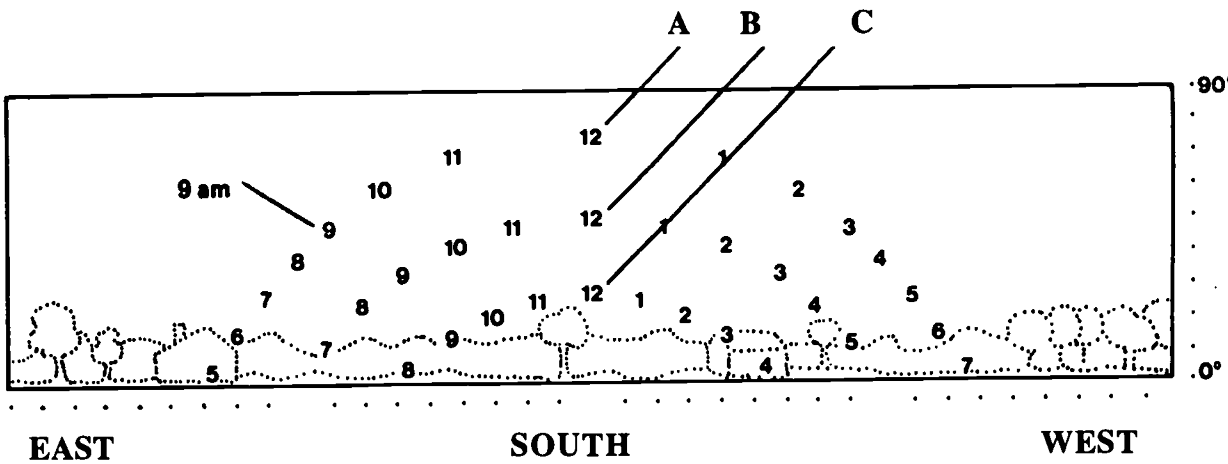


Figure 1

Use the information in Figure 1 to answer the following questions.

1. The winter solstice is the name given to the day with the fewest number of daylight hours during the year. Which of the paths on the diagram marks the day of the fewest daylight hours?

   A. Path A
   B. Path B
   C. Path C

2. Which of the following paths of the sun represents the spring equinox?

   A. Path A
   B. Path B
   C. Path C

3. Which position on the diagram identifies the direction to face to observe the rising sun?

   A. East
   B. South
   C. West
   D. North

The Sun and Earth Through the Seasons

We now know that changes in the sun's apparent motion in the daytime sky through the changes in seasons is related to characteristics of the earth's motion relative to the sun.

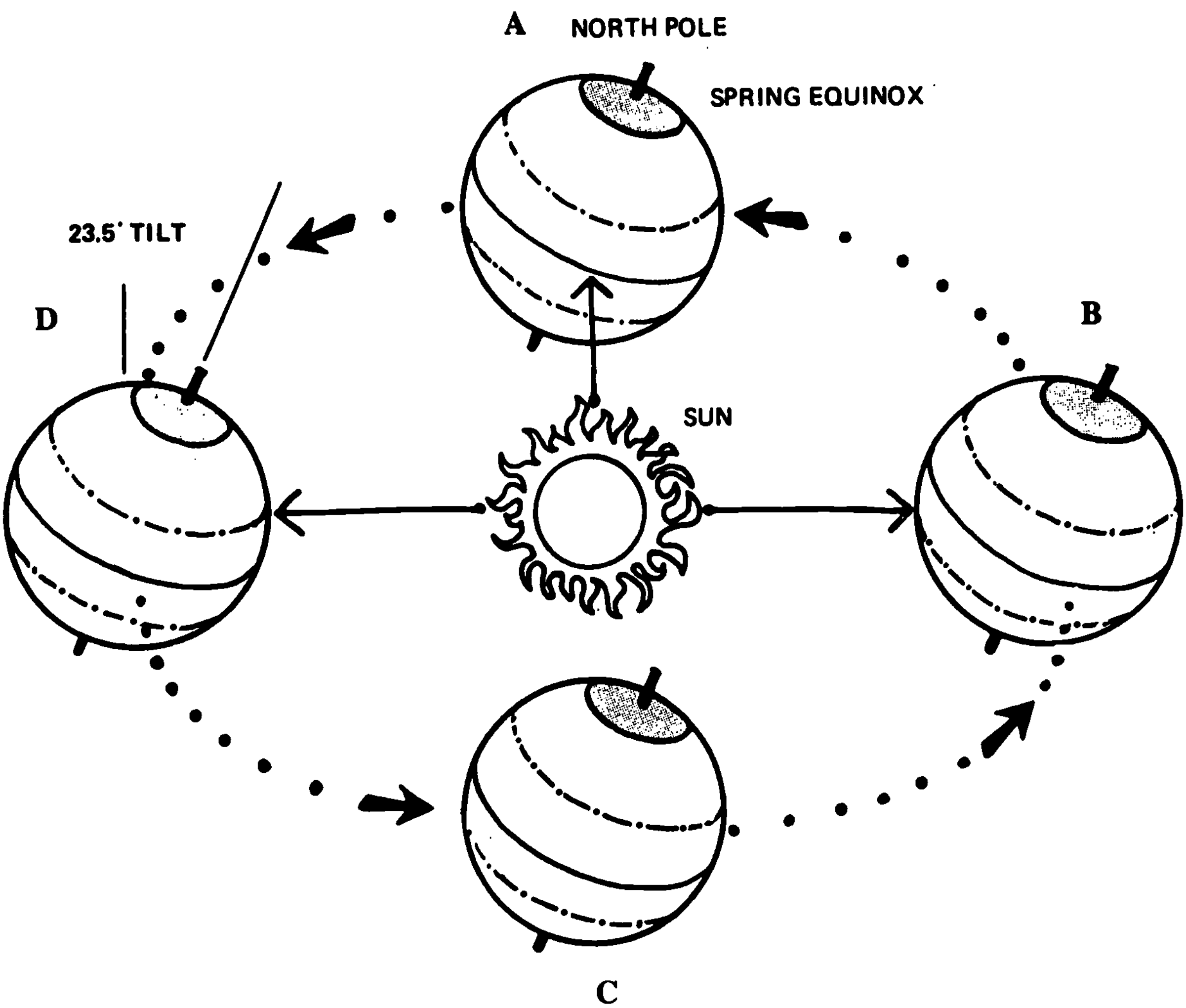


Figure 2

4. Figure 2 shows the relative position and tilt of the earth through the seasons. Which of the four positions of the earth shown in Figure 2 would be the one that represents the day of greatest amount of daylight hours in the northern hemisphere during the year?

   A. Position A
   B. Position B
   C. Position C
   D. Position D

5. Explain and justify your answer to **Question 4.**

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The Sun and Earth Through the Seasons

We now know that changes in amount of time the sun appears in the daytime sky varies with the seasons.

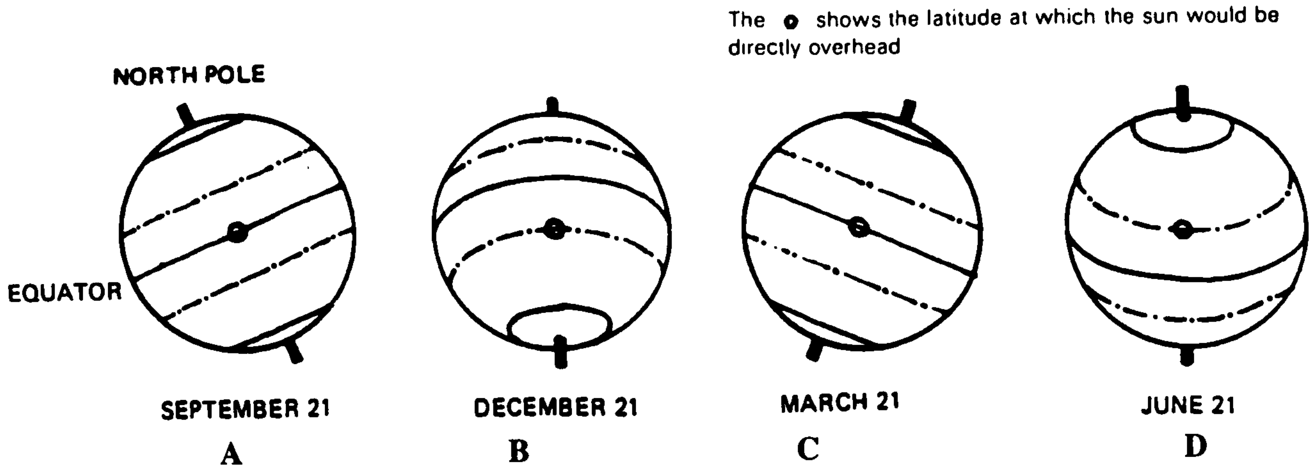


Figure 3

6. Figure 3 shows where the sun's light most directly strikes the earth's surface at different times of the year. Which of the four positions of the earth shown in Figure 3 would be the one that represents the day of least amount of daylight hours in the northern hemisphere during the year?

   A. Position A
   B. Position B
   C. Position C
   D. Position D

Short Answer

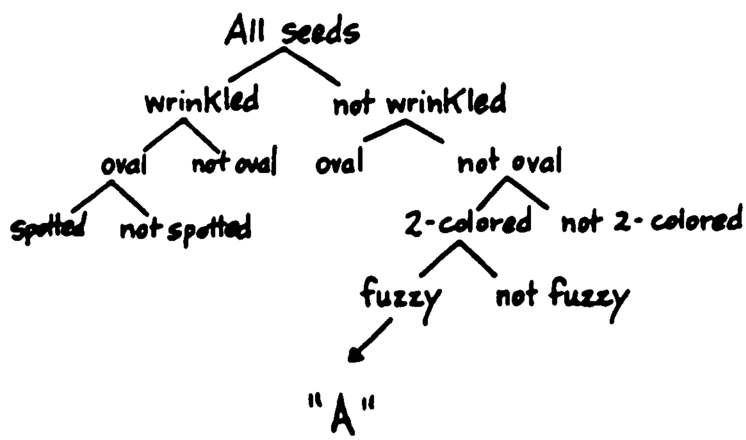
7. There is both an autumnal (fall) and vernal (spring) equinox that note different times in seasons during the year. Using all the information in the story and figures, describe equinox in your own words.

Extended Response

8. How would you demonstrate for younger students how the number of daylight hours varies by seasons? Describe the examples and resources you would use and the things you would do to help them really understand.

What Does It Tell Us?

During a class assignment to study different classification systems one group of students sorted a collection of seeds. The diagram below shows the different ideas the students used to sort their types of seeds.



Use the diagram to answer the following questions

1. All spotted seeds sorted by the students are
   A. oval
   B. two-colored
   C. fuzzy
   D. not wrinkled

2. Seeds were first divided into two groupings by
   A. fuzzy, not fuzzy
   B. oval, not oval
   C. wrinkled, not wrinkled
   D. spotted, not spotted

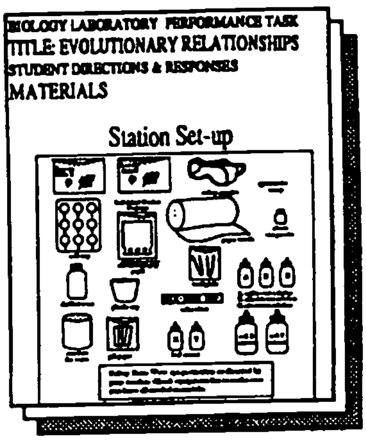
Short Answer

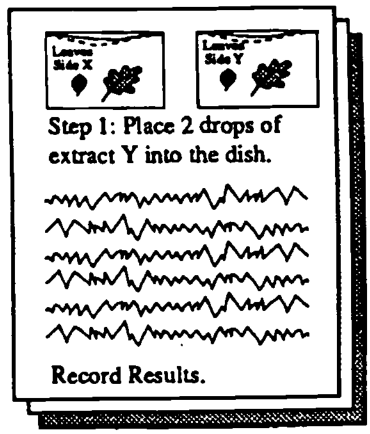
3. Describe all the characteristics of the seed sorted at point "A" in the branching diagram above.

Type 2

Fifth Grade Science

Competency-Based Education Assessment Series





° On Demand Problem-Solving Events °

(Performance-Like)

Characteristics

- Experimental and non-experimental research, requiring more than a single session and some out-of-class time
- Scoring Options: Holistic scoring (i.e., portfolio scoring guide and interviews); scoring with rubrics, check-lists, and/or interviews

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart.* Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments are focused on *Science Portfolio Scoring Guide* parameters, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with *Science Portfolio Entry* types, instructional strands, and organizing concepts.

Refer to the *Content Summary Chart.* It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Fifth Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 1 - 3							*Sixth Grade*
Magnetic Mapping	1	See Discussion	Processing	1, 2, 6	I: 1, 2, 4, 5 K: 1, 7, 8, 10 C: 8, 13 A: 4, 8, 9	Systems and Interactions	N: 3, 5 P: 7, 10 E: L:
	2	See Discussion	Extending				
Page(s) 4 - 6							
Batteries	1	See Discussion	Processing	4, 6, 7, 8	I: 1, 2, 4, 5 K: 1, 7, 8, 10 C: 8, 13 A: 2, 4, 8, 9	Change Over Time	N: 3, 5 P: 8, 9 E: L:
	2	See Discussion	Extending				
Page(s) 7							
Discovery and Invention	1	See Discussion	Processing	4	I: 1, 5, 6 K: 9 C: 2, 8 A: 3, 7	Models and Scale	N: 4 P: E: L: 16
	2	See Discussion	Processing				
Page(s) 8							
Drip, Drop and Stop	1	See Discussion	Processing	3, 5	I: 1, 2, 3, 5, 7, 9 K: 3, 8 C: 1, 6, 11 A:	Change Over Time	N: 2, 3, 5 P: 7, 8 E: L:
	2	See Discussion	Processing				

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Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
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• Fifth Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 9							*Sixth Grade*
Bird Adaptations	1	See Discussion	Processing	2	I: 3, 4, 7	Change Over Time	N: 1, 3, 5
	2	See Discussion	Extending		K: 5, 6, 7		P:
					C: 1, 8		E:
					A:		L: 15
Page(s) 10 - 15							
Circular Motion	1	See Discussion	Processing	3, 5	I: 1, 2, 3, 4, 5, 6, 8	Systems and Interactions	N: 2, 3, 5
	2	See Discussion	Processing		K: 3, 8		P: 7
	3	See Discussion	Extending		C: 1, 2, 4, 5, 6, 8, 9, 10, 12		E:
					A: 1, 8		L:
Page(s) 16 - 19							
Heat Storage	1	See Discussion	Acquiring	7, 8	I: 1, 2, 3, 4, 5, 8	Systems and Interactions	N: 2, 3, 5
	2	See Discussion	Acquiring		K: 1, 7, 8		P: 9, 10
	3	See Discussion	Processing		C: 1, 2, 4, 5, 6, 8, 9, 10, 12		E:
	4	See Discussion	Extending		A: 1, 2, 8, 9		L:

• Performance Objectives: Grade 5 ***Ohio's Model Competency-Based Science Program***

1. Using sense-extending devices, the learner will describe an object or organism not easily observed in terms of its attributes and behaviors.
2. Given data from a simple mechanical or biological system, the learner will describe how changing one component impacts the other components of the system.
3. The learner will propose 'What if...?' questions regarding a simple physical change, design and test his/her questions, and cite and justify appropriate safety precautions.
4. The learner will choose a simple technological device and describe the advantages and disadvantages to the user.
5. Given a question about a natural phenomenon, the learner will propose several sources of information that may assist in addressing questions about the phenomenon.
6. The learner will choose and use appropriate tools to assemble and disassemble a simple mechanism or model.
7. Given data on the performance of consumer products, the learner will choose and defend their choice of a product based on performance data.
8. The learner will trace the transmission, transformation, and conservation of various forms of energy in a simple system (e.g., food web, bicycle, kite, scissors, human body).

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Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description: Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

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Item Discussion

Item discussion on the following pages pertains to **FIFTH GRADE** SCIENCE TYPE 2 MODEL COMPETENCY ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content.

For student TYPE 2 ASSESSMENT work which is being considered as potential science portfolio entries, please consider using the parameters for holistic evaluation of student work that are suggested in the *Science Portfolio Scoring Guide*. Each student product or demonstration need not reflect all parameters or all indicators for all parameters in the *Science Portfolio Scoring Guide*. (i.e., the *Guide* is not intended for use as a check list).

Science Portfolio Scoring Guide used with permission from the *CCSSO SCASS* Science Portfolio materials.

Item: Magnetic Mapping

Item Description:

The task allows students to predict and describe how a compass is affected by placing it near different objects. Students are given a penny and a bar magnet and asked to place these items, one at a time, in the center of the magnetic map. The compass is placed at five different points around the map. Students are asked to draw arrows on the map to show the directions the compass needle is pointing with each object.

A good response will show that the students understands that a compass needle is magnetic and magnets are attracted to each other, or that a compass needle is attracted to a magnet but not to all metal objects.

Question 1 asks students to interpret the results of their experiment and explain why either the penny or the magnet caused the compass to work incorrectly.

A good response will show that the student understands that the compass should always point north. When the magnet is placed in the shaded rectangle, the compass will point toward the magnet; i.e., causing it to work incorrectly.

Question 2 asks students to use their understanding of the effects of a magnet on a compass by asking them to draw arrows on a map showing which way a compass will point when placed by a magnet. They are asked to explain why they drew the arrows where they did.

A good response will show the student understands that a magnet attracts the compass needle because the compass is magnetic and magnets attract. Some but not all metals are attracted to a magnet as illustrated by the penny.

Criterion	Rubric Summary
1.	Observation: Magnet with explanation (Question 1). Explanation may be very basic and/or based on observations.
2.	Properties of magnet: Magnet with explanation (Question 1). Explanation must go beyond the observations from the experiment and attempt to explain why the magnet affects the compass.
3.	Arrows drawn in the direction of the magnet or it is explained only the closest ones will. (Question 2)
4.	Explanations include magnets are attracted to each other or some metal objects are attracted to a magnet. (Patterns of attraction or repulsion and variability in tendency to attract.)

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Item: Batteries

Item Description:

Students focus on building a circuit that could be used to determine whether or not a long life battery really does last longer than a regular one. Two drawings and two questions allow students the chance to express their ideas.

First, students are given one D-size battery, one battery holder, one flashlight bulb, and two wires to construct their circuit. Minimally, all they would actually need to do is set the bulb on the positive post of the battery and run a wire from the bottom of negative post to the side of the bulb.

Second, students design a flashlight with a switch to turn it on and off. Students' flashlight design with switch, battery(ies), and bulbs must show the basic concept of regulating or controlling the current in the circuit.

Students who understand polarity have the chance to show it in at least one of their drawings or one of their explanations. This may be in how they represent the two different ends of a battery or as they describe electric potentials.

Criterion	Rubric Summary
1.	Clearly explains and/or draws their setup, for question one, describes a complete circuit. OR Clearly explains and/or draws how their flashlight works, for question two, describes a circuit that makes a continuous circular path, with or without the switch. Students may draw more than one battery in their flashlight. A break in the circuit should only exist at the switch if one is provided.
2.	Provides a complete circuit, in either question one or two, that would effectively work to light the bulb OR Demonstrates understanding of energy conversion, conservation, or transmission by way of a closed path in a simple electric circuit.
3.	Demonstrates understanding of a functioning switch.
4.	Demonstrates understanding that a small flashlight battery has polarity by labeling one battery, in either drawing, with a "+" or "-" end or simply draws the terminals on a battery differently OR Describes the wire or leads between components as positive or negative or by two separate colors.

Item: Discovery and Invention

Item Description: The item is designed to engage students in evaluating the positive and/or negative impacts of technology on human activities. In the text of a short reading on Garrett Morgan, inventor of the *gas inhalator* and patent holder on the *traffic signal*, students are given technologies to consider regarding associated short-term benefits and long-term burdens. Students are asked to investigate the history and function of the work of another inventor and/or scientist that was ignored or rejected during the inventor's lifetime. Students must use the research and good science to evaluate the overall impact of the technologies. Students must decide how best to communicate the summary of their decisions. Students include in the summary a discussion of the potential impact of each technology on the environment, humans, and society.

A good response to this open-ended task should compare favorably holistically to the parameters in the Science Portfolio Scoring Guide for Depth of Understanding, Evidence of Inquiry, Communication, and Relevance to Society.

Scoring Parameters

- The information and scientific/technological ideas the student presents are accurate and explained in a way that demonstrates understanding (e.g., student compares, synthesizes information and ideas). *For example, the student explains that a gas inhalator (using a screen/gauze, charcoal filter) provides air 'clean' enough for human respiration (a survival need).*
- The student uses information about technologies and science to defend his or her explanations coming from multiple sources (e.g., science and technology print material, Internet, trade documents, government publication). Risks and benefits are analyzed and conclusions are discussed. *For example the student explains that to reduce the likelihood of a person being exposed to air unfit to breathe while using the gas inhalator, the inhalator would need to come with instructions and explanations about its limitations.*
- The student uses a medium best suited to communicate the summary of their decisions (e.g., including tables/charts for comparing and synthezing information).
- The student includes in the summary a discussion of the potential impact of each technology on the environment, humans, and society. *For example, the student explains that the gas inhalator saves lives of people working in potentially hazardous environments/worksites.*

Item: Drip, Drop and Stop

Item Description: In the investigation a cup with a hole is leaking. When the cup is dropped the leak appears to stop. The item is designed to engage students in evaluating a "What if...?" question: Will the leak stop when the cup is dropped if the hole in the cup is made bigger? Students must design and conduct a test of a procedure to collect data to support their answer to the question. Students must also address safety procedures for the investigation. Finally, students must research and recommend resources (e.g., print material, experts, video/media) that can be used to help explain the science concepts behind the phenomena being observed.

A good response would address science content pertaining to conditions that affect the motion of the cup and the water in the cup (i.e., gravity, weight of fluid (pressure) in the cup, Newton's laws). The response would also include data from easily measured relative positions, distances, and rates of change for the falling cup and the water in the cup. Students must use this data to support their conclusions. The response would included documentation and explanation of the procedures, including safety, followed so that the investigation could be replicated by someone else.

A good response to this open-ended task should compare favorably holistically to the parameters in the Science Portfolio Scoring Guide for Depth of Understanding, Evidence of Inquiry, Communication, and Relevance to Society.

Scoring Parameters

- The information and scientific ideas the student presents are accurate and explained in a way that demonstrates understanding (e.g., student compares, synthesizes information and ideas). *For example, the student explains that when the hole was made bigger even more water dripped out of the cup when it was held at rest by a hand or on a tabletop. When the cup held at rest by a hand or tabletop the water drips out of the hole (hands-on observation) because only the water can be made, is free, to fall down because of the pull of gravity on the fluid (weight of fluid in the cup, Newton's laws). Even when the hole was made bigger he or she observed the water stopped dripping as the cup was falling (hands-on observation) because both the cup and water are made to fall down at the same rate while being pulled down by gravity (Newton's laws).*
- The student uses information about scientific information coming from multiple sources (e.g., science material, how it works books, audio/video materials) about the behavior of fluids in a cup and Newton's laws to defend his or her explanations. Cause and effect explanations/conclusions are logically connected and discussed based on evidence. The student accurately explains his or her investigation procedures, including safety precautions.
- The student uses a medium best suited to communicate the summary of their decisions (e.g., including drawings for comparing and synthesizing information).
- The student should be able to explain their new understanding of how this phenomenon can apply to the real world, or might be able to include in the summary a discussion of an example from personal experience relating this investigation. The student may only be able to infer a connection. The teacher needs to help students make these connections. *For example, the student explains that they could compare the way the water behaves (doesn't drip/stays inside the falling cup) to the way they feel inside when they ride down a steep hill on a roller coaster or when an elevator just starts to move down.*

Item: Bird Adaptations

Item Description: Students are given a table that summarizes example information about special characteristics and advantages of adaptations (i.e., beaks, feet, legs, wings, coloration) pertinent to various types of birds. Students are ask to use the information in the table to describe the features of a bird that would be successful at catching a large fish to feed its young. Also, students are asked to use data from field-based observations of birds living in the area to develop a presentation of how a group of specific birds meets survival needs (i.e., nesting habits, food sources, season behavior changes).

A good response would connect science content pertaining to both the physical characteristics and behaviors of ways which a single (Question 1) and group of specific birds (Question 2) meet basic needs. Students must use field-based data/observations of a group of specific birds (as determined by students and/or teachers) to support their conclusions to Question 2. Students are required to identify what characteristics or actions would meet a particular need; compare the advantages and/or disadvantages of characteristics or actions that meet the same or similar needs; and analyze a bird's physical characteristics and tell how the bird reacts to a particular stress (e.g., change in season; abrupt changes in temperature or available water and food) The response would included documentation and explanation of the observational procedures, including safety, followed so that the investigation could be replicated by someone else.

Scoring Parameters

A good response to this open-ended task should compare favorably holistically to the parameters in the Science Portfolio Scoring Guide for Depth of Understanding, Evidence of Inquiry, Communication, and Relevance to Society.

Item: Circular Motion

Item Description: This investigation is designed to engage students in evaluating a "What if...?" questions about motion in a circular path. Students compare perceived effects of motion in a curved path with hands-on observations of objects moving in a curved path. Students use this experience to support predictions and explanations of the influence of the motion of some objects on other objects, including identifying or describing the forces or impacts people can feel as a result of a change in an object's motion.

Part One: Students record and compare the kind of path followed when the ball rolls from the **Step 1)** inclined ruler onto the table top (e.g., 'the balls motion changes from speeding up along a straight-line path to moving at a steady rate along a straight-line path'), **Step 2)** table top onto the plate (e.g., 'the balls motion changes from a straight-line path at a steady rate to a curved path moving at a steady rate, and with some slowing down'), **Step 3)** plate onto the table top (e.g., 'the balls motion changes from a curved path to a straight-line path at a steady rate, and with some slowing down'), and **Step 4)** plate onto the table top and back into a plate (e.g., 'the balls motion changes from a curved path to a straight-line path at a steady rate, and back to motion along a curved path').

A good response/drawing would also include observations/data from easily measured relative positions, distances, and rates of change for the ball. Students must use data and drawings to support their recorded observations. Students responses/drawings that hint at a curved aspect to the balls motion when it is not in contact with the plate would not be appropriate under ideal circumstance. Yet the students may actually observe a curving motion of the ball while the ball is rolling along the table top (e.g., if there is sufficient spin to the ball's motion brought about by contact with the curved edge of the plate and sufficient friction between the ball and the tabletop, or the tabletop is not level).

Part Two: Question 1: Students response should demonstrate understanding that the ball begins to travel in a straight line along a tangent to the circular path at the point/instant of release (i.e., using words and drawings). The student's explanation should refer to observations from Part One and connect these observations to ideas in Newton's first law (e.g., 'the instant the force of the string keeping the ball moving in a circular path is removed/released the ball will begin to move along a straight line, just like when the rolling ball moved from the plate onto the table top') Students observations/explanations may include a description of an additional motion/aspect of the ball's path as it is falling to the ground after release. They may reference gravity being responsible for this aspect of the ball's path/motion.

Question 2: The student's explanation should refer to observations from Part One and connect these observations to ideas in Newton's first law (e.g., 'the instant the force of the curved edge of the plate keeping the ball moving in a circular path is removed the ball will begin to move along a straight line, just like before in Part One when the rolling ball moved from the plate onto the table top') Students' responses to this part will likely not include (and appropriately so) any reference to gravity effects on the path/motion of the ball.

Question 3: The student's explanation should refer to observations from Part One and Two and connect these observations to ideas in Newton's first (and third) law (e.g., 'the instant the car starts to make a turn the force of the door/side of the car makes your body move in a circular path (Newton's first law). The effect of this force is to make you feel like you are being pushed into the side/door of the car (Newton's third law), because you are being kept from continuing to move along a straight line by the door. This force you feel is similar to the force in Part Two when you feel the string pulling against your hand/fingers as you twirl the ball overhead at the end of the string.') Students' responses to this part will likely not include (and appropriately so) any reference to gravity effects on the path/motion of the ball.

A good response would address science content pertaining to conditions that affect the motion of the ball in a curved/circular path (i.e., Newton's laws, effects of gravity and friction on moving object). The response would also include observations/data from easily measured relative positions, distances, and rates of change for the ball. Students must use observations and drawings to support their conclusions.

Scoring Parameters

A good response to this open-ended task should compare favorably holistically to the parameters in the Science Portfolio Scoring Guide for Depth of Understanding, Evidence of Inquiry, Communication, and Relevance to Society.

Item: Heat Storage

Item Description:

Students are asked to test five materials (four assigned and one of their choice) and decide which would be the best for use as a heat mass. The student will defend their recommendation for the best heat storage material based on performance data collected during the investigation. Students will also need to identify characteristics/properties of the heat storage material/system that impact the rate of cooling. Students will design and explain a method to control rate of cooling, including a discussion of the practicality of the method.

A good student response would connect characteristics of the materials being investigated (e.g., heat capacity, ability to become warm by absorbing sunlight) with hands-on observations of the behavior of the material (e.g., rate of temperature change (cooling)). **The students' selection for their recommended material needs to be based on observed behavior**. Under ideal circumstances, the recommended material will be the material with a high heat capacity (i.e., takes the longest to heat up and the longest to cool down - water, sand, gravel) and is a good absorber of sunlight (e.g., sand or gravel). However, uncontrolled/recognized variables may yield experimental data that can lead the student to select a material from the group being investigated that does not have the highest heat capacity or is the best absorber of sunlight. (Teachers may consider extending the task to ask to suggest conditions under which the material they selected might not be the best choice and to design a fair test of those conditions.)

Finally, a good student response would explain a way to control the cooling rate of the material (e.g., use more of the recommended material, use an insulator around the surfaces of the material unexposed to sunlight to slow it's cooling by conduction/radiation)

A good response to this open-ended task should compare favorably holistically to the parameters in the Science Portfolio Scoring Guide for Depth of Understanding, Evidence of Inquiry, Communication, and Relevance to Society.

Scoring Parameters

- Student accurately identifies, explains and connects pertinent scientific ideas (i.e., heat capacity, warming by absorption of sunlight, more mass implies more stored heat, insulator material slow cooling/heat transfer).
- Student combines ideas of a material cooling slowly (high heat capacity) and having a higher overall temperature (good absorber of light energy) in defending their choice of heat mass. Data tables and graphs which shows graphed clearly and accurately
- All graphs and explanations are clear, focused and organized.
- Student might discuss as an advantage of a solar heated home that it reduce dependency on non-renewable fuel supplies. *For example, the more heat that comes from the heat mass at nighttime the more fuel (e.g., natural gas, fuel oil, wood) is saved, lessening the stress put on the environment to make these fuel sources available and through the pollution produced by use.*

Magnetic Mapping

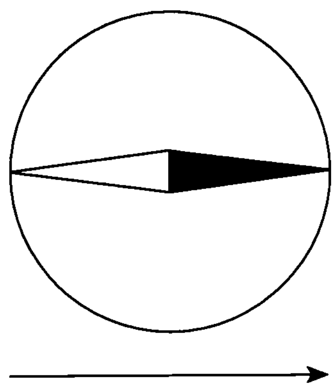
One day you are hiking in the woods and carrying your compass. The compass needle usually points north, but now it keeps pointing toward your pocket. Your pocket contains a penny and a magnet. Can either a penny or magnet affect your compass needle?

Find the *Magnetic Map* on the next page. Place the map on a desk. Be sure that the arrows point north. North is the direction in which the dark end of the compass needle points when the compass is placed, by itself, on the Magnetic Map. You will use the Magnetic Map to see if either the penny or magnet affect the compass needle.

Explore the effects of a penny and a magnet on a compass.

Students may work in groups to complete the following explorations. but each student will write the results in his or her own booklet.

- Place the penny in the center of the shaded box on the Magnetic Map. Put the compass on Circle A. Use your pencil to draw an arrow that shows where the dark end of the compass needle points. See the example in the picture below.



- Now, move the compass to Circle B. Draw an arrow with your pencil that shows where the dark end of the compass needle points. Do this for the other three circles. Make sure to use your pencil for all of the arrows you draw for the penny.

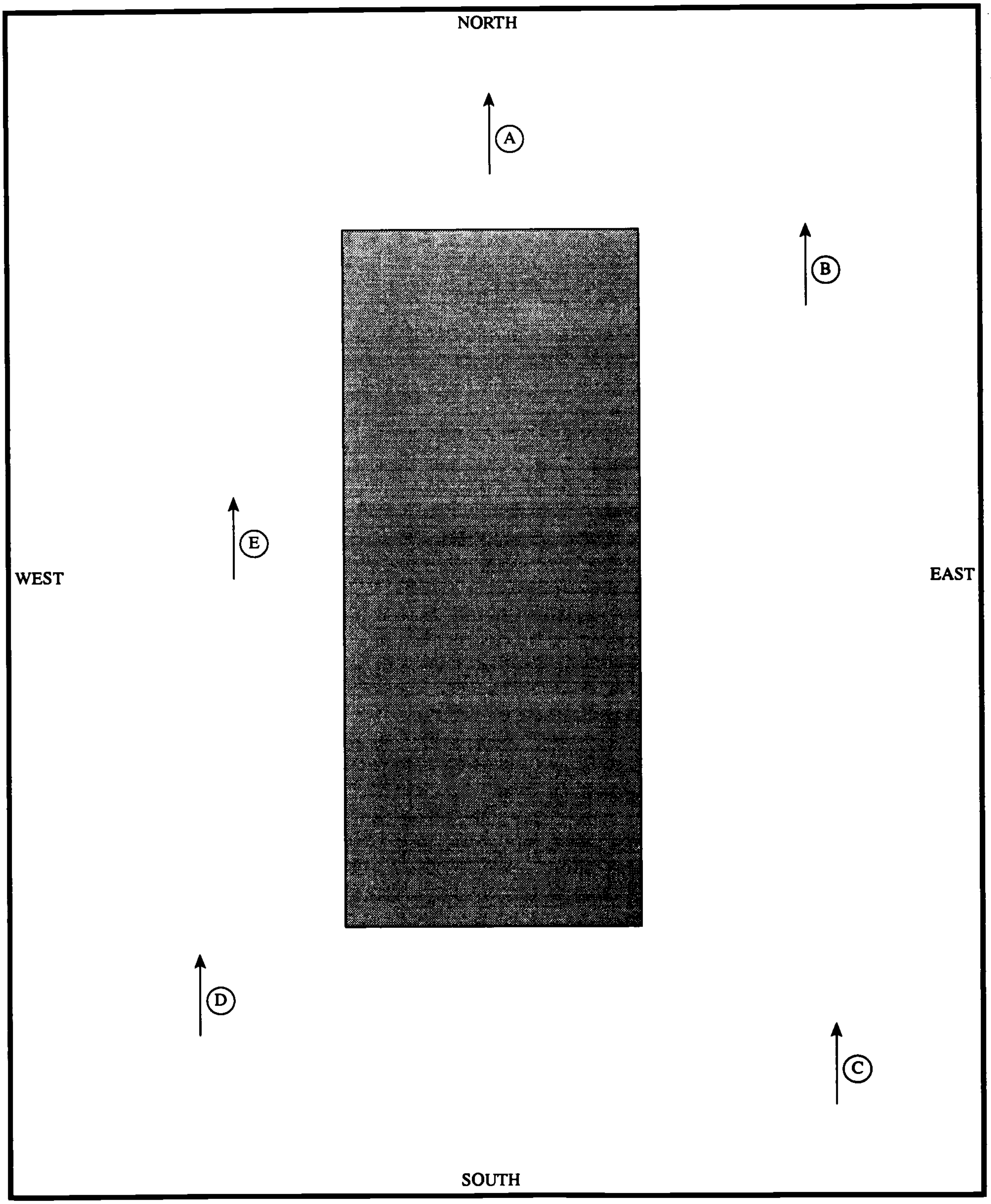
- Remove the penny and place the magnet in the center of the shaded box on the Magnetic Map. Put the compass on Circle A. Use your colored pencil to draw an arrow that shows where the dark end of the compass needle points.

- Complete your test of the magnet by moving the compass to each of the other circles on the map and drawing an arrow to show where the dark end of the compass needle points. Make sure to use your colored pencil for all of the arrows you draw for the magnet.

When you are done, go back to your desk. Use the arrows that you drew on your Magnetic Map to help you answer the following questions.

Magnetic Mapping

Magnetic Map (with Shadow Box)



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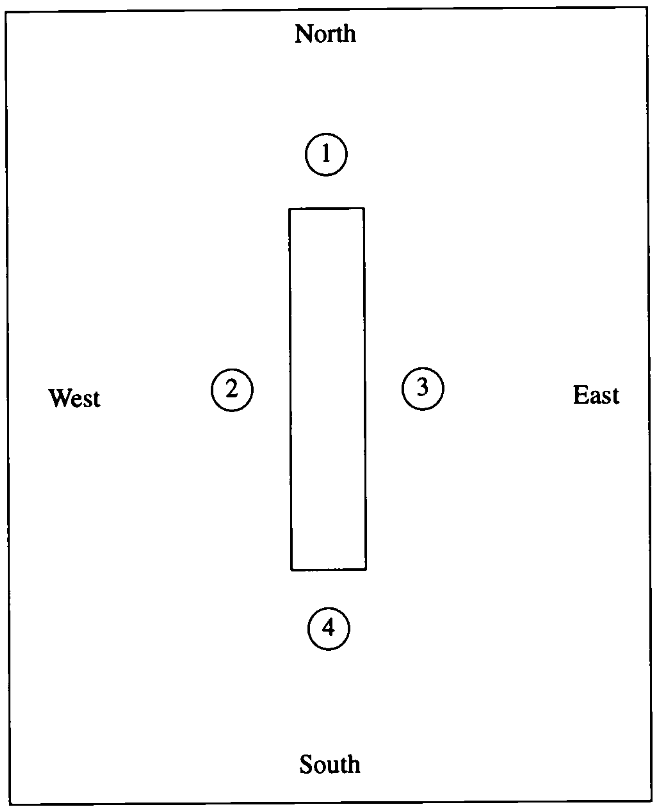
Magnetic Mapping

Questions

Please answer the following questions by yourself.

1. Based on the results of your experiment, do either the penny or the magnet seem to be causing your compass to work incorrectly? Explain your answer.

2. Look at the map drawn below. Which way will the compass point if it is placed at each of the circles, numbered 1 through 4? Draw arrows on the map to show your predictions.



Explain why you made these predictions and drew the arrows where you did on the map above.

Batteries

A company makes two types of batteries, Regular and Long Life. They are shown below.

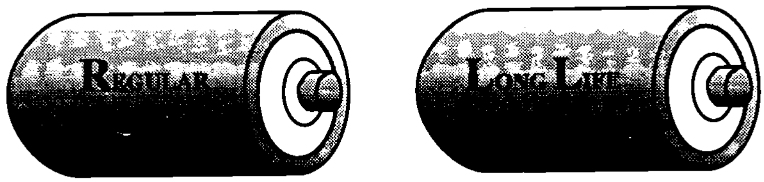


Figure 1

You want to know if the Long Life battery really does last longer than the Regular battery. You decide to do an experiment.

Design a battery test of the long-life characteristics of a battery.

Use the materials you have been given to set up an experiment you could perform to find out which of the batteries really does last the longest. Each member of the group should draw a picture of the setup in his or her own booklet in the box on page 5. Be sure to label all the parts.

When you are finished designing your experiment and drawing your picture, go back to your desk to answer the questions.

Batteries

Draw Your Picture in the Box Below

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Batteries

Questions

Please answer the following questions by yourself.

1. Explain in words how you set up your experiment and tell how it works.

2. Using what you learned in designing your experiment to test the life of the two batteries, design a flashlight with a switch to turn it on and off. Draw a picture of your flashlight design in the box below. Be sure to show all the parts and label them. In the lines below the box, tell how your flashlight works.

Discovery and Invention

Garrett Morgan was born in Paris, Kentucky in 1877. He was a self-educated black man who became a famous inventor in his day. He discovered the *gas inhalator* (gas mask) when he, his brother and some volunteers were rescuing a group of men caught by an explosion in a smoke-filled tunnel under Lake Erie. Although this rescue earned Mr. Morgan a gold medal for the City of Cleveland and the Second International Exposition of Safety and Sanitation in New York, he was unable to market this gas inhalator because of racial prejudice. However, the U.S. Army used his device as gas masks for combat troops in World War I.

Mr. Morgan used his *gas inhalator* fame to sell his patented automotive *traffic signal* to the General Electric Company, which he invented in 1923 for use at street intersections to control the flow of traffic.

Short Answer

1. Based on personal experience and/or what you know from the experiences of family and acquaintances, complete the following. Evaluate Mr. Morgan's inventions in terms of advantages and disadvantages to us of their use.

Extended Response

2. Identify the work of another inventor and/or scientist that was rejected or ignored during his or her lifetime. How has that scientific discovery or invention made an important contribution to our lives today?

Drip, Drop and Stop

Study the illustration below. In this investigation the cup with hole is leaking. When the cup is dropped the drip appears to stop.

Make a prediction.

◆ Will the leak stop when the cup is dropped even if the hole in the cup is made bigger?

Design an experiment.

◆ Design and recommend steps to be followed to investigate this phenomena. Take into account considerations for safety of yourself and others in this investigation.

Answer the questions.

1. Were the results of your investigation consistent with your predictions? Explain how this investigation confirms, extends, or conflicts with your understandings about this phenomena.
2. Research and recommend resources that can be used to help explain science concepts behind what is being observed in this investigation.

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Bird Adaptations

Animals and birds often need special types of food, climate, and areas to live or nest. Birds have great variety in their types of special purpose shapes of beaks, feet, legs, wings and colors. The chart below illustrates some of those adaptations of birds to their environment.

ADAPTATION		BIRD	ADVANTAGE
Beaks	pouch-like	pelican	can hold fish, a food source
	long, thin	avocet	can probe shallow water and mud for insects
	pointed	woodpecker	can break and probe bark of trees, for insects, a food source
	curved	hawk	can tear solid tissue, like meat, a food source
	short, stout	finches	can crack seeds and nuts, a food source
	slender, long	hummingbird	can probe flowers for nectar, a food source
Feet	webbed	duck	aids in walking on mud, transportation
	long toes	crane, heron	aids in walking on mud, transportation
	clawed	hawk, eagle	can grasp food when hunting prey
	grasping	chicken	aids in sitting on branches, roasting, protection
Legs	flexor tendons	chicken	aid in perching, grasping
	long, powerful	ostrich	aids running, transportation
	long, slender	heron, crane	aids wading, transportation
	powerful muscles	eagle, hawk	aids lifting, carrying prey, transportation
Wings	large	eagle	aids flying with prey, soaring while hunting
Coloration	bright plumage	male birds	attraction in courtship, mating rituals
		female birds	aids in camouflage while nesting, protection in shelter
	change of plumage with seasons	owl	provides camouflage protection (brown in summer, white in winter), protection in shelter

Short Answer

1. Describe the features of a bird that would be successful catching large fish to eat and feed its young.

Extended Response

2. Observe the variety of birds living in your area. Based on your notes for a group of specific birds develop a presentation of their survival needs for specific kinds of nesting areas, food sources, and seasonal behavior changes.

Circular Motion

You have noticed that your body is pushing against the door or side of a car (or bus) when the vehicle makes turns. Or you may remember feeling a crushing force while you were rapidly spinning around or making sharp turns on an amusement park ride. You want to figure out why this happens.

You have learned in science that objects moving in a straight line continue moving in a straight line unless acted on by an outside force. This behavior is described by Newton's First Law, or the law of inertia. We are going to look at objects that move in circles to see what keeps them moving in a circle. You will then use this knowledge to figure out why you push against the side of the car or into the person sitting next to you when the car turns a corner.

You will work in a group to perform the experiments, but each student will record his or her own observations and answer the questions alone.

Part One

1. You are going to roll a marble on a flat surface (a table top or the floor). You will place the marble in the groove that runs down a ruler so that you can direct the motion of the marble. To start the marble in motion, slightly elevate the ruler with the marble in the groove. Note the path that the marble takes. Record your observations on the observation sheet.
2. Place a plastic plate on a flat surface. Using the groove of the ruler to start the marble in motion, roll the marble around the edge of the plastic plate (see Figure 1 below). Observe the motion of the marble and record it on the observation sheet.

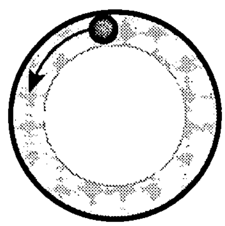

Figure 1

3. Cut the plastic plate in half. Roll the marble around the half-plate (see Figure 2 below). Record your observations.

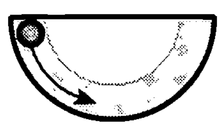

Figure 2

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Circular Motion

4. Set up the two half-plates as shown below. Be sure that the edge of the plates are lined up. Tape them down. Use the groove of the ruler to roll the marble around the rim starting at Point A (see Figure 3 below). Record your observations on the observation sheet.

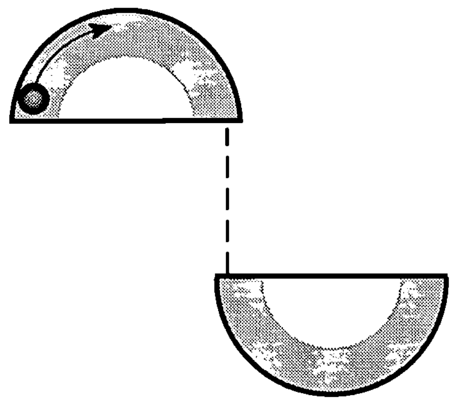

Figure 3

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Circular Motion

Observation Sheet

1. The marble rolling off the ruler onto the floor or table top:

2. The marble rolling around the edge of the plastic plate:

3. The marble rolling around the edge of the half-plate:

4. The marble rolling around the edges of the two half-plates:

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Circular Motion

Part Two

During this activity, you will work with a partner, but each student will record his or her own data.

- Place a tennis ball inside a plastic bag.
- Use one end of a string to tie the plastic bag shut. Make sure you have enough string left over to use as a handle. Also, double-check the strength of your knot.

Once you have completed the above assembly you will go outside for five minutes. Your pair will play a game of catch using the ball-in-the-bag device you have made, as shown in Figure 4.

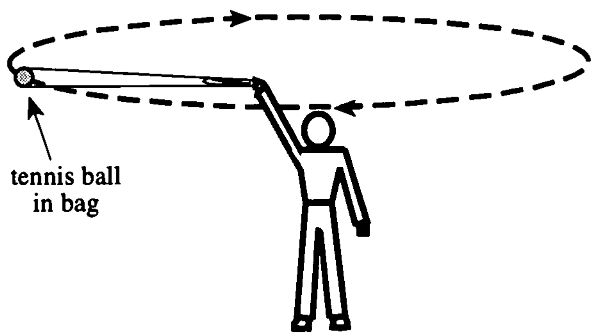

Figure 4

- You and a partner should stand 4-5 meters apart.
- Holding your device by the string, swing the ball around your head in a circle.
- Determine when to let go of the string so that the ball will go to your partner.
- Continue to play catch until you have determined the proper "letting go" point.
- Give the ball-in-the-bag device to your partner, so that your partner can determine the proper "letting go" point.
- Go back to your classroom and complete the following questions on your own.

Circular Motion

Questions

Please answer the following questions by yourself.

1. Explain your location, your partner's location, and the "let go" point for your game of catch. Why must you let go at that point?

2. Suppose that the plate were cut as shown below in Figure 5 instead of being cut in half. Draw the path that the marble would take if it were rolled around the edge. Explain your drawing.

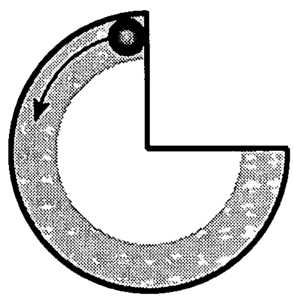

Figure 5

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Circular Motion

3. If you are traveling in a vehicle that makes a sudden turn, your body pushes against the side or door. Explain why that happens. You are encouraged to use diagrams to help answer the question.

Heat Storage

You and your lab team have been hired by a group of architects to help them design a solar home. The architects have asked you to help them select the material that will be used as the *heat mass*. The heat mass is a large amount of material, usually in a wall or on the roof, that is efficient in converting sunlight into heat energy. The heat energy is stored in the wall and then slowly re-radiated into the home during the cool evening hours. The architects have asked your lab team to test the following materials: water, sand, gravel, and Styrofoam. You will conduct the tests as a group but each member of the group will individually record and analyze the data and make a recommendation to the architects.

Pick one more material to test than the architects have asked. **Record in Table 1 the type of the material your group has decided to include in the following testing.**

You will be working with three other students to collect data. Each member of the team will collect data for a different material: water, sand, gravel, or Styrofoam. **Each student must record the data for all four materials in his or her own booklet.**

1. Fill your 250 mL cup with one of the four substances. The material should be level with the top of the cup.
2. Insert a thermometer into the material. The thermometer will remain in the material throughout the experiment. DO NOT REMOVE IT! The thermometer's mercury or alcohol level must extend above the material, so that you can read the temperature during the experiment, as shown in Figure 1 below. DO NOT TURN ON THE LAMP!

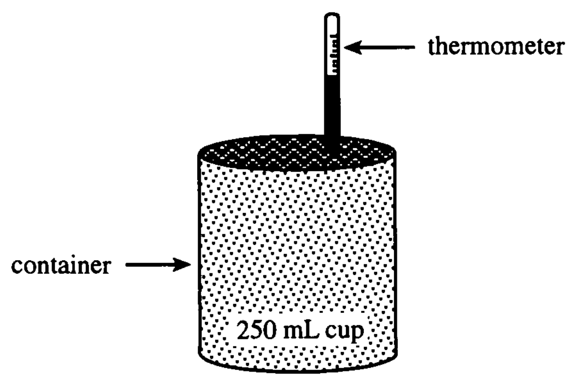

Figure 1

3. Each cup should be placed on one of the Xs that is marked on the workbench. The four Xs are the same distance from the bulb. The bulb should be about 30 cm above the table top.
4. Measure and **record** the temperature of your material (the *initial temperature*) in Table 1. (**Note:** Each thermometer in the four cups should be pushed down to the same depth).
5. Turn on the bulb and leave it on for 10 minutes.
6. After 10 minutes, turn off the bulb and immediately record the temperature inside your cup. This temperature will be designated T0.
7. Allow each of the materials to cool naturally. Two minutes after the lamp is turned off, measure the temperature (T2) and record it in Table 1. To obtain temperatures T4, T6, T8, and T10, record the temperatures every 2 minutes after the lamp is off. This should take 10 minutes.
8. Each member of the group must record the data in his or her own booklet.

Table 1

Material	Initial temperature	T0	T2	T4	T6	T8	T10
water							
gravel							
sand							
Styrofoam							
*							

**Record the experimental data for the material your group decided to investigate in the open row above*

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Heat Storage

Questions

Please answer the following questions by yourself.

1. Using a different colored pencil for the graph of each material, plot the data for water, gravel, sand, Styrofoam, and your groups additional material. If you do not have colored pencils, use different kinds of lines, e.g., dashes, dots, or squares, for each graph (- - - - • • • • ■ ■ ■ ■ ★ ★ ★ ★ ▲ ▲ ▲ ▲).

Heat Storage

Questions

2. How many degrees (°C) did each material cool during the 10-minute cool down period?

   Water: __________ ; Sand: __________ ; Gravel: _________ ; Styrofoam: __________

   ___________. ___________
   (Group's Choice)

   Which material cooled the fastest? ______________________________

   Which material cooled the slowest? ______________________________

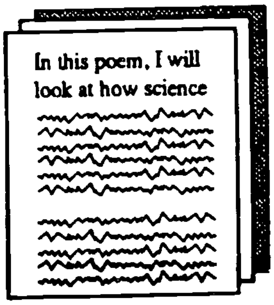
3. Based on the data, which material would you recommend for use as the heat mass of this solar home? Explain to the architect why you have selected this material.

4. You've made your recommendation. The group of architects is asking you and your group to help them consider next steps. They want the heat mass you recommended to stay warmer longer. What are some ways to keep the heat stored in the material until it is needed (e.g., at night when the sun goes down or on cloudy days)? Design and explain a method to control the cooling of the material. Consider in your explanation the practicality of the method, including space requirements and impact on humans and the environment.

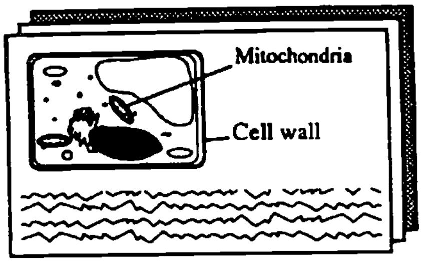
Type 3

Fifth Grade Science

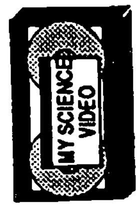
Competency-Based Education Assessment Series



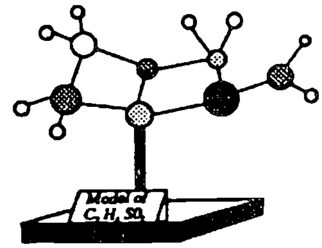
Writing



Artwork



Video



Models

Substantive Application-Based Performance Tasks

(Open-Ended)

Characteristics

- Relevant inventive and creative applications, requiring experimental research, non-experimental research, and more out-of-class preparation
- Holistic scoring (e.g., portfolio scoring guide and interviews)

Item discussions provide an overview of items, pertinent content, and scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart*. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments are focused on *Science Portfolio Scoring Guide* parameters, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with *Science Portfolio Entry* types, instructional strands, and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• **Fifth Grade Type 3** • • **Competency-Based** • **Science Model Assessments** • • **Ohio** •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 1	🗁						*Sixth Grade*
The Garden		See Discussion	Extending	2, 3, 5, 7	I: 1, 2, 3, 5, 6 K: 1, 2, 4, 5, 6, 7, 8, 9, 10 C: -All- A: 2, 8	Systems and Interactions	N: 2, 4, 5 P: E: 11, 12, 13 L: 14, 15, 16, 17
Page(s) 2 - 3	🗁						
Fossil Kit		See Discussion	Extending	1, 5	I: 1, 2, 4, 5, 6, 8 K: 4, 5, 6, 7 C: -All- A: 8, 9	Change Over Time	N: 1, 3 P: E: 13 L: 15
Page(s) 4 - 6	🗁						
Alarms		See Discussion	Extending	2, 6, 8	I: 1, 2, 3, 4, 5, 6, 8 K: 4, 7, 10 C: 7, 8, 9, 11, 12, 13, 14 A: 2, 4, 8	Systems and Interactions	N: 2 P: 10 E: L:
Page(s) 7 - 8	🗁						
Benefits and Burdens	1	See Discussion	Extending	2, 4, 5, 7, 8	I: 6, 7 K: 1, 4, 9 C: 1, 6, 7,9, 10 A: 1, 2, 3, 5, 6	Systems and Interactions	N: 4, 5 P: E: 13 L: 16, 17

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Content Summary Chart

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• Fifth Grade Type 3 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 9	🗁						*Sixth Grade*
Solar Energy	1	See Discussion	Extending	2, 4, 7, 8	I: 8 K: 2, 3, 5, 9,10 C: 1, 8, 10 A: 2, 3, 4, 5	Models and Scale	N: 3, 4 P: 9, 10 E: 11, 13 L: 16
Page(s) 10	🗁						
Weather Report	1	See Discussion	Extending	1, 5, 8	I: 1, 3, 4 K: 2, 3, 10 C: 1, 2, 6, 8. 9. 11 A: 9	Systems and Interactions	N: 3, 5 P: E: L:

• Performance Objectives: Grade 5 ***Ohio's Model Competency-Based Science Program***

1. Using sense-extending devices, the learner will describe an object or organism not easily observed in terms of its attributes and behaviors.
2. Given data from a simple mechanical or biological system, the learner will describe how changing one component impacts the other components of the system.
3. The learner will propose 'What if...?' questions regarding a simple physical change, design and test his/her questions, and cite and justify appropriate safety precautions.
4. The learner will choose a simple technological device and describe the advantages and disadvantages to the user.
5. Given a question about a natural phenomenon, the learner will propose several sources of information that may assist in addressing questions about the phenomenon.
6. The learner will choose and use appropriate tools to assemble and disassemble a simple mechanism or model.
7. Given data on the performance of consumer products, the learner will choose and defend their choice of a product based on performance data.
8. The learner will trace the transmission, transformation, and conservation of various forms of energy in a simple system (e.g., food web, bicycle, kite, scissors, human body).

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Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description			
	Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

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Item Discussion

Item discussion on the following pages pertains to **FIFTH GRADE** SCIENCE TYPE 3 MODEL COMPETENCY ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content.

For student TYPE 3 ASSESSMENT work which is being considered as potential science portfolio entries, please consider using the parameters for holistic evaluation of student work that are suggested in the *Science Portfolio Scoring Guide*. Each student product or demonstration need not reflect all parameters or all indicators for all parameters in the *Science Portfolio Scoring Guide*. (i.e., the *Guide* is not intended for use as a check list).

Science Portfolio Scoring Guide used with permission from the *CCSSO SCASS* Science Portfolio materials.

Item: The Garden

Item Description:

Successful completion will depend on the student's ability to collect, use and organize information to be used in decision-making for planning and writing directions for others to follow in planting and caring for a garden. Students answer questions.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide*.

Scoring Parameters

- Student uses good science to describe garden plan related to plant growth patterns and needs. Response accurately address information and ideas pertaining to factors impacting a successful garden (e.g., use of water, fertilizer, soil preparation, grow light and pre-planting, insect control, use of fence, weeding, special device).

- Student references multiple sources of relevant information to their recommendation. Student has used evidence from research, made accurate interpretations and application of science principles to describe and support conclusions about conditions that favor successful garden plan. Alternative are explored.

- Student discussion of the details of the experiment is clear, focused, and organized. Safety considerations for self, others, and the environment is discussed. Precise and realistically scaled illustration (i.e., garden layout to accommodate growth needs of selected plants) and explanation is presents garden plan over time (i.e., planting dates, harvesting times) to Rachel and Paul.

- Student makes a recommendation to Rachel and Paul. Consequences and alternatives are discussed (e.g., time required to maintain the garden, use of environmentally safe garden techniques).

Item: Fossil Kit

Item Description:

- Students will be working in groups of 4-6 for the performance tasks, and each group will prepare and submit their results as a group.
- Group assignments should be made in advance.
- Although it is not a requirement, you may want to integrate the exercise into your regular science curriculum.
- The student groups may take up to three weeks to complete the exercise.
- Students may work on the exercise outside the classroom period, they may consult as many references as they wish, and you may provide them with advice and direction. However, the product of the exercise must be the students' own work in their own words.
- The exercise may result in a report, artwork, or even a videotape.
- The results of the exercise should bear the names of all members of the group.

Successful completion requires each student group to produce a complete "Fossil Guide" that covers all twelve fossils. If they wish, students may simply photocopy the sample Fossil Guide to use as the format for their Guide. If they choose to use their own paper, the drawing and written description of each fossil should appear on the same page. The written descriptions should include such things as size, shape, general appearance, and how the fossils are organized for younger children to be able to use the guide.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide.*

Scoring Parameters

- Student uses good science to accurately and thoughtfully describe all 12 fossils, indicating recognizable patterns.
- Student references multiple sources of relevant information to their fossil collection. Student has used evidence from research, made accurate interpretations to describe and support conclusions about the fossils.
- Student discussion of fossil pictures (details) is accurate, clear, focused, and organized. Mode and level of communication is appropriate for younger students to be able to understand the fossil guide (collection).
- Student makes fossil guide (collection) relevant to an audience of younger students (i.e., younger children will be able to understand the descriptions and organization of the fossil kit).

Item: Alarms

Item Description:

Successful completion requires students to write their reports after they have been able to construct and successfully test each of the circuits shown in the booklet, linking explanations to explorations completed. Successful descriptions of good applications for a light bulb or buzzer alarm should illustrate different conditions for each type of alarm (e.g., a light bulb alarm might not always be in the line-of-sight, a buzzer alarm might not be loud enough to be heard).

The paper clips illustrated in the circuit serve as inexpensive connectors between the buzzer's wire leads which are permanently soldered to the buzzer in some applications.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide*.

Circuits Data Table

	BUZZER	LIGHT
A	No	No
B	No	No
C	Yes/No*	Yes
D	No/Yes*	Yes

* **Note**: Check your buzzers out ahead of time. There are a variety of buzzers available. Depending on the variety of buzzer available for this exercise, for the Buzzer to work properly the polarity of the buzzer connection must be correct (i.e., RED to RED and BLACK to BLACK as in Circuit D), or polarity may not effect the operation of the buzzer at all and therefore the buzzer circuit might always work, or the buzzer might not work at all when connected like Circuit C or like Circuit D (e.g., the internal buzzer circuit is broken or it requires a different kind of electric supply). Therefore it is more important to take into consideration that the student explains why or why not the buzzer circuit worked for Circuit C and D, than merely scoring for which circuit (C and/or D) the student records the buzzer working.

Scoring Parameters

- The student demonstrates that he or she correctly understands what it takes to complete the circuit, and such concepts as polarity and flow. Patterns are recognized and discussed.
- Table is filled in, student discussion shows that the experiment was done. The questions are answered and are consistent with the results in the boxes in the table. Safety for self and others is demonstrated.
- Student answers questions correctly relative to making a complete circuit. Answers are consistent with the boxes of the Alarms data table, clear, focused, and organized.
- Student gives successful descriptions of good applications for a light bulb or buzzer alarm, illustrating different conditions for each type of alarm (e.g., a light bulb alarm might not always be in the line-of-sight, a buzzer alarm might not be loud enough to be heard).

Item: Benefits and Burdens

Item Description: The item is designed to engage students in evaluating the positive and/or negative impacts of technology on human activities. Students are given an chart of various technologies to consider regarding associated short-term benefits and long-term burdens. Students are asked to contribute to and collectively decide on five example technologies to research. Students must use the research and good science to evaluate the overall impact of the technologies. Students must decide how best to communicate the summary of their decisions. Students include in the summary a discussion of the potential impact of each technology on the environment, humans, and society.

Scoring Parameters

A good response to this open-ended task should compare favorably holistically to the parameters in the Science Portfolio Scoring Guide.

Item: Solar Energy

Item Description: Students should infer a limitation in the design of the solar house from observation of the illustration (e.g., solar screening, fresh air supply, insulation, solar energy storage system). Students should use good science to explain how they would redesign the house to solve this problem. They need to design and describe a fair test of the effectiveness of the proposed design change, including the data, tools, procedures, analyses, and medium they would use to communicate the results of the test. Finally, they must adapt the given solar house to convert it to an active solar system (e.g., drawing in a large mass, high heat capacity system in the floor and/or walls in the path of the sunlight); and use good science to explain how it works (e.g., energy transformations and/or transfer, seasonal and/or day/night patterns, water evaporation and or condensation).

Scoring Parameters

A good response to this open-ended task should compare favorably holistically to the parameters in the Science Portfolio Scoring Guide.

Item: Weather Report

Item Description: Students should decide what information they need to collect to predict the weather and how they would clearly present a focused weather report. Students should make predictions from observation of the weather data. Students should use good science and the data collected to accurately explain the patterns and trends in their weather prediction.

Scoring Parameters

A good response to this open-ended task should compare favorably holistically to the parameters in the Science Portfolio Scoring Guide.

The Garden

Your neighbors, Paul and Rachel, have asked your team to plan a garden for them. They want to plant three kinds of vegetables. They will plant the garden in the spring and take care of it for three months (or the length of the growing season in the geographical area). They have asked your team to come up with a design for this garden during the next few weeks.

The garden will be located in a sunny spot along a chain-link fence in your neighborhood. The garden will be 2 meters wide and 3 meters long.

Collecting information to help make garden planning decisions.

You can use information from books, gardening catalogs, and seed packages to make your plans. Be sure to think about the following things.

- What three vegetables should Paul and Rachel grow?
- When and where should they plant the vegetables?
- How close together should they put the plants?
- How should they take care of the garden?
- When can they harvest the vegetables?

After you have planned the garden, your group should complete the following assignment.

1. Draw a map of the garden. Be sure to show each plant. Label everything in the garden.

2. Write out directions for Rachel and Paul. The directions should include the information, with sources referenced, they need to know in order to grow the vegetables in the garden. Be sure to think about your answers to the questions (above) on this page.

3. Be sure to explain why you selected the three vegetables for Rachel and Paul to grow. Discuss the information, consequences, and alternatives you considered before making your recommendation.

Fossil Kit

Your group has been asked to put together a fossil kit. The kit will be used by younger children who want to learn about fossils. You will have several weeks to complete this assignment.

Putting together a fossil collection.

You should include the following things in the fossil collection you assemble and organize in a carton:

- A *box* for the fossils

- 12 *fossils*, organized (numbered 1 through 12)

Describe and explain the organization of each fossil in your collection.

You now have the fossils organized. To complete the kit, you must create a "Fossil Guide", which includes:

a picture of each fossil, numbered 1 through 12

a description of each fossil, to go with the pictures

Make sure the pictures are big enough for a younger reader to easily study. Write down as much information as you can about each fossil. One idea for a Fossil Guide is shown on the next page. You may use this idea or come up with your own.

You may use books to help you figure out what to say, but be sure to use your own words. Do not copy words from a book. Use words that are easy enough for a younger child to understand.

Fossil Guide

Fossil #1
Picture
Description

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Alarms

During the next few weeks, your group will begin to work on a design for an alarm system. You will test several different systems with two different types of alarms: a light (bulb) alarm and a buzzer alarm.

During the first two weeks, your group should do the following things.

- For the first day or two, read about electrical circuits. Your science textbook might be helpful.
- Study the four diagrams of circuits on the next page. Then experiment with the materials listed below. Put together each of the four circuits with the light bulb to see which of the circuits will light the bulb. Then put together each of the four circuits with the buzzer to see which of the circuits will make it buzz.
- Every time you put together a circuit, turn to the table on the back page of this booklet and write in the proper place in the table "Yes" or "No" to indicate whether that circuit works.
- You will need to collect the following equipment and carefully return it when completed.
  - 1 buzzer
  - 1 flashlight bulb
  - 1 D-cell battery with battery holder
  - 2 pieces of wire (1 red wire and 1 black wire)
  - 2 paper clips

Your group should work together to write a report that contains the following:

a. Look at your table and write down which circuits *do not* work with the light bulb. Tell why you think they do not work.

b. Look at your table and write down which circuits *do not* work with the buzzer. Tell why you think they do not work.

c. Look at your table and write down which circuits *do* work with the light bulb. Tell why you think they work.

d. Look at your table and write down which circuits *do* work with the buzzer. Tell why you think they work.

e. Write about one situation in which a light bulb alarm would be a good alarm to have.

f. Write about one situation in which a buzzer alarm would be a good alarm to have.

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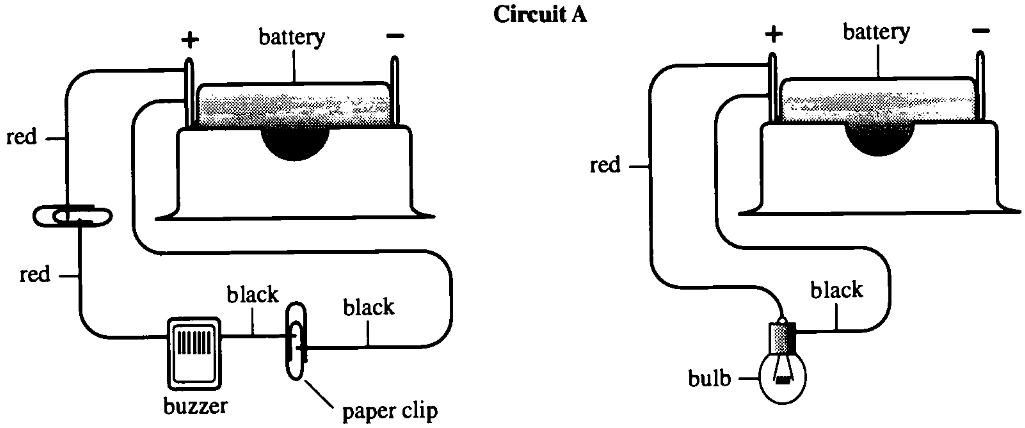
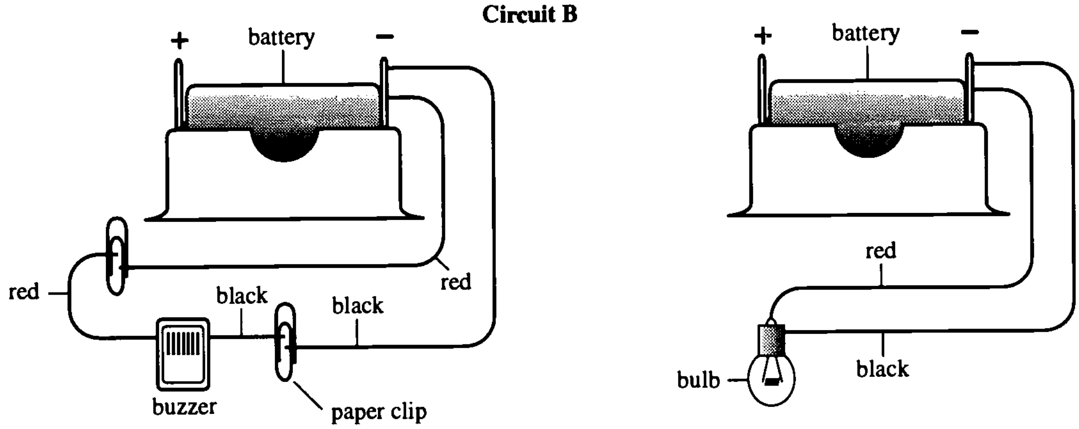
Alarms

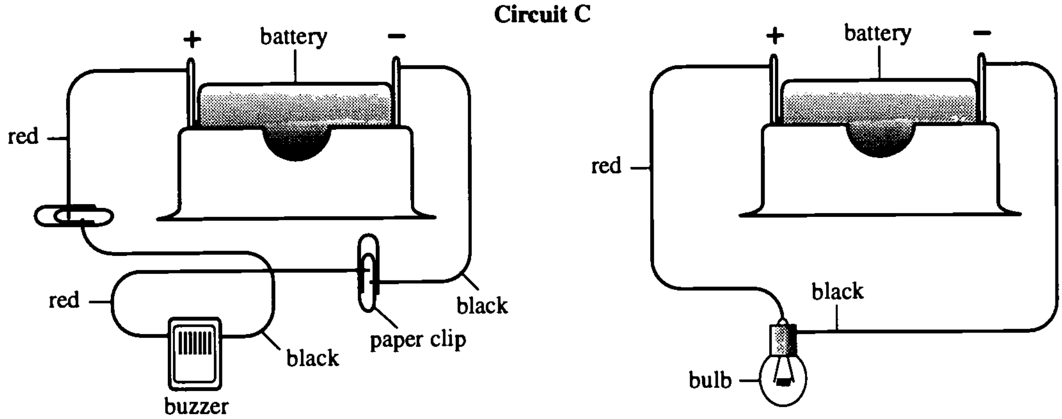
Circuit A



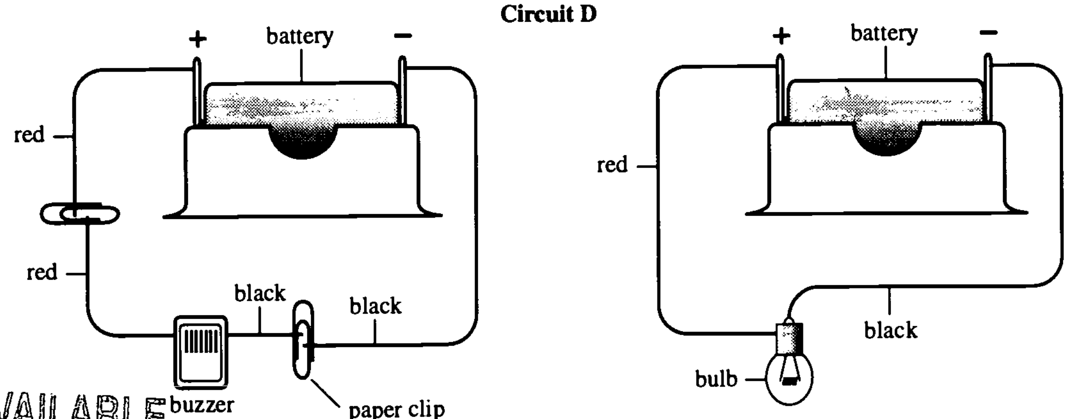
Circuit B



Circuit C



Circuit D



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Alarms

Table

	Buzzer	Light bulb
Circuit A		
Circuit B		
Circuit C		
Circuit D		

Benefits and Burdens

We often see and hear in news reports of good ideas or developments that result in benefits and burdens to humans, society, and the environment. Below is a chart that represents some examples.

TECHNOLOGICAL PROCESS OR DEVICE	SHORT-TERM BENEFIT	LONG-TERM BURDEN
chemical fertilizers	higher agricultural yields	kills fish in lakes
artificial sweeteners	convenience for diabetics and dieters	possible increased risk of cancer
strip mining	increased fuel supply	unusable land, water pollution
automobile	increased mobility	increased air pollution
modern-day packaging with plastic	fresher food	nonbiodegradable waste in landfills
logging	increased supply of wood products	deforestation of tropical jungles
robotics	modernized, efficient industry	loss of jobs
drugs	treat diseases	dependence through abuse
pesticide/insecticide	increased agricultural yields	extinction of helpful species
computers	increased ability to process data	loss of jobs, health problems from video-display terminals
life-sustaining devices	keep people alive	how to decide when to use or remove them

On your own, identify examples of technological impacts over time.

1. In one row of blank spaces on the chart above write-in your own example of a technology process or device that may have a "short-term benefit" and possibly a "long-term burden". Your example should be a concern that is being discussed in your community or be of personal interest to you.

2. In another of the rows of blank spaces write-in another example from history or the past of a development that had "short-term benefit" and an unexpected "long-term burden".

Benefits and Burdens

Working in groups, summarize technological impact information.

Thinking on your own you added stuff to the chart above -- your examples of long- or short-term benefits or burdens for specific technologies.

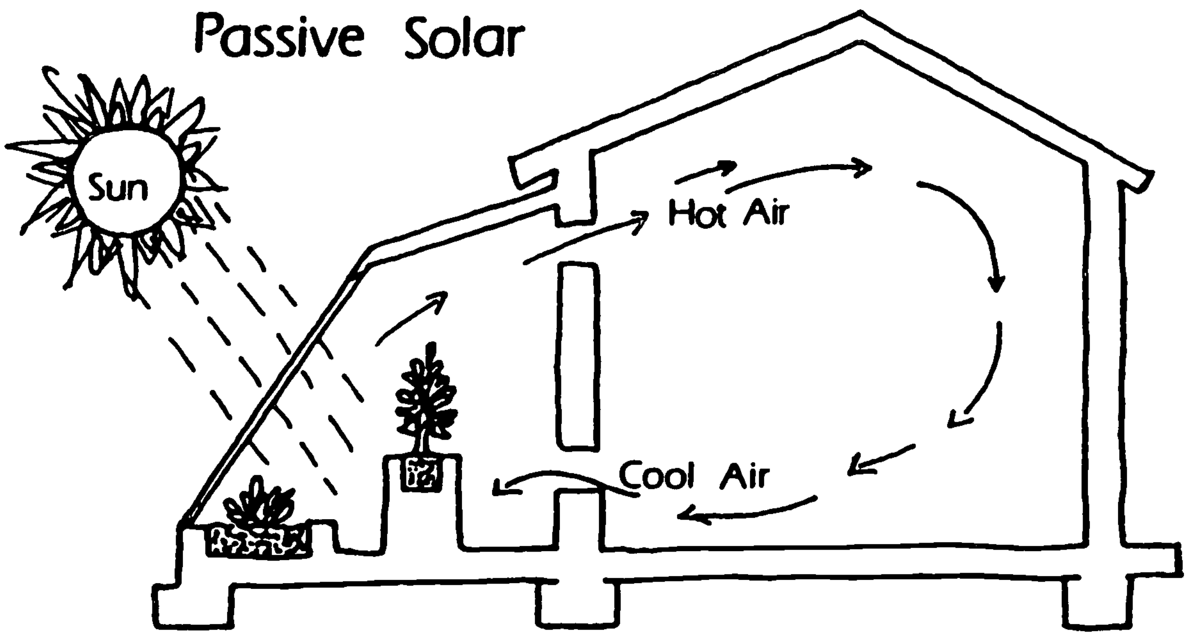
3. Now your group task is to collaboratively decide on five examples of technologies to add to the group chart, complete research on the benefits/burdens of these technologies, and summarize your findings.

   Include in your group summary, a discussion of consequences and alternatives for the five technologies. Think about answering the following question for your five new examples: How does the technology rate overall — burden or benefit — as it potentially impacts the environment, humans, and society? Use your research and what you know about science to support your conclusions about consequences and alternatives of the technologies that should be considered.

4. Devise a way to organize and communicate the results of your summary to your class or others. The groups should all prepare so that each person in the group can successfully discuss and explain one part of the overall impact summary.

Solar Energy

Energy from the sun is called solar energy. The drawing below shows solar energy being used to help warm a house. Special features are designed into the house to improve the effectiveness of this process.



Analyze Solar Heated Houses

1. Using your knowledge of science, describe in your own words how solar energy is being used to benefit persons living in a passive solar heated house.

2. There are many things that affect how well a passive solar heated house will work for the persons living in it. Based on what you know about science, describe a design problem for a solar house and what could be done to correct that problem. Design and describe a fair test of your proposed solution, including the data, tools, procedures, analyses, and medium you would use to communicate the results of the test.

Modify the design of a Solar Heated House

3. To change this house design from a passive solar system to an active solar system design requires a method of storing solar energy. Based on what you know about science describe and/or draw on the house diagram above how a solar energy storage system could be added to that house.

Weather Report

There are many things that affect our daily weather. Your assignment is to collect information about weather in your area and present a weather report based on the data you collect. You must decide the kinds of information you will need and the tools you will need to collect the information. The chart below shows some of the types of information that may be useful in making your report.

Weather Record

Date							
Precipitation							
Air Temperature							
Wind Speed							

Collect and use weather report information.

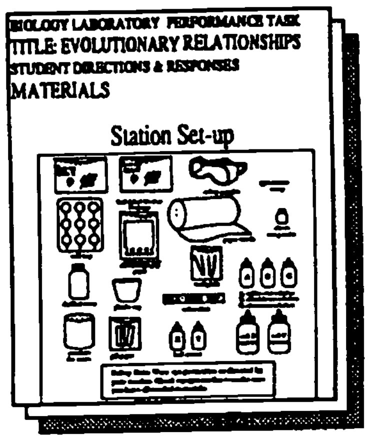
1. Different types of information help describe different weather conditions. Describe the types of information you collected and weather instruments you used. Also describe how you organized and accurately recorded the information. Give an example of how the information you collected helped you make a weather prediction for a day.

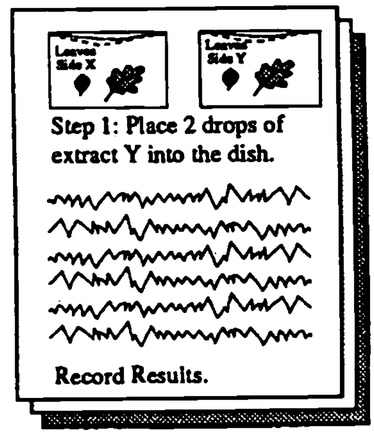
2. Using print and broadcast media sources, review weather information for your area and across several neighboring states. Make a prediction about the weather in your area over the next several days.

Organize and present a weather report.

3. Devise a way to use weather data to make a weather report for an audience. Use multimedia devises and resources in your presentation.

Type 2
Sixth Grade Science
Competency-Based Education Assessment Series





° On Demand Problem-Solving Events °

(Performance-Like)

Characteristics

- Experimental and non-experimental research, requiring more than a single session and some out-of-class time
- Scoring Options: Holistic scoring (i.e., portfolio scoring guide and interviews); scoring with rubrics, check-lists, and/or interviews

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart*. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

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Ohio Department of Education
1998

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• Sixth Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)* *Sixth Grade*
Page(s) 1							
Aquarium	1	See Discussion	Acquiring	7	I: 10 K: 2, 3, 4, 6, 7, 10 C: 4, 5, 9 A: 7	Systems and Interactions	N: 3 P: E: L: 14, 15, 17
	2	See Discussion	Acquiring				
	3	See Discussion	Acquiring				
	4	See Discussion	Processing				
	5	See Discussion	Processing				
Page(s) 2 - 4	🗁						
An Investigation of the Growth of Yeast	1	See Discussion	Acquiring	2, 4, 6	I: 2, 3, 4, 5, 6, 7, 10 K: 2, 5, 9, 12 C: 1, 2, 4, 6, 9, 13, 15 A: 1, 3, 7	Change Over Time	N: 2, 3, 5, P: 8, 10 E: L: 14, 15, 16
	2	See Discussion	Processing				
	3	See Discussion	Extending				
Page(s) 5 - 7	🗁						
Tomatoes	1	See Discussion	Processing	1, 7	I: 2, 3, 5, 9, 10 K: 2, 4, 8, 10 C: 3, 4, 9, 13, 15 A: 3, 7	Models and Scale	N: 3, 5 P: E: 12, 13 L: 15
	2	See Discussion	Processing				
	3	See Discussion	Extending				
Page(s) 8 - 10	🗁						
Soil Types	1	See Discussion	Processing	3, 4, 7	I: 2, 3, 4, 5, 6, 7, 10 K: 1, 2, 6, 7, 8, 10 C: 2, 4, 6, 9, 13 A: 7	Change Over Time	N: 1, 2, 3 P: 8, 10 E: 12, 13 L:
	2	See Discussion	Processing				
	3	See Discussion	Extending				
	4	See Discussion	Extending				
Page(s) 11							
Molds To The Rescue	1	See Discussion	Acquiring	3, 6, 7	I: 1, 10 K: 5, 8, 9 C: 1, 4, 6, 7, 11, 14, 15 A: 3, 5	Change Over Time	N: 2, 3, 4, 5 P: E: L: 16
	2	See Discussion	Acquiring				
	3	See Discussion	Acquiring				
	4	See Discussion	Acquiring				
	5	See Discussion	Acquiring				
	6	See Discussion	Acquiring				
	7	See Discussion	Processing				

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Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Sixth Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 12 - 14	🗁						*Sixth Grade*
Propeller	1	See Discussion	Acquiring	1	I: 2, 3, 9, 10 K: 1, 3 C: 2, 4, 6, 9, 13 A: 7	Systems and Interactions	N: 3 P: 7, 9 E: L:
	2	See Discussion	Acquiring				
Page(s) 15 - 16	🗁						
Seesaw	1	See Discussion	Acquiring	1, 2, 7	I: 6, 7, 9, 10 K: 1, 2, 4, 8, C: 2, 4, 6, 9, 13 A: 7	Patterns	N: 3 P: 6 E: L:
	2	See Discussion	Processing				
	3	See Discussion	Processing				
Page(s) 17	🗁						
Insulation	1	See Discussion	Acquiring	7	I: 1, 2, 3, 5, 6, 7, 8, 10 K: 2, 7, C: 2, 3, 4, 5, 6, 9, 13 A: 3, 4, 7	Constancy	N: 3, 4 P: 9, 10 E: L:
	2	See Discussion	Extending				
	3	See Discussion	Extending				

• Performance Objectives: Grade 6 ***Ohio's Model Competency-Based Science Program***

1. The learner will predict and test the effects of influences on the motion of selected objects (e.g., rubber band-powered vehicles, hygrometers, sailboats, tropisms, flowing water).
2. Provided with examples of patterns in natural phenomena (e.g., period of a pendulum, variation in populations, the spread of disease, Logo fractals, position of the moon, reflection, refraction, interference patterns), the learner will design and perform an investigation to document the constancy of the pattern.
3. The learner will identify a community problem (e.g., recycling, water quality, animal and plant overpopulation and competition, extinction, urban growth, soil conservation, transportation issues, physical recreation opportunities) and propose a solution for that problem using information collected to support their proposal.
4. Given a collection of data presented in tabular or graphic form, the learner will make inferences to explain the events or phenomena from which the data was collected.
5. Given the observations of witnesses and related evidence, the learner will identify the impact of different perspectives on explanations of an event.
6. Presented with different versions of a historical event in science or technology, the learner will discuss the impact of scientific and social context at the time of the event.
7. Given a set of data and a set of attendant conclusions, the learner will verify or refute the accuracy of the conclusions.

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Instructional Strands • Grade 6 • *Ohio's Model Competency-Based Science Program*

Objectives	*Inquiry* • The learner will:	*Knowledge* • The learner will:	*Conditions* • The learner will be:	*Applications* • The learner will be:
1	share findings and offer explanations for inconsistencies, limitations, and variability in recorded observations from similar investigations carried out at different times in different places, and using different techniques.	investigate the factors that influence the motion of objects and the motions of and within organisms.	participating in the selection of topics and themes for class investigation.	making decisions regarding personal wellness by monitoring body system performance.
2	design and conduct a range of investigations (e.g., observations of objects and events, controlled experiments) associated with everyday experience.	investigate patterns in nature (e.g., soil ecology, sedimentary rock layers, vibrations in physical materials, reproductive strategies, transfer and transformations of energy, and genealogies).	repeating learner-designed experiments several times to improve the reliability of results through improved experimental design.	learning, performing, and explaining magic tricks, illusions, and cinemagraphic techniques from a scientific point of view.
3	utilize caution and demonstrate care and concern for ones self, classmates, equipment, specimens and environment when making observations and participating in group interactions.	investigate the limitations of individual components within technological, social, and ecological systems.	performing investigations in a community environment (e.g., natural, altered, and built).	evaluating and challenging where appropriate, the claims made in consumer product advertisements.
4	measure and mix dry and liquid materials in prescribed amounts, in various settings, exercising reasonable safety.	investigate the diversity and scale of various technological and a natural systems.	using appropriate terminology in context to discuss investigations of scientific concepts.	making everyday scientific and technological decisions.
5	select and use appropriate manipulative devices and technologies to collect information directly, choosing appropriate units for measures and reporting diverse magnitudes.	investigate and make inferences from collections of artifacts and objects (e.g., fossils, footprints, echoes, photographs, seismic patterns).	considering the perspectives of others in group investigations of natural phenomena.	gaining insight into his/her own situation in light of the historical background of important inventions and technologies.
6	utilize appropriate units for counts and measures and keep track of them in computations performed by hand, calculator or computer.	investigate classification systems that are based on attributes that are not readily visible (e.g., electromagnetic radiation, tissues, sounds, minerals, stars).	using technologies to investigate and communicate ideas, questions, and information.	monitoring and proposing improvements appropriate to the disposition of various types of wastes in the home, school, community, and the environment.
7	select and use math tools such as numerical manipulation (e.g., whole, fractions, decimal equivalents), geometric figures (e.g., circles, rectangles, triangles, ellipses, planes, spheres, rectangular solids), and simple tables, graphs and representational charts (e.g., simple line graphs, pie and bar charts, pictographs) to measure, count, order, sort, identify, describe, label and communicate information from observations.	investigate various quantitative representations of rates of change and duration of phenomena.	raising issues and engaging in discussions of current scientific issues.	following step-by-step instructions, recipes, and sketches.
8	apply appropriate mathematical operations to make mental estimates of the reasonableness of measures of everyday observations and events.	investigate inferences about large objects, organisms, and systems made from observations of smaller objects, organisms, and systems.	creating dramatizations and simulations of events to help explain phenomena.	
9	make, interpret, and use scale drawings, maps, and models.	investigate different versions of historical events in science (e.g., Thomas Edison and the light bulb, Louis Pasteur and pasteurization, Marie Curie and radium, George Washington Carver and peanut butter).	using a variety of modes of expression to communicate ideas.	
10	formulate explanations and inferences and make decisions on verifiable data.	investigate various resource cycles in physical and biological systems (e.g., carbon, nitrogen, water).	critiquing presentations that utilize propaganda techniques (e.g., irrelevant motivators, half-truths, generalizations).	

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Instructional Strands • Grade 6 •

Ohio's Model Competency-Based Science Program

Objectives	*Inquiry* • The learner will:	*Knowledge* • The learner will:	*Conditions* • The learner will be:	*Applications* • The learner will be:
11		investigate various impacts of biological and geological activity on the earth.	asking for evidence that supports or refutes explanations.	
12		investigate the reversibility of phenomena and events in terms relative to time and space (e.g., changes of phase, collisions, rechargeable batteries).	assisting learners of various ages to learn about science concepts and their applications.	
13			maintaining a journal over an extended period of time in which observations are recorded and inferences are noted.	
14			identifying and addressing scientific issues of local and global importance.	
15			meeting and working with people engaged in scientific and technological careers.	

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Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description			
	Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

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Item Discussion

Item discussion on the following pages pertains to **SIXTH GRADE** SCIENCE TYPE 2 MODEL COMPETENCY ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content. Parameters for holistic evaluation of student work are suggested in the *Science Portfolio Scoring Guide*.

Science Portfolio Framework

(Used with permission from the *CCSSO SCASS* Science Portfolio materials.)

RATIONALE. A science portfolio assessment strategy supports improved proficiency performance. A portfolio supports science program implementation, framing teachers' on-going guidance and suggestions to keep students' work manageable, productive, and relevant to the objectives for student learning. A portfolio interfaces with previous assessment development*. A portfolio allows holistic assessment of students' doing and knowing science. (*Note: Examples of potential science portfolio work included in the **SIXTH GRADE** TYPE 2 MODEL ASSESSMENTS are marked with a folder icon, 🗁, in the accompanying *Content Summary Chart*s.)

ASSUMPTIONS. Potential science portfolio entries will result from a combination of teacher initiated questions and student initiated questions. Students will learn and extend self-evaluation skills. The student's **final science portfolio** contains his or her choices of the best four products, with revisions, to represent his or her science learning. These products are selected from among all the learning activities and demonstrations he or she completes over a set time period (i.e., quarter, semester, year). Product are selected as **portfolio entries** and placed in one of the four categories of science work described below.

- 🗁 **Investigation** Experimental research: Requires students to design, carry-out, and report results of an observational and/or experimental process.
- 🗁 **Research** Non-experimental research: Requires students to access, analyze, synthesize, evaluate, and use the kind of information the average citizen might use to investigate and solve a problem of personal or societal significance. Students also identify alternatives, trade-offs, and make a decision regarding an issue.
- 🗁 **Application** Inventive or expressive in nature: Requires students to choose a manner of demonstrating what they *can do*, what they *can apply*, and how thoroughly they *can justify* their thinking. An inventive application allows students to show how scientific information can be used to solve real-world problems. An expressive application allows students to communicate scientific information in a medium of his or her choice. His or her work includes a written or verbal description of the scientific basis for the entry.
- 🗁 **Open Choice** Students may use this entry to provide further evidence of his or her science learning. This entry may be another piece of the previously described categories of science work.

Each entry is accompanied by the student's **entry summary** (self-evaluation). Students discuss how well the entry reflects the *Science Portfolio Scoring Guide's* **four parameters**

- Depth of Understanding
- Evidence of Inquiry
- Communication
- Relevance to Society

- 🗁 **Portfolio Summary** The *fifth entry* of the students' final science portfolio: Students write his or her **portfolio summary** to illustrate how the final portfolio entries reflect one or more of the above **four parameters.**

Teachers, parents, and administrators can use the Portfolio Summary as a road map of the how students' final portfolios demonstrate progress toward the objectives of instruction. The act of scoring students' final science portfolios may be mediated by teachers (and others) holistically comparing students' final portfolios to the suggested parameters in the *Science Portfolio Scoring Guide*. In this process take into consideration that each student entry need not reflect all parameters or all indicators for all parameters in the *Science Portfolio Scoring Guide* (i.e., the *Guide* is not intended for use as a checklist).

EXAMPLE STUDENT PORTFOLIO: Constancy, and Patterns of Change Portfolio *

- 🗁 **Example Portfolio Summary Outline**

Students discuss examples from his or her portfolio entries that demonstrate their understandings of those processes in which some properties and behaviors of things change while other properties and behaviors remain constant. In this discussion, students present evidence from across his or her **four entries** to illustrate one or more of the **four parameters** (see *Science Portfolio Scoring Guide*). In the process students answer the following questions

- How well do I know science? ...(Depth of Understanding)
- What can I do in science? ...(Evidence of Inquiry)
- How well do I communicate what I know and can do in science? ...(Communication)
- How well do I show how science affects people's lives. ...(Relevance to Society)

- **Examples of Student Entries** (*Examples result from a combination of student and teacher generated questions*):

  🗁 **Investigation Entry** Students make observations, use tools, collect data, and use evidence to support conclusions about the behaviors and patterns of change of observable organisms (e.g., *Meal Worm Lab*).

  🗁 **Research Entry** Students devise and test models of objects and groups of objects to describe and make predictions about how things work and transform energy(e.g., *Solar Energy*).

  🗁 **Application Entry** Students make use of creative and inventive communication tools to illustrate constancy and make predictions of change in the biosphere, lithosphere, hydrosphere, and atmosphere (e.g., *The Globe*).

  🗁 **Open Entry** Students discuss a question of personal interest illustrating relevant science knowledge (e.g., *Chlorophyll and Red Plants*).

*In this example, the unifying concepts that glue the objectives of classroom instruction and learning activities are constancy, and patterns of change. These unifying concepts are not the topics of instruction. Separate topics that are taught in classrooms can be tied together with these unifying concepts.

START-UP SUGGESTIONS

DEFINE THE GOALS AND OBJECTIVES THAT YOU WANT THE PORTFOLIO TO DEMONSTRATE. Think about existing opportunities for students to become familiar with the targets of their science learning.

DECIDE ON THE LOGISTICS AND RESPONSIBILITY OF THE PORTFOLIO. Time and space needs for completion and storage of portfolios should be addressed. Also, think about existing opportunities for potential science portfolio entries to come from a combination of teacher initiated questions and student initiated questions. Teachers continue to offer on-going guidance and suggestions to make student's work manageable, productive, and relevant to the objectives for student learning.

BE SURE TO COMMUNICATE YOUR EXPECTATIONS CLEARLY TO STUDENTS, PARENTS, AND ADMINISTRATORS. Think about existing opportunities for sharing the parameters in the Science Portfolio Scoring Guide relevant to the science program objectives for student learning.

THINK BIG; START SMALL. EXPERIMENT UNTIL YOU FIND A FORMAT AND PACE THAT IS COMFORTABLE FOR EVERYONE. Think about existing opportunities for students to start, receive feedback, revise his or her work, and practice self-evaluation skills.

Item: Aquarium

Item Description:

This item assesses the student's understanding of the concept of balance in a simple, closed system. The student is given a definition of gas balance in the aquarium and told which organisms produce oxygen (plants) and which use it (fish and snails). The student must be familiar with the words "produce and use", and be able to relate them to "add" and "subtract". A GOOD RESPONSE will show for question #:

1. ROCKS. The student understands that ROCKS (because they are not plants, snails, or fish), according to the information given, do not affect the balance of the in the aquarium.
2. BECOMES HUNGRY **OR** BEGIN TO RUN OUT OF OXYGEN. The student understands that the fish rely on the plants for food and oxygen from the information. However, after a few hours, the fish will likely be affected by the loss of food (HUNGER) OR the loss in oxygen production (BEGIN TO RUN OUT OF OXYGEN).
3. PLANTS WILL (BEGIN TO) DIE. The student understands the role of the light in providing energy for the plants to grow in the closed system. Explains that with the loss of this light the plants will be unable to produce food enough for their own survival (PLANTS WILL (BEGIN TO) DIE). **AND/OR** THE PLANTS COULD POSSIBLY SURVIVE FROM THE ROOM LIGHTS. The student understands the limitations of the Aquarium as representing a truly closed system. Light entering the tank from the sides during the daylight or room lights, may be enough for the plants to produce enough food for their own survival and for the fish to feed on.
4. ADDING PLANTS ADDS OXYGEN. The student understands that adding oxygen-producers (plants) will increase the amount of oxygen available in the aquarium and decrease the amount of carbon dioxide in the aquarium.
5. ADDING FISH REDUCES OXYGEN. The student understands that adding oxygen-users (fish) will decrease the amount of oxygen available in the aquarium. Also this change effects the amount of food available/consumed and the carbon dioxide produced/used.

Parameter	**Scoring Guide**
1.	The student accurately discusses and links major scientific concepts and themes and identifies patterns and connections. [For example, the student may explain that the fish, snails, and plants are all living together and interacting with each other within the (nonliving) physical setting (i.e., water, rocks) of the aquarium system. Living things together fulfill various functions (i.e., plants produce food and oxygen through photosynthesis; fish and snails consume resources and generate carbon-dioxide). With light present, all the things in the aquarium impact the balance of biotic and abiotic resources and factors (e.g., adding plants increases oxygen and food available; adding fish decreases oxygen and food and increases carbon dioxide; removing the light reduces oxygen and food by reducing the ability of plant to carry-out photosynthesis)].
2.	Students' explanations demonstrate a logical, cause-and-effect relationship between effect (e.g., decrease in oxygen and food available) and cause (e.g., adding more fish to the tank). Also student recognize how the variability of available light impacts the aquarium system (i.e., if the artificial light is removed, there still is background/natural light entering the tank from the room light through the glass sides of the aquarium).
3.	Students communicate scientific information clearly and focus his or her discussion.
4.	The student may provide a context for interpreting the cause-and-effect relationship (e.g., human overpopulation in some parts of the world degrades the environment) and explain how this personal/social context helps explain or is similar to the way something is taking place in the aquarium (e.g., adding too many fish can cause the aquarium to become over populated with consumers and degrade the system from an increased use of available resources (e.g., oxygen).

Item: An Investigation of the Growth of Yeast

Item Description: #1

This item assesses students' understanding of Yeast as a living one-celled organism that produces carbon dioxide gas and alcohol; and the use of BTB (bromothymol blue) AS an indicator that will turn light green or yellow in the presence of carbon dioxide. A good student response should include a description of the difference between the contents of Test Tube 1A and 2A (2A has sugar.); and an explanation of the reason for the difference between tubes 1A and 2A.

Criterion	Rubric Summary
1.	The response demonstrates minimal understanding of the events in this experiment. Student states something other than "sugar" as the difference between the two test tube contents. For example: 1A had a yellow balloon and 2A had a blue balloon. We put them like that so we can tell them apart.
2.	The response demonstrates some understanding of the events in this experiment. Student correctly points out that the difference is the presence of sugar in 2A but does not explain why they were designed to be different.
3.	The response demonstrates adequate understanding of the experiment. Student correctly points out that the difference is the presence of sugar in 2A and provides an explanation for designing such a difference in the experiment, but the explanation is brief. For example, the student points out that the difference was designed into the experiment to see the effect of sugar on carbon dioxide production level, but does not talk about what the microorganism (yeast) does to sugar and where does the carbon dioxide gas come from.
4.	The response demonstrates a high level of understanding of scientific principles and experimental procedures involved in this item. The student correctly and completely describes and explains that the difference between the two test tubes is the sugar and the role of this difference in the experiment is pointed out with further explanations that might include some information on sugar metabolism by yeast. Written expressions are effective and free of major flaws.

Item Description: #2

This item assesses the student understanding that some factors that limit the growth of living yeast cell population , including limit in resources (food, space, etc.); build up of harmful metabolic bi-products; and environmental limits (temperature, etc.). A good student response should describe two of the conditions mentioned above. Students may name two conditions within the same factor.

Criterion	Rubric Summary
1.	The response demonstrates minimal understanding of yeast and the conditions that effects its population growth rate. Student presents a wrong answer. The following would be an example: *The yeast could not increase any more because they were too tired.*
2.	The response demonstrates some understanding of yeast and the conditions that affect its population growth rate. Student provides one condition, with or with out explanation.
3.	The response demonstrates adequate understanding of yeast and the conditions that affect its population growth rate. Student identifies at least two conditions and explains one. The explanations are brief and may contain some inaccuracies.
4.	The response demonstrates a high level of understanding of yeast and the conditions that affect its population growth rate. Student provides at least two unique conditions and explains both. The explanations are complete and effective with no inaccuracies.

A good response to Question #3 should compare favorably, holistically to the parameters in the *Science Portfolio Scoring Guide.*

Item: Tomatoes

Item Description: #1, #2, and #3

This item asks students to look at some of the factors which affect the growth of tomatoes. They must interpret and follow directions on packages and follow the scale given by the item. They must explain the need for spacing out the plants in terms of the plants' need for sunlight. Lastly, they should choose other factors which might affect plant growth (i.e., water, sunlight, inside/outside planting, temperature). The test should be a comparison between two different factors.

A good response to Question #3 should compare favorably holistically to the parameters in the Science Portfolio Scoring Guide.

Criterion	Rubric Summary
1.	Student completes a garden plot drawing that illustrates evenly spaced plants (Question 1) AND infers that it will be easier for plants to get the light they need to grow in the illustration.
2.	Student explains the planting pattern regarding satisfying the plants' need for light to grow OR Identifies a variable that would affect plant growth (e.g., plants are given different amounts of water)
3.	Student identifies a second variable (e.g., pear tomatoes are planted 3 cm apart, instead of the recommended 60 cm apart)
4.	Student tests designs of two gardens to be used to collect information on the effect of the variables they identified.

Item: Soil Types

Item Description: #1&#2

The student is expected to use his or her data to determine which soils were most and least able to retain water, and associate this finding with observed properties associated with the soil type (e.g., potting soil, sand, mixture of sand and potting soil). They are also expected to explain their conclusions regarding the relationship between the amount of organic matter present and the water retaining ability of the soil (i.e., the more organic material in the soil the more water it retains) A good response should demonstrate correspondence with the student's data and provide acceptable explanations, including observation-based descriptions of the soil types (e.g., texture, color, mass, granularity of the soil type).

Criterion	Rubric Summary for #1&#2
1.	Student identifies the soil with least and most amount of retained water. Question 1.
2.	Student connects observed properties of the soil types with water retention. Question 1.
3.	Student draws a conclusion about a relationship between soil type and water retention behavior. Question 2.
4.	Student defends conclusion with data and observations. Question 2.

A good response to Question #3 and #4 should compare favorably holistically to the parameters in the Science Portfolio Scoring Guide.

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Item: Molds to the Rescue

Item Description:

This item engages students in analysis of one version of an historical event. Student's need to identify and/or evaluate the conclusions of Dr. Fleming. Generally, the event is an example of research and practice associated with analyzing behavior and/or activities/technologies that positively or negatively influence human health. Specific to this event, bleach is a common **disinfectant** (destroys vegetative forms of microorganisms on inanimate objects). When used in or on living tissue, a disinfectant destroys the living cells and damages the tissue. In treating a severe wound, **antiseptics** (substances that check the growth or action of microorganisms in or on living tissue) are used. Penicillin is a familiar example of an antiseptic drug.

A GOOD RESPONSE will show for item:

1. IT KILLS BACTERIA, BUT IT DOES NOT KILL WHITE BLOOD CELLS. The student accurately acquires information from the text.
2. THE NEGATIVE EFFECTS ON HUMAN TISSUE OF ANTISEPTICS BEING USED AT THE TIME. The student accurately acquires information from the text.
3. THE MOLD AFFECTS SOME TYPE OF BACTERIA BUT NOT OTHERS.
4. A CLEAR RING AROUND THE PENICILLIUM MOLD.
5. BACTERIA GREW EVERYWHERE OUTSIDE THE CLEAR RING.
6. NO, BECAUSE ONLY ONE TYPE OF MOLD WAS DISCUSSED. A successful student needs to provide the rationale for a 'NO' response.

A good response to Question #7 includes 1) the reason for not using bleach to treat severe wounds, and 2) a quality explanation.

Criterion	Rubric Summary for #7
1.	Students' response is relevant to the question but it is a wrong explanation.
2.	Students' response demonstrates some understanding of the effect of a disinfectant on living tissue but fails to accurately state it (e.g., it would hurt a lot).
3.	Response demonstrate adequate understanding of the effect but does not explain in great detail (e.g., bleach will damage the tissue at the wound).
4.	Response demonstrates high level of understanding of the effect and a good explanation is provided with no mistakes.(e.g., bleach is a good disinfectant. it kills germs but it is also harmful to the human body. it kills body cells.)

Item: Propeller

Item Description:

This item assesses students' observation of 1) the motor turns the propeller if it is connected in a complete circuit with a battery (i.e., electric current makes the motor spin); and 2) reversing the polarity of the battery connection reverses the direction the motor spins a propeller. To be successful, students need to identify and explain the cause and effect relationships and associate the difference in the direction the propeller spins with switching the motor connection to the two ends of the battery. Finally, they must draw an incomplete circuit (containing the motor, the battery, and single connection wire) and explain in their own words why the motor will not spin.

Criterion	Rubric Summary
1.	The student refers to the two ends of the batter as distinct parts (having different polarity).
2.	The student explains that electric energy (transferred by moving electrons) flows along a complete (closed) path connected between the two distinct ends of the battery.
3.	The student explains energy from the battery (transformed by the electric motor into kinetic energy) causes the effect of the propeller spinning.
4.	The student associates the reversed spin of the propeller with switching the two connections between the motor and the battery (i.e., reverses the direction current flows through the motor).

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Item: Seesaw

Item Description:

This item assesses student understanding that the tendency for an object to make a seesaw go into/out of balance is related to both the mass (weight) of an object on a seesaw and the distance that mass is from the fulcrum (center of mass of the seesaw). The tendency for the seesaw to go out of balance is greater if the mass is greater or the distance between the mass and fulcrum is increased.

A good response to Question 2 would show that the student successfully completed the experiment and can make a data-based prediction (i.e., the data shows that as the mass gets larger it should be moved closer to the fulcrum to maintain balance).

A good response to Question 3 requires the student to successfully apply these concepts. Suggestions include moving the lighter person out toward the end of the seesaw, move the heavier person closer to the fulcrum, or a combination of the two previous strategies.

Criterion	Rubric Summary
1.	Student gives a location which follows the basic trend set by the data collected in question 1.
2.	A position is given which is closer to the center of the ruler than the answers to question 1.
3.	Students describes any method that adds weight to Maria's side or lessens weight on Andy's side is acceptable. OR Student explains that Andy moves closer (in toward the center) OR Maria moves away (out; toward the end).
4.	Student gives an appropriate justification for balancing method. Specific distances are not required. This is similar to Criterion 3, but must be accompanied why their suggestion would work (e.g., students' reasoning includes a discussion of a cause-and-effect relationship such as how the tendency (*effect*) of the seesaw to go out of balance is lessened (*cause*) by reducing an imbalance between a combination of the mass of the people on both sides of the seesaw and the difference in the distances they are sitting from the fulcrum).

Item: Insulation

Item Description:

Students make a prediction about what material is the best insulator, by reflection, from among a group of selected materials (e.g., black or white paper, aluminum foil). This item assesses the student's ability to evaluate their prediction and defend a conclusion based on experimental evidence (Question 1) and correctly use their science knowledge to explain the outcomes of an experiment. It also assesses the student's ability to logically apply their knowledge (Question 2). Students investigate the insulating capacity of various materials, by measuring the temperature changes caused by shining light on each of three thermometers wrapped in a different test material. They extend their findings and procedures to design and conduct a test of their answer to (Question 2).

A good response to Question #1 will be based on experimental data for the thermometer that showed the least temperature change for the three minute trial. It will correctly associate the material (e.g., white paper) with this data as the most effective material capable of insulating the thermometer (keeping it cool) from the heat of the lamp. In the event experimental data conflicts with the student prediction (e.g., black paper may be the best insulating material from a set of materials); the student correctly explains the conflict (e.g., identifying a previously unidentified/uncontrolled variable such as the thickness of the black paper compared to the white paper; OR discussing personal reconsideration of a naive conception in light of experimental evidence).

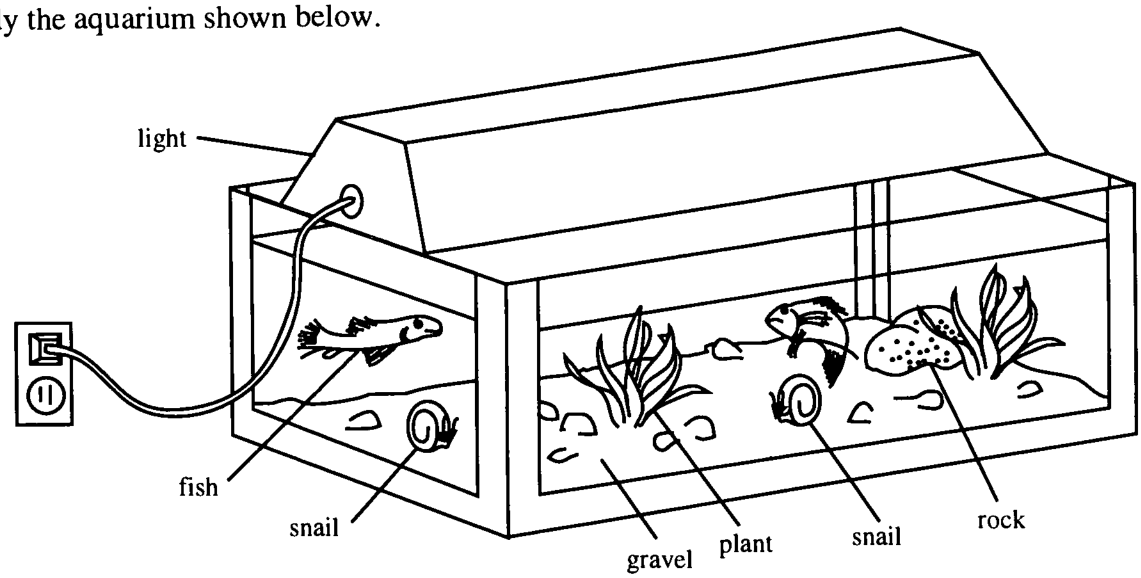
A good response to Question #2 should demonstrate correct understanding of the principles of insulation behavior of a material with respect to the color of the material. In this case the clear soup container needs to be wrapped completely in a material that contributes to the container retaining heat (keeping it warm). The student would also describe how they would wrap the material around the container.

A good response to Question #3 should compare favorably holistically to the parameters in the Science Portfolio Scoring Guide.

Criterion	**Rubric Summary for Question #1, #2, & #3**
1.	Question #1 (Correct interpretation of the experimental results OR Correct identification of an uncontrolled variable)
2.	Question #1. Explains, using good science, why the material chosen is best at blocking (i.e., reflecting for white paper OR absorbing for thicker paper) heat and refers to experimental data.
3.	Question #2. Explains, using good science, why and how to use the chosen material to keep the soup in the clear container warmer longer.
4.	Question #3. Supports response to Question #2 with designing and conducting a fair test of the chosen material to keep the soup warmer longer.

Aquarium

Study the aquarium shown below.



The plants use energy from the light to make their own food. When they do this, they use carbon dioxide and produce oxygen. This process is called photosynthesis.

The fish eat the plants. The snails eat the waste produced by the fish. Both the fish and the snails use oxygen and produce carbon dioxide. This process is called respiration.

The aquarium is in *balance* when:

- the amount of oxygen produced equals the amount of oxygen used; and
- the amount of carbon dioxide produced equals the amount of carbon dioxide used.

Use the information and your observations of the aquarium above to complete the following questions.

Questions

1. Look at the illustration of the Aquarium above. Which of the objects or organisms labeled in the illustration does not affect the balance in the aquarium?

2. Suppose the plants are removed. Explain a likely effect this will have on the fish after a few hours.

3. A best friend of yours predicted that plants in the aquarium will most likely die if the aquarium light is removed. Help your friend explain why they made this prediction. Include in your explanation . conditions that might make this prediction incorrect.

4. Suppose another plant is added to the aquarium. Describe what might happen to the balance of carbon dioxide and oxygen.

5. Suppose the aquarium is balanced. What will happen to the balance of the aquarium if more fish are put into it? Why will this happen?

An Investigation of the Growth of Yeast

You and your best friend have just started a bakery business for fun and profit. You hope to sell homemade baked goods to your family, friends, and neighbors. As part of completing your research on the background and use of yeast in the bakery industry, you discover that yeast is important to the rising of bread, rolls, and other tasty morsels.

Yeast is a living one-celled organism that produces carbon dioxide gas and alcohol as a result of its "eating habits." The holes in bread are really spaces where carbon dioxide bubbles were trapped.

Working in a group, you will use yeast to produce carbon dioxide. You will verify the presence of carbon dioxide using an indicator called *bromothymol blue* (BTB). BTB will turn light green or yellow in the presence of an acid formed by carbon dioxide and water.

Complete procedures, including safety and clean-up, and answer the questions below as directed by your teacher.

Procedure:

A. Label one of the test tubes as "1A", one as "2A", one as "1B", and one as "2B". Do not label the fifth test tube.

B. A *water bath* is a container of water at a given temperature. An object is placed in the water bath in order to keep the object at the temperature of the water. To prepare a water bath, pour warm tap water into the plastic cup. Adjust the water's temperature to 40° C by adding hot or cold tap water as needed. Total volume of the 40° C water should be at least 200 mL.

C. To Test Tubes 1A and 2A, add 20 mL of distilled water. Place Tubes 1A and 2A in the water bath, as shown in Figure A.

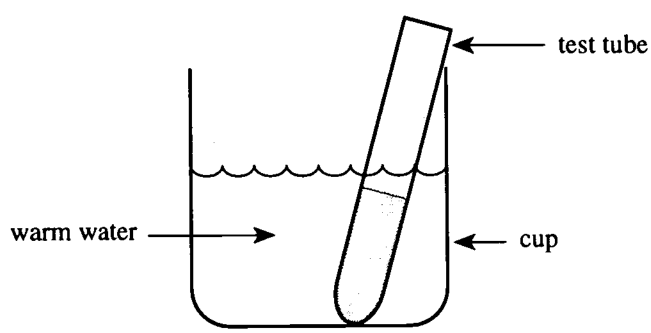


Figure A

Keep the tubes in the water bath when they are not in use. From time to time, check the temperature of the water bath, and add hot water to the water bath as needed to keep the temperature near 40° C.

D. **Add yeast and sugar to Test Tubes 1A and 2A in the amounts specified in Table 1 on the next page**. Using the glass rod, **gently** stir the contents of each tube. (**NOTE**: To avoid contaminating the contents of one test tube with the contents from another tube, after you stir the contents of any test tube, thoroughly rinse the stirring rod with clean tap water and then dry the rod.

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An Investigation of the Growth of Yeast

Table 1

Test tube	Volume of water (mL)	Water temperature (°C)	Amount of sugar (teaspoons)	Amount of yeast (teaspoons)
1A	20	40	none	1/4
2A	20	40	1/4	1/4

E. Measure the temperature in each tube. **Record the temperatures in Table 2 below.**

NOTE: To avoid contaminating the contents of one test tube with the contents from another tube, thoroughly rinse the thermometer with clean tap water and then dry the thermometer after each measurement.

Table 2

Test tube	1A	2A
Temperature (°C)		

F. Squeeze as much air as you can out of one of the two balloons. Place the balloon over Tube 1A, so that any gas that escapes from Tube 1A will be trapped by the balloon and cause the balloon to inflate. Repeat the procedure using the other balloon and Tube 2A.

Set the water bath containing Test Tubes 1A and 2A aside for 10 minutes, to allow the yeast time to make carbon dioxide.

G. While you are waiting, drop 5 mL of BTB indicator into the unlabeled test tube. Using the straw, gently blow air into the BTB for one minute and observe any color change. **Record your observation in the following space.**

The change occurs when carbon dioxide in your breath dissolves in the BTB and changes it to a weak acid (lowers its pH). When you are finished with this step, carefully rinse the test tube and set it aside.

H. To maintain the 40° temperature of the water bath, quickly pour some of the bath water out and replace it with hot tap water. Measure the temperature of the water bath, making sure that it is 40° F. Allow the contents of the tubes to react for another 10 minutes. While you are waiting, do Steps I and J. (**Note:** Make sure that foam and bubbles do **not** get into the balloons. When the foam gets close to the top of the tube, the balloons should be pinched off or tied off.)

An Investigation of the Growth of Yeast

I. Drop 5 mL each of BTB indicator into Test Tubes 1B and 2B. Set these test tubes aside.

J. Observe the contents of Tubes 1A and 2A and **record your observations in the Data Table below.**

K. Carefully pinch off Tube 1A's balloon, so that no gas can escape from the balloon. Remove the balloon from Tube 1A and attach it to Tube 1B. Repeat this procedure with the other balloon, moving it from Tube 2A to Tube 2B.

L. Turn Tube 1B upside down and let the BTB solution run into the balloon. After 30 seconds, turn the test tube right side up again and let the BTB solution flow back into the test tube. **Record your observations in the Data Table below.**

M. Repeat Step L for Tube 2B.

Data Table for Yeast Investigation

Test Tube	Observations (color, bubbles, etc.)	Test Tube	Observations (color, bubbles, etc.)
1A		1B	
2A		2B	

Questions

Please answer the following questions by yourself.

1. Describe the difference between the contents of Test Tubes 1A and 2A, and explain the purpose in having this particular difference.

2. For yeast cells that are growing in a sugar solution and producing alcohol, Figure B below shows the relationship between the number of live yeast cells per mL of solution and time.

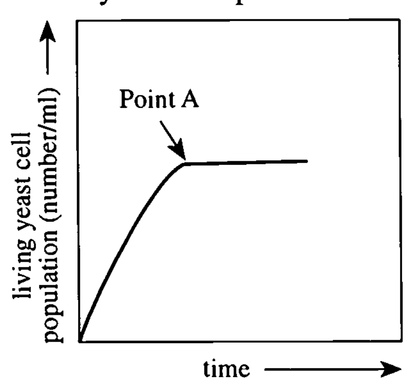


Figure B

Describe two conditions that could prevent the number of living yeast cells per mL from increasing with time beyond Point A.

3. Conduct background research on the use of yeast in the bakery industry. In your summary of this research, include a discussion of these questions: 1) Why are yeast important to the baking industry? 2) What are consequences of using yeast? 3) What are some alternatives to using yeast?

Tomatoes

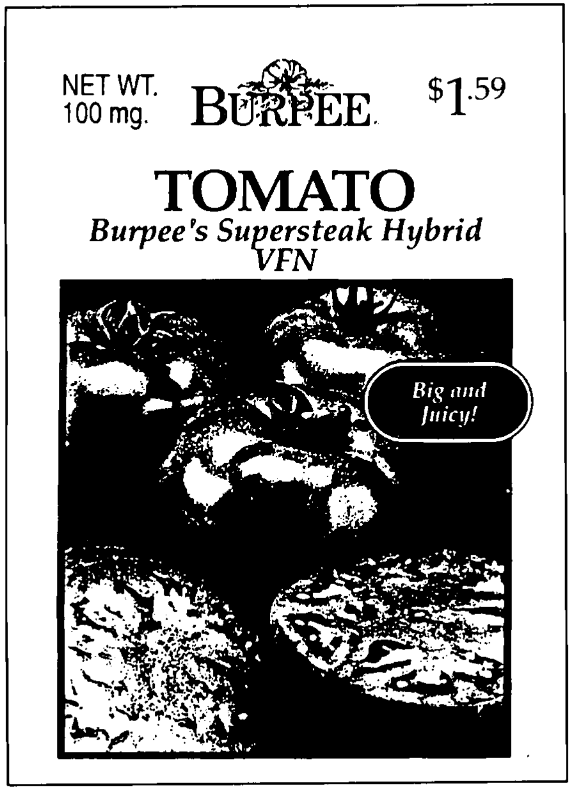
You want to grow your own food and must be sure to include certain plants in a small area.

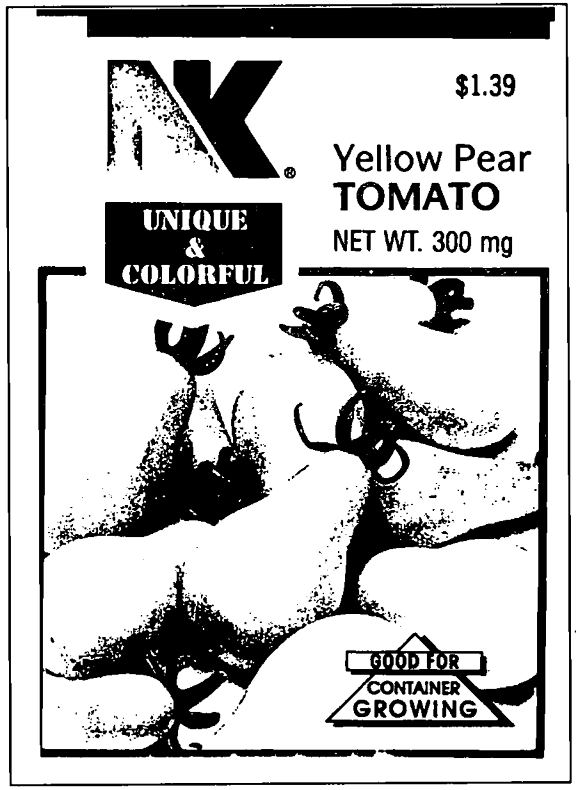
- You choose a place that is 3 meters wide and 4 meters long.
- About six weeks ago you planted three kinds of tomato seeds in pots inside your house. You planted small cherry tomatoes for salads, large red tomatoes for sandwiches, and yellow tomatoes because your friend likes those best.
- You saved the empty seed packages because important information is written on the back of each package.

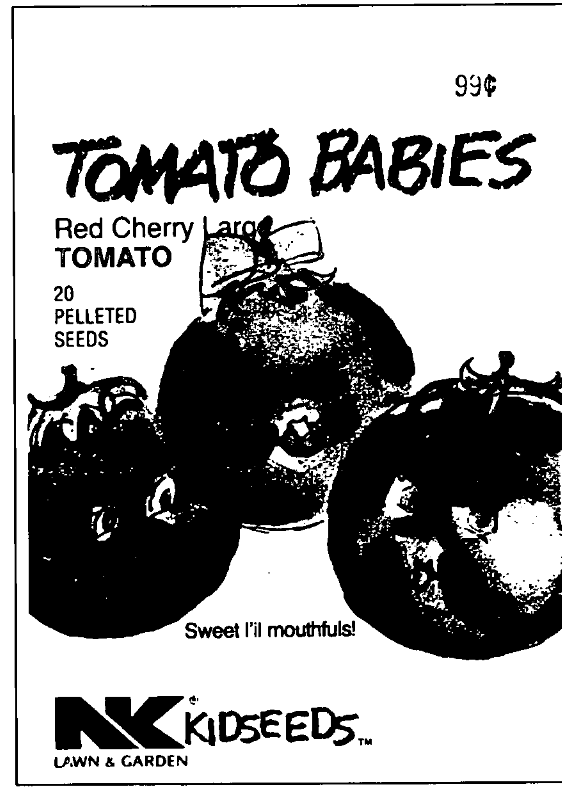
When these plants are about 15 centimeters high, it is the time to plant the seedlings in your garden.

Use the information on the seed packages to help you design your garden. You will need to consider how tall each type of plant will get and how much space to leave between plants. Design the garden to contain as many plants as possible.

Turn the page to see your seed packages and garden plot.







Red Supersteak Tomatoes

This type of tomato grows best in sunny areas.

Plant the seedlings 20 cm apart. They will grow 60 cm tall.

They will be ready to eat in 80 days.

Yellow Pear Tomatoes

This type of tomato grows best in sunny areas.

Plant the seedlings 60 cm apart. They will grow 30 cm tall.

They will be ready to eat in 52 days.

Red Supersteak Tomatoes

This type of tomato grows best in sunny areas.

Plant the seedlings 50 cm apart. They will grow 50 cm tall.

They will be ready to eat in 48 days.

Tomatoes

Questions

Answer the questions below as directed by your teacher.

1. Draw a picture of your garden in the rectangle below labeled "Garden." Use your ruler to draw the picture of your garden to scale. Make sure you label everything!

Garden

Scale for this drawing: 4 centimeters on your ruler = 1 meter in the actual garden

2. Explain why you designed your garden the way you did.

3. List two factors that might increase the number of tomatoes you could grow in your garden. Explain how you would design a test to find out if one of the factors you listed above increases the number of tomatoes you could grow in your garden.

Soil Types

Soil is a mixture of weathered rock and decayed organic material. Organic material typically consists of decaying parts of plants and animals. Some soils have a high percentage of organic material. Other soils have very little organic material. The amount of organic material affects the ability of the soil both to support plant growth and to retain water. In this event you will determine which of three soil samples can hold the most water. Soil A is sand. Soil B is a mixture of sand and potting soil. Soil C is potting soil. Compared to the sand, the potting soil contains more organic matter.

Complete procedures, including safety and clean-up, and answer the questions below as directed by your teacher ***Use the provided or make a quarter-sized disc for Steps 1 and 2.***

1. Place the quarter-sized disc on the outside bottom of a Styrofoam cup. Use the pen to trace the outline of the disc on the cup. Repeat this procedure for the other two cups.
2. Using this circle as a guide, use the pushpin to make eight equally spaced holes around the circle's edge. Repeat for each cup.

3. Place a different soil sample in each cup.
4. Mark the paper towels A, B, and C. Remove a one-teaspoon sample of each soil type and place each sample on the appropriate towel. Keep the three soil samples separate. You will use these samples in Step 9. Now proceed to Step 5.
5. Place the two popsicle sticks on the top of each clear plastic cup so that the popsicle sticks can support a Styrofoam cup. Set each of the Styrofoam cups on the top of one of the clear plastic cups. Make sure the holes you made with the pushpin are not covered by the popsicle sticks. See Figure 1 below.

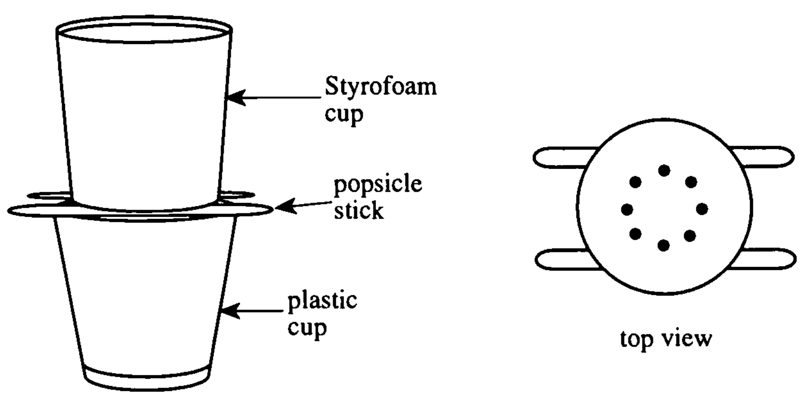


Figure 1

6. Locate the Data Table for Steps 7 and 10 in Section A on the next page. Your data will be recorded in this table.

STOP!!! *Timing is important here!* You will need to begin timing your experiment as soon as you see water emerging from your soil sample. **Read the next few steps before you pour any water** so that you are prepared to time your experiment and record your data.

Soil Types

7. Have a clock with a second hand in sight or a digital stopwatch. Slowly and carefully pour 100 mL of tap water over the soil in each cup. **Record the time that you start pouring the water into each cup and the time that the first drop of water drips into each plastic cup.**

8. Let the cups sit for exactly 5 minutes.

9. While you are waiting, use the magnifying lens to closely examine the soil samples that you saved on the paper towels. Examine each sample and describe the makeup of each sample. Record your observations in Section B below.

10. After 5 minutes, remove the cup containing the soil. Use the graduated cylinder to measure the amount of water in each plastic cup and record it in the data table.

Laboratory Data

Section A

Data Table for Steps 7 and 10

Soil sample	Time water added	Time for first drop	mL of water captured after 5 minutes
A			
B			
C			

Section B

Observations of Soil Types for Step 9

Soil Sample A:

____

____

____

Soil Sample B:

____

____

____

Soil Sample C:

____

____

Soil Types

Questions

Please answer the following questions by yourself.

1. Which soil was most able to retain water? Which soil was least able to retain water? Consider the properties of the soils that you observed with the magnifying lens. In what ways, if any, are these properties related to the soil's relative ability to retain water? Provide evidence for your answers.

2. Write a conclusion that you could draw about the relationship between the amount of organic matter (pieces of plants and/or animals) and the water-retaining ability of the soils that you tested. Use your data and observations to defend your conclusion.

3. The heating and cooling effect of sunlight shining on different parts of the earth's surface varies. List two soil factors that might affect the rate of soil heating/cooling caused by sunlight. Explain how you would design and conduct a test to see if one of the factors you listed increases the rate of heating/cooling caused by sunlight shining on different soil types under similar conditions.

4. Discuss two potential connections between your findings in this investigation and patterns of world wide plant growth/populations.

Molds to the Rescue

The growth of mold on bread, cheese, fruits, and other substances is very common. But in 1928, the growth of one particular mold became a very special event.

Sir Alexander Fleming was a Scottish physician and bacteriologist, specializing in the treatment of wounds by antiseptics, who served in the Royal Army Medical Corps during World War I. Antiseptics are substances that destroy microscopic organisms (microbes) that cause disease. He noticed that many antiseptics injured the body cells even more than they injured microbes. He searched for a chemical substance that would destroy infectious bacteria without destroying human tissues or weakening the body's defenses.

In 1928 Dr. Fleming was working in his laboratory, studying colonies of bacteria that he had grown in petri dishes. He was through with one particular dish and was about to discard it when he noticed that some specks of a blue-green mold were growing in it. Although bacteria covered most of the bottom of the dish, around each speck was a clear ring where no bacteria were growing. Dr. Fleming isolated the mold and eventually identified it as being *Penicillium notatum*, closely related to the common variety often found growing on oranges. He hypothesized that the mold made a substance that destroyed bacteria. He called the substance penicillin.

Dr. Fleming cultured the mold and tried to grow various types of bacteria near it. Some types of bacteria grew well near the mold, while others did not. He also studied the effect of the mold on white blood cells and found that penicillin did not adversely affect white blood cells.

This mild drug, penicillin, has been called the "miracle-worker" and the "wonder-drug," because of its power to rapidly cure infection without harmful side effects.

1. According to the passage, what is the major advantage of penicillin?

2. According to the passage, what effect on human health concerned Dr. Fleming enough to begin his research?

3. By culturing *Penicillium* mold with different types of bacteria, Dr. Fleming found that:

4. What observation lead Dr. Fleming to conclude that the *Penicillium* mold may have been producing a substance that killed bacteria?

5. How did Fleming know that not all the bacteria in the dish containing *Penicillium* were dead?

6. Based on Fleming's results, can one generalize that all types of mold produce substances that kill germs?

Short Answer

7. Bleach is an effective disinfectant that can be used to kill disease-causing microbes in the home. Why would you **not** recommend the use of bleach to treat severe wounds?

Propeller

A toy company wants to test a new toy. It is called a *propeller pack*. Your group has been asked to help.

Complete procedures, including safety and clean-up, and answer the questions below as directed by your teacher.

Step 1. Put together the battery, wires, motor, and propeller so that the propeller will spin. Use tape to hold the wires in place and to hold the motor down on the edge of the table.

Step 2. In the box below, draw a picture of how you put the pieces together. Be sure to label all the parts and show which way the propeller spins. You can hold the tissue paper in front of the propeller to see if the propeller is blowing air out or in.

Picture of Setup from Step 1

Propeller

Step 3. Use the same pieces from Step 1, but change the setup so that the propeller spins in the opposite direction.

Step 4. In the box below, draw your setup from Step 3. Be sure to label all the parts and show which way the propeller spins. You can use your tissue paper again.

Picture of Setup from Step 3

When you are finished, return to your desk. You will be asked to answer some questions.

Propeller

Questions

Please answer the following questions by yourself.

1. What did you do to make the propeller spin in reverse? Describe how you changed the way you put the pieces in your kit together to make the propeller spin in reverse.

2. If you hooked up only one wire to the propeller motor, the propeller would not spin. In the box below, draw a picture of the setup with only one wire hooked up. Be sure to label all the parts. Then on the lines below the box, tell why the propeller would not spin.

Seesaw

Andy and Maria like to play on the seesaw, but Andy is heavier than Maria. Maria always ends up in the air. Andy always ends up on the ground. See Figure 1.

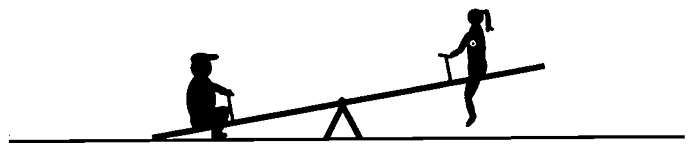


Figure 1

Help them balance their seesaw.

Complete procedures, including safety and clean-up, and answer the questions below as directed by your teacher.

Step 1. Tape the pencil on the bottom of the ruler. See Figure 2. Be sure to use the inches scale so that the pencil is right in the middle of the ruler (at the 6-inch mark).

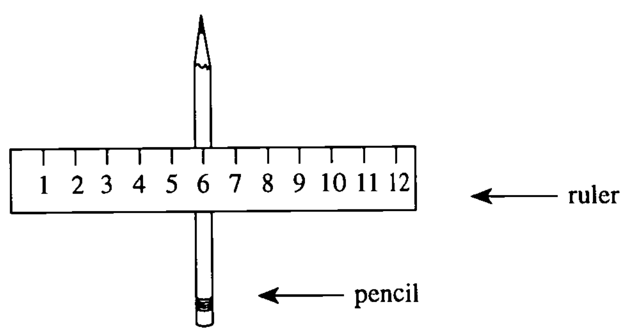


Figure 2

Step 2. Lay the pencil on the table. Be sure the numbers on the ruler face up. This is the seesaw. In the next steps you will add weights to the seesaw. Pretend that the weights are people.

3C6

Seesaw

Step 3. Put the 10-gram weight at the 1-inch mark. Tape it in place. See Figure 3.

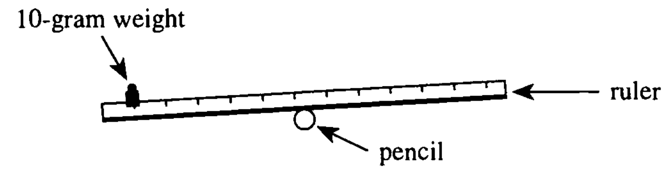


Figure 3

Put the 20-gram weight on the 11-inch mark, but do not tape it down. See what happens. The ruler should tip.

Move the 20-gram weight along the ruler toward the pencil. Try to make the seesaw balance. Write down where the 20-gram weight is when the seesaw balances. Be sure that you are reading the inches scale.

____

Step 4. Repeat Step 3 using the 30-gram weight. Write down where the 30-gram weight is when the seesaw balances. Be sure that you are reading the inches scale.

____

Step 5. Go back to your desk. You will be asked to answer some questions.

Questions

Please answer the following questions by yourself.

1. Look back at Step 3. Where did you put the 20-gram weight to make the seesaw balance?

____

Look back at Step 4. Where did you put the 30-gram weight to make the seesaw balance?

____

2. Suppose you have a 40-gram weight. Where would you predict you would need to put it to make the seesaw balance? Use your results from Step 3 and Step 4 to help you make your prediction.

3. Look at Figure 1. Help Andy and Maria. Tell them how they can make the seesaw balance. Explain why your idea would work.

Insulation

Insulating containers are used to keep hot foods hot. They are also used to keep cold foods cold. A thermos is one kind of insulating container. Insulation is a material used to prevent or lessen the flow of heat.

You have been given three materials: white paper, black paper, and aluminum foil. You must find out which material prevents or lessens the flow of heat the best. You have an electric lamp to serve as a heat source. Follow the directions below and then answer the questions.

Complete the activities safely and answer the question(s) below as directed by your teacher.

Step 1. You have three thermometers. Securely stand each thermometer upright in a large base (e.g., made of clay) placed near the center of your table. The bulb end of each thermometer should be upright, exposing the bulbs to the air.

Step 2. Read the temperature on each thermometer. Use the Celsius scale (°C). Write each temperature in the table below.

Step 3. Wrap the first thermometer with black paper. Wrap the second thermometer with white paper. Wrap the third thermometer with aluminum foil. Wrap each thermometer the same way. Use tape to hold it together.

Step 4. Put each wrapped thermometer 20 centimeters from the light bulb of the electric lamp. Predict which thermometer will stay coolest. Write your prediction below the data table. Then turn on the lamp for 3 minutes.

Step 5. After 3 minutes, turn off the lamp. Read the temperature on each thermometer. Carefully unwrap each thermometer so that you do not burn your fingers! Use the Celsius scale (°C). Write each temperature in the table below.

Your Results

Thermometer	Temperature from Step 2 (°C)	Temperature from Step 5 (°C)	Temperature Difference (C°)
First (black paper)			
Second (white paper)			
Third (aluminum foil)			

Prediction for which thermometer will stay the coolest:

Questions

Please answer the following questions by yourself.

1. Which material prevented or lessened the flow of heat the best? How did the investigation turn out compared to your prediction? Explain why you think so. Be sure to tell about the temperatures of each thermometer in Step 2 and Step 5, and the temperature difference (change) of each thermometer between Step 2 and Step 5.

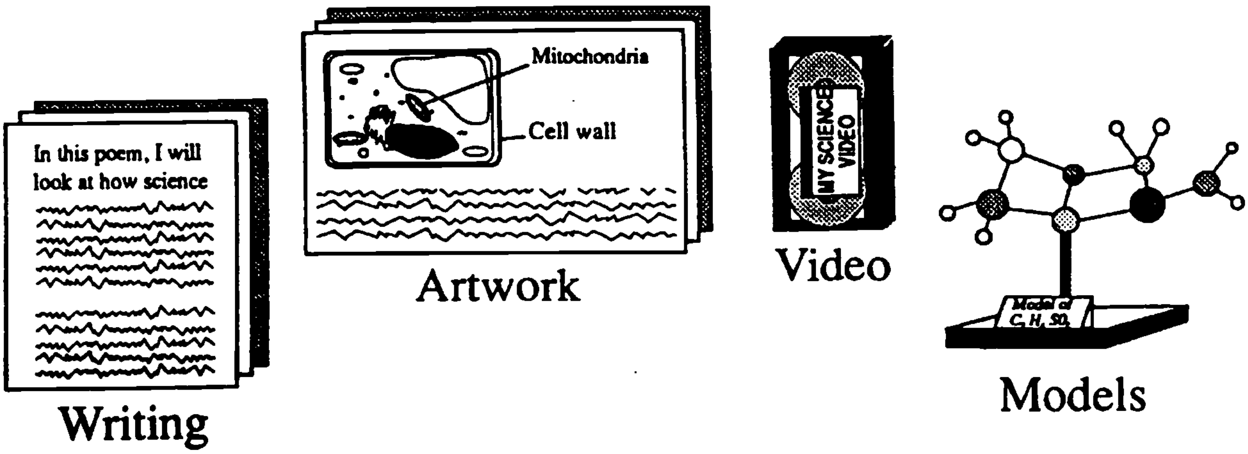
2. Suppose it is a cold day. You will be outside for the afternoon. You have hot soup in a clear plastic container, and you want your soup to stay warm. Tell how you could wrap the container of soup to keep the soup warm. What would you use? How would you do it?

3. Describe how would you design and conduct a fair test of your answer to Question 2?

Type 3

Sixth Grade Science

Competency-Based Education Assessment Series



Substantive Application-Based Performance Tasks

(Open-Ended)

Characteristics

- Relevant inventive and creative applications, requiring experimental research, non-experimental research, and more out-of-class preparation
- Holistic scoring (e.g., portfolio scoring guide and interviews)

Item discussions provide an overview of items, pertinent content, and scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart*. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments are focused on *Science Portfolio Scoring Guide* parameters, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with *Science Portfolio Entry* types, instructional strands, and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Sixth Grade Type 3 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s) Sixth Grade*
Page(s) 1	🗁						
Moldy Oldies	1	See Discussion	Extending	3, 4	I: 2, 3, 4, 5, 6, 7, 8, 10 K: 7, 8, 9, 11 C: 1, 2, 3, 4, 8, 9, 11, 13, 14 A: 3, 5, 6, 7	Change Over Time	N: 2, 3, 4, 5 P: E: L: 16
Page(s) 2	🗁						
What Grows Well Where and Why?	1	See Discussion	Extending	3, 4, 7	I: 5, 6, 7, 9, 10 K: 2, 3, 4, 5, 6, 8, 10, C: 1, 3, 4, 5, 6, 7, 9, 13, 14 A: 4	Models, Systems and Interactions, Patterns	N: 1, 5 P: E: 12, 13 L: 17
Page(s) 3	🗁						
Motion Toys	1	See Discussion	Extending	1	I: 2, 3, 5, 6, 7, 8, 9, 10 K: 1, 3, 4, 7, 8, 12 C: 1, 2, 4, 6, 8, 9, 12, 13 A: 1, 5, 7	Models, Systems and Interactions	N: 2, 5 P: 6, 7, 8, 9 E: L:

• *Performance* Objectives: Grade 6 — ***Ohio's Model Competency-Based Science Program***

1. The learner will predict and test the effects of influences on the motion of selected objects (e.g., rubber band-powered vehicles, hygrometers, sailboats, tropisms, flowing water).
2. Provided with examples of patterns in natural phenomena (e.g., period of a pendulum, variation in populations, the spread of disease, Logo fractals, position of the moon, reflection, refraction, interference patterns), the learner will design and perform an investigation to document the constancy of the pattern.
3. The learner will identify a community problem (e.g., recycling, water quality, animal and plant overpopulation and competition, extinction, urban growth, soil conservation, transportation issues, physical recreation opportunities) and propose a solution for that problem using information collected to support their proposal.
4. Given a collection of data presented in tabular or graphic form, the learner will make inferences to explain the events or phenomena from which the data was collected.
5. Given the observations of witnesses and related evidence, the learner will identify the impact of different perspectives on explanations of an event.
6. Presented with different versions of a historical event in science or technology, the learner will discuss the impact of scientific and social context at the time of the event.
7. Given a set of data and a set of attendant conclusions, the learner will verify or refute the accuracy of the conclusions.

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Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description: Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

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Item Discussion

Item discussion on the following pages pertains to SIXTH GRADE SCIENCE TYPE 3 MODEL COMPETENCY ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content. Parameters for holistic evaluation of student work are suggested in the *Science Portfolio Scoring Guide*.

Science Portfolio Framework

(Used with permission from the *CCSSO SCASS* Science Portfolio materials.)

RATIONALE. A science portfolio assessment strategy supports improved proficiency performance. A portfolio supports science program implementation, framing teachers' on-going guidance and suggestions to keep students' work manageable, productive, and relevant to the objectives for student learning. Portfolio interfaces with previous assessment development*. A portfolio allows holistic assessment of students' doing and knowing science. (*Note: Examples of potential science portfolio work included in the **SIXTH GRADE** TYPE 3 MODEL ASSESSMENTS are marked with a folder icon, 🗁, in the accompanying *Content Summary Charts*.)

ASSUMPTIONS. Potential science portfolio entries will result from a combination of teacher initiated questions and student initiated questions. Students will learn and extend self-evaluation skills. The student's **final science portfolio** contains his or her choices of the best four products, with revisions, to represent his or her science learning. These products are selected from among all the learning activities and demonstrations he or she completes over a set time period (i.e., quarter, semester, year). Products are selected as **portfolio entries** and placed in one of the four categories of science work described below.

- 🗁 **Investigation** — Experimental research: Requires students to design, carry-out, and report results of an observational and/or experimental process.
- 🗁 **Research** — Non-experimental research: Requires students to access, analyze, synthesize, evaluate, and use the kind of information the average citizen might use to investigate and solve a problem of personal or societal significance. Students also identify alternatives, trade-offs, and make a decision regarding an issue.
- 🗁 **Application** — Inventive or expressive in nature: Requires students to choose a manner of demonstrating what they *can do*, what they *can apply*, and how thoroughly they *can justify* their thinking. An inventive application allows students to show how scientific information can be used to solve real-world problems. An expressive application allows students to communicate scientific information in a medium of his or her choice. His or her work includes a written or verbal description of the scientific basis for the entry.
- 🗁 **Open Choice** — Students may use this entry to provide further evidence of his or her science learning. This entry may be another piece of the previously described categories of science work.

Each entry is accompanied by the student's **entry summary** (self-evaluation). Students discuss how well the entry reflects the *Science Portfolio Scoring Guide's* **four parameters**

- Depth of Understanding
- Evidence of Inquiry
- Communication
- Relevance to Society

- 🗁 **Portfolio Summary** The *fifth entry* of the students' final science portfolio: The student writes his or her **portfolio summary** to illustrate how the final portfolio entries reflect one or more of the above **four parameters.**

Teachers, parents, and administrators can use the Portfolio Summary as a road map of the how students' final portfolios demonstrate progress toward the objectives of instruction. The act of scoring students' final science portfolios may be mediated by teachers (and others) holistically comparing students' final portfolios to the suggested parameters in the *Science Portfolio Scoring Guide*. In this process take into consideration that each student entry need not reflect all parameters or all indicators for all parameters in the *Science Portfolio Scoring Guide* (i.e., the *Guide* is not intended for use as a checklist).

EXAMPLE STUDENT PORTFOLIO: Models, Systems and Interactions *

- 🗁 **Example Portfolio Summary Outline**

Students discuss examples from his or her portfolio entries that demonstrate their understandings of those processes in which some properties and behaviors of things change while other properties and behaviors remain constant. In this discussion, students present evidence from across his or her **four entries** to illustrate one or more of the **four parameters** (see *Science Portfolio Scoring Guide*). In the process students answer the following questions

- **Examples of Student Entries** (*Examples result from a combination of student and teacher generated questions*):

  🗁 **Investigation Entry** Students make observations, use tools, collect data, and use evidence to support conclusions about the properties and behaviors of objects not directly observable (e.g., *The Black Box*).

  🗁 **Research Entry** Students devise and use models of objects and groups of objects to describe and make predictions about seasons, eclipses, and motion of planets observed in the sky (e.g., *The Solar System*).

  🗁 **Application Entry** Students make use of creative and inventive communication tools to illustrate order and organization in the universe (e.g., *Cosmic Comic*).

  🗁 **Open Entry** Students discuss a problem of personal interest illustrating relevant science knowledge (e.g., *The Tai Kwan Do Hook Kick*).

*In this example student portfolio, the unifying concepts that glue the objectives of classroom instruction and learning activities are models, systems and interactions. These unifying concepts are not the topics of instruction. Separate topics that are taught in classrooms can be tied together with these unifying concepts.

START-UP SUGGESTIONS

DEFINE THE GOALS AND OBJECTIVES THAT YOU WANT THE PORTFOLIO TO DEMONSTRATE. Think about existing opportunities for students to become familiar with the targets of their science learning.

DECIDE ON THE LOGISTICS AND RESPONSIBILITY OF THE PORTFOLIO. Time and space needs for completion and storage of portfolios should be addressed. Also, think about existing opportunities for potential science portfolio entries to come from a combination of teacher initiated questions and student initiated questions. Teachers continue to offer on-going guidance and suggestions to make student's work manageable, productive, and relevant to the objectives for student learning.

BE SURE TO COMMUNICATE YOUR EXPECTATIONS CLEARLY TO STUDENTS, PARENTS, AND ADMINISTRATORS. Think about existing opportunities for sharing the parameters in the Science Portfolio Scoring Guide relevant to the science program objectives for student learning.

THINK BIG; START SMALL. EXPERIMENT UNTIL YOU FIND A FORMAT AND PACE THAT IS COMFORTABLE FOR EVERYONE. Think about existing opportunities for students to start, receive feedback, revise his or her work, and practice self-evaluation skills.

Item: Moldy Oldies

Item Description:

The student is required to prepare a detailed description of an experiment (i.e., a list of materials and equipment used; step-by-step procedures followed; factors observed and method of observation; safety considerations); results of the experiment, including illustrations showing damages in mold growth over time; conclusions about conditions that inhibit mold growth; recommendations; alternative comparisons.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide*.

Scoring Parameters

- Student uses good science to describe mold growth.
- An experiment was performed and relevant information was found. Student has used evidence from experimentation, made accurate interpretations and application of science principles to describe and support conclusions about conditions that favor growth on mold (e.g., temperature, humidity, presence of air, presence of fats, presence of sugars). Alternative strategies to prevent mold growth are explored. Safety for self and others is demonstrated.
- Student discussion of the details of the experiment is clear, focused, and organized. Safety considerations for self and others is discussed. Illustrations are used to show mold growth over time.
- Student makes a recommendation to the school bakery for storing baked goods to prevent mold growth. Consequences and alternatives of two strategies are compared.

Item: What Grows Well: Why and Where?

Item Description:

A good response will include 1) a map accurately depicting regions of productive and unproductive land; 2) a chart comparing productive and nonproductive land; 3) a list of 5 different crops including a discussion of growth requirements, nutritional value, and soil; and 5) a plausible proposal to the UN with a summary or conclusion of the report.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide*.

Scoring Parameters

- Student uses good science to accurately depict and describe regions of productive and unproductive land; 5 different crops and growth requirements.
- Student has used evidence from research, made accurate interpretations and application of science principles in formulating a plausible recommendations to the UN.
- Student summary demonstrates clarity, focus, and use of media to enhance communication of a recommendation to the UN.
- Student made multiple connections and provided background information in the recommendation relevant to global issues (e.g., social, cultural, economic, environmental impact)

Item: Motion Toys

Item Description:

This item assesses the student's understanding of forms of energy and energy transformations; factors affecting the motion and stability of the propeller driven toy. Factors that affect safe use of the toy by a child of 6 to 10 years of age include such factors as power system, shut-off controls, speeds, masses, shapes, types and strengths of materials, its physical dimensions, and its stability.

Evaluation of the students' products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide*.

Scoring Parameters

- Student uses good science to describe an inventive toy.
- Student has used evidence from experimentation, made accurate interpretations and application of science principles to design of the toy.
- Student discussion of the operation of the toy demonstrates clarity, focus, and the use of media to enhance communication of safe operation and assembly instructions, if needed.
- Student has designed an inventive toy that can be used safely by a child of 6 to 10 years of age

Moldy Oldies

You and your classmates are running the school bakery. You sell crackers, bread, rolls, doughnuts, and croissants. The bakery is profitable, but you are running into problems. Your bakery products are molding quickly in storage. Therefore, you decide to design and conduct experiments to investigate mold growth on bakery products and how to prevent it. You will report your findings in writing to the other students.

Prior to writing your report, you will need to identify at least one factor that may promote the growth of mold on bakery products and one factor that may prevent mold growth. You should set up an investigation in which you observe how well each of these factors either promotes or prevents mold growth. Run your investigation and record your observations. When you have completed your investigation, write your report.

Your report should include the following parts.

1. A detailed description of the experiments you performed, including a list of the materials, equipment, procedures, and information references you used. Be sure to identify the factors you observed and how you made your observations.

2. The results of your observations, including illustrations that show any changes in mold growth over time.

3. Your conclusions as to the conditions that favor mold growth on your products and the conditions that prevent mold growth.

4. Your recommendations to the school bakery for storing the baked goods to best prevent mold growth. Include in your recommendation a discussion of another method that could be used to prevent mold growth. Your discussion should compare what you think the results might be if your recommendations were tried. As you make your comparison think about the likelihood of mold growth, spoilage due to mold, training needs for bakery workers, impact on nutrition and health, costs.

What Grows Well: Where and Why?

World hunger has become an ever-increasing problem. Many people do not understand what factors influence plant and crop growth. The United Nations is very interested in the problem of global hunger and what can be done to alleviate it. The U.N. has created a Global Food and Hunger Council to investigate solutions to this problem.

Your group is to determine what is needed for productive plant and crop growth so that new areas can be cultivated. During the next few weeks, your group will be looking into several different factors that may influence the growing capabilities of the land. Once you have conducted your research and come to your conclusions, you will be able to advise the UN about new areas that can be cultivated.

Part I: Locating the Fertile Soil

Create a map of the world, including a key to identify areas of the world that are rich producers of crops and areas that are poor producers of crops. Use a Venn Diagram or other chart to compare and contrast the regions.

Part II: Possible Factors that Influence Land Productivity

Some factors that may influence plant growth include weather patterns; topography; lake and river systems; time (the geology of the area and what the land was like millions of years ago); and how different types of crops that are presently grown on the land influence soil fertility. Using this information, create a chart that compares and contrasts productive and unproductive land. In a written report, describe the patterns you see.

Part III: New Plant Requirements

Do research to determine how five basic crops (for example, wheat) can help sustain human life. Describe the crops as to their growth requirements, life spans (from seed to maturity), effects on soil, and nutritional value.

Part IV: Compiling Data, Making Recommendations

Once you have determined what makes land productive or unproductive, and what plants can be used to sustain human life, you will be able to make recommendations for locations for new farms. Your report to the U.N. should summarize your findings. It should include properties of fertile and infertile land; suggestions for new locations to grow crops (including the type of crop that should be planted there); possible supplements to support crop growth in that area; and any other factors the U.N. should consider. Your recommendations should be supported by charts, graphs, maps, and other visual aids.

Part V: What to Submit

Your group's final report for the UN Global Food and Hunger Council should be turned in to your teacher along with all the information and data you collected during the study.

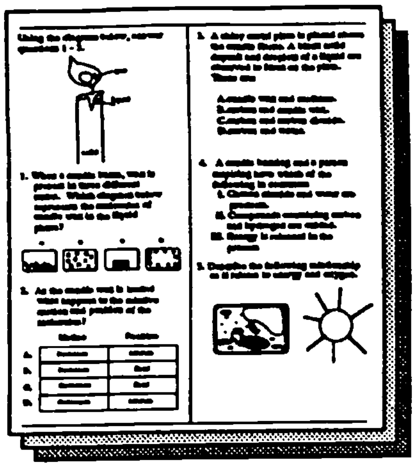
Motion Toys

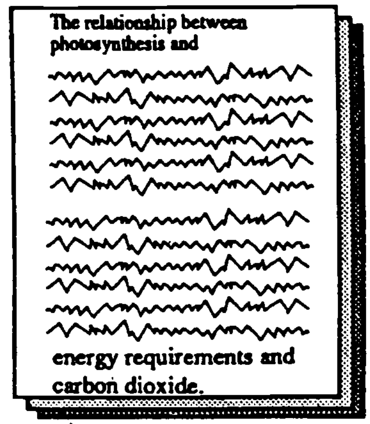
A toy company called your school. They want to invent, test, and sell a new toy. It is called a *propeller pack.* As you probably have already guessed, the toy's motion will be propeller driven. The company has not decided how the propeller will be powered or the kind of toy-like motion the propeller will produce. The toy will be designed for safe use by children of ages 6 to 10 years. The final retail price will depend on the design. Your group has been asked to help.

Your job will be to prepare a written design proposal for a complete *propeller pack* toy. You decide the toy-like motion. You need to decide what will power the propeller pack. Your suggestion, including a detailed drawing, should completely explain how the toy works*; how to assemble the toy; if assembly is required; and how to safely use the toy.

*You must conduct tests, supported by data, to evaluate this portion of your suggestion.

Type 1
Seventh Grade Science
Competency-Based Education Assessment Series





° Multiple Choice, Short Answer and Extended Response °

(Traditional)

Characteristics

- Requiring a minimum of a session
- Scoring with answer keys in combination with (interviews and) rubrics

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments reflect all performance levels, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure district assessments reflect a coherence with instructional strands and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*

• Seventh Grade Type 1 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s) Ninth Grade*
Page(s) 1 - 2							
Butterflies	1	C	Acquiring	2, 3, 7	I: 8 K: 4, 8 C: 3, 5, 8 A: 3	Systems and Interactions	N: 1, 2 P: E: L: 13, 20
	2	D	Processing				
	3	B	Acquiring				
	4	B	Acquiring				
	5	See Discussion	Processing				
	6	See Discussion	Processing				
Page(s) 3 - 4							
Microscopes and Measurements	1	B	Acquiring	3, 7	I: 5, 6, 8 K: 11 C: 5 A: 6	Models and Scale	N: 2, 4 P: E: L:
	2	B	Acquiring				
	3	C	Acquiring				
	4	A	Acquiring				
	5	C	Acquiring				
	6	See Discussion	Processing				
Page(s) 5 - 6							
Star Trek Voyage	1	C	Acquiring	6, 7	I: 4, 7, 8 K: 4, 5, 6, 10, 11 C: 5 A: 7	Models and Scale	N: 2, 4, 17 P: E: L:
	2	A	Acquiring				
	3	B	Processing				
	4	D	Acquiring				
	5	B	Acquiring				
	6	A	Processing				
	7	See Discussion	Processing				
	8	See Discussion	Extending				
	9	See Discussion	Extending				
Page(s) 7 - 9							
Predicting Weather	1	C	Processing	1, 3, 6, 7	I: 6, 7, 8 K: 2, 3, 4, 6 C: 3, 10 A: 1, 2, 7	Constancy	N: 2 P: E: 7 L:
	2	C	Acquiring				
	3	D	Acquiring				
	4	B	Acquiring				
	5	D	Acquiring				
	6	A	Processing				
	7	See Discussion	Processing				
	8	See Discussion	Extending				

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Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*

• Seventh Grade Type 1 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)* *Ninth Grade*
Page(s) 10 - 11							
Phase Equilibrium	1	A	Acquiring	3, 5, 6, 7	I: 4, 6, 8, 9 K: 2, 3, 9 C: 7 A: 1	Constancy	N: 2 P: 12 E: L:
	2	C	Processing				
	3	See Discussion	Processing				
	4	C	Acquiring				
	5	D	Acquiring				
	6	C	Processing				
	7	D	Acquiring				
Page(s) 12 - 14							
Electromagnets	1	D	Acquiring	2, 5, 7	I: 1,2, 4, 5, 8 K: 1, 2, 3, 4, 6, 7, 11 C: 5, 7, 8 A: 1, 2, 6	Patterns	N: 17, 19 P: 10 E: L: 20
	2	C	Processing				
	3	A	Acquiring				
	4	A	Acquiring				
	5	B	Processing				
	6	D	Processing				
	7	See Discussion	Extending				
	8	See Discussion	Extending				

• Performance Objectives: Grade 7 ***Ohio's Model Competency-Based Science Program***

1. The learner will analyze and critique the science presented in the media (e.g., periodicals, advertisements, literary works, cinema, public documents).
2. The learner will design and use procedures to test the suitability of various materials for different purposes.
3. The learner will choose and use appropriate technologies to collect observations regarding a complex system (e.g., the atmosphere or an ecosystem) and use the observations to make predictions about the effects of changes made in various components of the system.
4. Presented with data on the consumption pattern of a resource in the local community, the learner will propose (e.g., written proposal, persuasive materials, videos) a strategy to manage the resource more efficiently and economically.
5. The learner will construct, test, and trouble-shoot a set of procedures for younger learners to use to investigate a common natural phenomenon.
6. Given a set of data on an event or phenomenon, the learner will summarize the data in several meaningful ways (e.g., graphs, tables, narratives, models).
7. The learner will use scientific terminology appropriate to their developmental level to make predictions in a complex system (e.g., weather, ecosystems, inertial, energy).

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Instructional Strands • Grade 7 •

Objectives	*Inquiry* • The learner will:	*Knowledge* • The learner will:	*Conditions* • The learner will be:	*Applications* • The learner will be:
1	predict what might be wrong with an experimental design when observations vary widely, and propose and execute design changes to correct these problems.	investigate principles which describe the impacts of various forms of mechanical and electromagnetic waves on various organisms and objects.	using a diversity of writing styles to communicate scientific ideas.	writing and following instructions (e.g., algorithms, formulas, flow diagrams, and sketches).
2	analyze a variety of divergent explanations for similar natural phenomena.	investigate patterns in nature (e.g., vibrations, probabilities, behaviors, growth, migrations, energy transmission and transformation).	using primary sources and interviews to examine the history of science concepts.	designing, building, and testing working models of structures and systems.
3	store, retrieve and manipulate information with a computer, using various files types (e.g., topical, alphabetical, numerical, keyword files) and use simple files of their own design.	investigate resistance to change in natural and technological systems (e.g., dynamic equilibrium, inertia, electrical resistance).	seeking explanations for conflicting descriptions of the same event.	differentiating between the scientific and non-scientific information found in folklore.
4	utilize mathematical models (e.g., number lines, graphs, and charts) for exploring, organizing and displaying information and identifying trends and patterns.	investigate the interactions of objects and organisms in simple technological and natural systems.	observing and discussing the process of community decision making.	choosing everyday consumer products that utilize recent innovations (e.g., polymers, silicon chips, computer software).
5	utilize analogies to understand how things work.	investigate qualitatively the geometry and regularity of motion found in interactions in the solar system (e.g., planetary motion, comets, satellites).	investigating living and nonliving things holistically and by component structures and functions through (e.g., models, simulations, multimedia, technologies, evidence collection).	making decisions in light of possible outcomes of different genetic combinations of inherited characteristics.
6	make and accurately record observations, inferences, hypotheses, experiences, ideas, and explanations.	investigate the organization within and among the atmosphere, hydrosphere, lithosphere and celestial sphere.	using multimedia and human contacts to investigate how different cultural factors exert influences on scientific perceptions around the world.	choosing, modifying, and inventing tools, instruments, devices, computer-based technologies and procedures that enable student developed investigations to proceed more efficiently.
7	find and read facts and figures in news media, books, or databases, make sense of them, and construct appropriate lists, tables, or graphs.	investigate the properties of new materials as compared with those of the familiar materials.	maintaining records of group investigations (e.g., accounts of processes, results, individual contributions).	analyzing advertisements and technical information to recognize biases and misrepresentation of scientific information.
8	recognize regular occurrences in nature and describe various spatial, behavioral, temporal patterns; formulate their own explanations for them; and offer evidence for their explanations, while remaining open to alternative explanations of others in the group.	investigate the interdependence and similarities of organisms and their physical environments (e.g., mimicry, camouflage).	visiting community workplaces to examine applications and reinforce understanding of scientific concepts.	
9	organize information into simple tables or graph to look for relationships.	investigate the chemical and physical attributes of matter.	asking for clarification of scientific ideas.	
10		investigate the scale of historical time (e.g., years, decades, centuries).	using available communications technology to consult authorities for information and clarification (e.g., letters, phones, electronic networks, satellite telemetry).	
11		investigate the limits of size in technological and natural systems.	weighing the biases of information sources.	
12		investigate the renewable and nonrenewable nature of the earth's resources and various strategies for managing these resources.		

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Item Discussion

Below is a summary list of items from the SCIENCE TYPE 1 MODEL COMPETENCY ASSESSMENT for the **SEVENTH GRADE** that begin with the "Explain and justify..." stem and immediately follow a related selected response item. In general, use of this "Explain and justify..." strategy is consistent with the questioning spirit of the Science Model (e.g., "How do we know?", "What is or reasonably can be inferred?", "How does it work?"). Secondly, this is another strategy for making a multiple choice item more interactive for students, and depending on how they respond, provide a wider window into their thinking.

The use of this strategy and the interpretation of student responses to this prompt, will depend upon numerous factors (e.g., the content of the district science program, particular emphases placed on individual topics, differing expectations for student performance on particular topics, needs of teachers and students to collect and share deeper insight). In any event, a general rubric approach that can be used to interpret student responses follows:

Criterion	**Rubric Summary**
1.	Answer in any way addresses the prompting question relative to the context of multiple choice item. Any remotely reasonable assumption and scientific response to this question is acceptable (even if incorrect).
2.	Answer presents assumption and accurate scientific explanation that accounts for and successfully connects students' selected response to the information in the context of the item.

Summary List of Multiple Choice Items With the "Explain and justify..." Prompt

• Seventh Grade Type 1 •		
Assessment Block	*Item*	*Answer*
P. 2		
Butterflies	5	Response Varies
P. 4		
Microscopes and Measurement	6	Response Varies
P. 6		
Star Trek Voyage	7	Response Varies
P. 9		
Predicting Weather	7	Response Varies
P. 11		
Phase Equilibrium	3	Response Varies

The discussion on the following pages pertains to the **Short Answer** and **Extended Response** items on the SCIENCE TYPE 1 MODEL COMPETENCY ASSESSMENT for the **SEVENTH GRADE**. Discussion of these items include an **Item Description** which provides an overview of the item and the elements of an acceptable student response. The **Rubric Summary** further organizes these elements in a quick reference table reflective of suggested stages of an acceptable student response.

Item: Butterflies
#6 • Short Answer

Item Description

This item asks the student to explain why a mixture to different specific kinds of plants is appropriate for a butterfly garden. The module's introductory information provides the fact that flowers are butterflies' only source of food. Also provided is the table of butterfly adult and larval food showing preferences. It is assumed that the student has knowledge about the butterfly life cycle.

A good response will show that the student understands that adult and larval butterflies prefer specific but different food plants and that by planting a mixture of those plants you can provide a place for butterflies to reproduce and feed, as well as provide for different kinds of butterflies.

Criterion	Rubric Summary
1.	Certain flowers attract certain adult butterflies. OR Certain food plants are preferred by certain butterfly larvae.
2.	Adult and larval food preferences are different.
3.	The increase in the variety of plants may allow for an increase in the variety of butterfly species.
4.	The mixture of plants will provide food for much of the butterfly life cycle to take place in the garden.

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Item: Star Trek Voyage
#8 • Short Answer

Item Description:

This item requires students to speculate about the difference in composition between the inner planets and the outer planets and offer an explanation which accounts for that difference. On the most basic level, the explanation can be very simple:

The rocky inner planets are closer to the sun, so they are warmer, whereas the more distant planets are so much colder that they are frozen. Additional explanation would discuss the implication(s) of the known composition difference between these planets for a model that can successfully represent the distribution of rocky materials and more volatile elements of the formative solar system in the distant past when the planets formed.

Criterion	Rubric Summary
1.	Any genuine attempt to answer the question.
2.	Discusses at least one varying physical condition across the solar system such as distance, temperature and gravitation.
3.	Discusses the potential impact on planet composition from at least one of the varying physical conditions across and relative to the solar system such as distance, temperature and gravitation.
4.	Discusses the effects of the interaction between and among the varying physical conditions — distance from the sun, temperature differences and gravitational forces — on the distribution of materials and the formation of planets across the formative solar system. (Similar to the Kant-Laplace Nebular Hypothesis.)

#9 • Extended Response

Item Description:

This item requires students to reflect on the conditions which permit life and make judgments on reasonable parameters within which life might be possible. This includes deciding whether life "as we know it," would be possible under the conditions shown in Table 1 or recognizing other forms of life radically different from what exists on Earth may be possible.

Students will recognize that the other planets are either too hot or too cold because of their distance from the sun to support earth-type plants or animals. Reasonable and credible ideas students will discuss include how a planets proximity to the sun impacts revolutions which affects length of seasons; amount of sunlight reaching the planet which affects average surface planet temperature; presence of liquid water which supports life as we know it; rotation rate which affect surface temperature.

Criterion	Rubric Summary
1.	Makes any attempt to say how these factors affect the possibility of life on planets other than Earth.
2.	Correctly and fully states any one of the ideas from the list in the item description. Partially states at least two of those ideas.
3.	Correctly and fully states any two of the ideas from the list in the item description.
4.	Correctly and fully states three or more of the ideas in the list in the item description.

Item: Predicting Weather
#8 • Short Answer

Item Description:

This item assesses the student's ability to read the symbols on the weather maps provided and to predict what weather changes will occur next in a particular place, as well as how to dress for that weather.

A good response will show that the student located the two cold fronts that are moving toward Minneapolis from the west and the north, with their associated rain and cooler temperatures, and predicted that the weather would be cooler and possibly rainy. The appropriate clothing to wear would be warm and waterproof. An explanation based on the maps provided will also be included.

Good map reading skills and a basic understanding of weather map symbols are assumed skills.

Criterion	Rubric Summary
1.	The student provides a description of the weather in Minneapolis.
2.	The student advises dress that is appropriate to the weather predicted, whatever that prediction was.
3.	The student's explanation includes at least, three specific references to features of the weather maps provided, which may include but not be limited to cold fronts locations; cooler (60s) temperatures associated with the cold fronts; rain associated with the cold fronts; location of high or low pressure areas; wind movement associated with pressure areas (not fronts); and frontal movements or stationary fronts.
4.	The student's explanation relies on the movement of fronts, or clearly links the positions of weather patterns on June 10 with their new positions on June 11.

Item: Electromagnets
#7 • Short Answer

Item Description:

This item asks students to speculate about the nature of magnetism by trying to think of ways it affects our lives. Given a few basic concepts in the text and previous questions students may legitimately interpret the question in two basic ways.

A good response based on two possible interpretations: One interpretation may lead students to discuss the planet's basic magnetic field, and this will lead to examples of the way the magnetosphere protects us from cosmic rays or induces ionic effects like the Auroras near the poles, etc. Another interpretation may lead students to discuss all magnetic fields, and this will lead to examples pertaining to all things electrical, electronic, magnetic, etc., (e.g., electric generators depending on magnetism would not be possible, machines using electric motors would not run, social and economic conditions would change due to absence of devices).

Criterion	Rubric Summary
1.	Any genuine attempt to answer the question that does not contain any bad science.
2.	Correctly describes and example or creates a valid analogy between the Earth's magnetic field and related phenomena.
3.	Correctly describes two or more examples or analogies.
4.	Correctly describes two or more examples or analogies and supports at least one of them with an exceptional level of detail, elaboration, or scientific insight.

#8 • Extended Response

Item Description:

This item requires that students first understand the concepts in the previous items of the assessment block and the correct conclusion from them. This item assesses students' understanding of the significance of these concepts as they apply to the basic components of an electric generator circuit using a magnet (i.e., relative motion between magnet and coil of wire, the size/strength of the magnet, the number of turns of wire in the coil, and a compete circuit).

A good response correctly

Criterion	Rubric Summary
1.	Any genuine attempt to answer the question that does not contain any bad science.
2.	Describes and illustrates an example change or addition to make a complete circuit of the incomplete electric generator illustration.
3.	Correctly describes two or more concepts (e.g., relative motion, a complete circuit) applicable to explaining the components of a working electric generator using a magnet.
4.	Correctly describes two or more examples of changes or additions to make a stronger electric generator (e.g., increase relative motion between magnet and coil of wire, the size/strength of the magnet, the number of turns of wire in the coil) and supports at least one of them with an exceptional level of detail, elaboration, or scientific insight for conducting testing.

Butterflies

Ms. Harris' class wanted to attract butterflies to their schoolyard. They knew that certain flowers are the butterflies' only source of food. Therefore, they decided to plant a butterfly (flower) garden. To prepare for this project, the students worked in cooperative groups to gather data on butterflies and flowers. The students also gathered data about the butterfly caterpillar (larval stage in the life cycle of an insect).

Mark and Melody visited three areas: a vegetable garden, a weedy lot, and a park. They found flowers and butterflies at each location. The data they gathered is shown in the following table.

Table 1

Name of butterfly	Flower to which butterfly is most attracted	Plant preferred by butterfly larvae for food
black swallowtail	clover	parsley
cabbage white	nasturtium	thistle
dwarf yellow	marigold	broccoli
fritillary	milkweed	violets
monarch	aster	milkweed
snout	butterfly bush	hackberry bush

Use the information in Table 1 to help you answer the following questions.

1. Mark and Melody wanted to figure out where butterflies lay their eggs. After studying the information in Table 1, which of the following statements were they LEAST likely to make?

   A. The fritillary is most attracted to milkweed.
   B. The snout is most attracted to butterfly bushes.
   C. The dwarf yellow is most attracted to clover.
   D. The monarch is most attracted to aster.

2. One group of students decided to plant flowers that attract dwarf yellow, monarch, and cabbage white butterflies. Based on the information in the table, the class members were LEAST likely to select which of the following flowers?

   A. Marigolds
   B. Nasturtium
   C. Asters
   D. Clover

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Butterflies

3. The class wanted to select a food source for the larva of the black swallowtail butterfly. Based on the information in the table, which of the following plants would they choose?

   A. Clover
   B. Parsley
   C. Thistle
   D. Milkweed

4. As a butterfly obtains nectar from the base of a flower, a powdery substance found in the flower sticks to the butterfly's body. This substance is used directly in which of the following processes?

   A. Nectar production
   B. Pollination
   C. Photosynthesis
   D. Root development

5. Explain why you chose your answer to **Question 4.** Include in your explanation what you know about how nectar is used directly in this process.

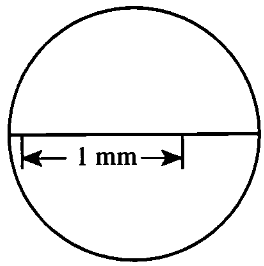
Short Answer

6. To convert a flower bed into a butterfly garden, both flowers and other kinds of plants should be planted in the bed. Explain the reason for this type of planting.

Microscopes and Measurements

You are studying cells. You realize that a cell is very small, but you do not know its actual size.

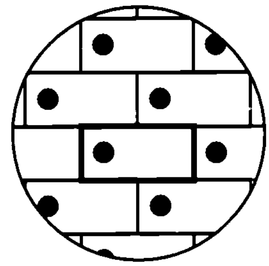
transparent ruler



low power (100x)
microscope field

Figure 1

onion skin cells



low power (100x)
microscope field

Figure 2

Use Figures 1 and 2 to help you answer the following questions.

1. Suppose you place a transparent metric ruler on the stage of your microscope. Figure 1 illustrates what you see through the microscope at low magnification. If the graduations on the ruler are actually 1 mm apart, what is the diameter of the microscope's field of view at low magnification?

A. 1.0 mm
B. 1.5 mm
C. 2.0 mm
D. 1.0 cm

2. One of the cells in Figure 2 is outlined by a heavy line. What is the approximate length of that onion skin cell?

A. 25.00 mm
B. 0.75 mm
C. 1.50 mm
D. 3.00 mm

3. Consider a cell that is 0.5 mm long and 0.25 mm wide. When the cell is viewed through the microscope, the cell is magnified 100 times (100x). How large does the microscope's image of the cell appear to be?

A. 0.5 mm × 0.25 mm
B. 0.005 mm × 0.0025 mm
C. 50 mm × 25 mm
D. 500 mm × 250 mm

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Microscopes and Measurements

4. Suppose a *paramecium* stretches a little more than halfway across the field of view of the microscope. Select the best estimation of the length of the *paramecium*?

   A. 1 mm
   B. 2 mm
   C. 1 cm
   D. 2 cm

5. Consider a small, round, one-celled organism that is about 1/4 the size of the *paramecium* observed previously. How many of these one-celled organisms, placed side by side, would stretch across the diameter of the microscope field?

   A. 2
   B. 4
   C. 8
   D. 12

6. Explain and justify your answer to **Question 5.**

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Star Trek Voyage

A Star Trek voyage in our solar system took probe readings of all of the planets. The probe information is listed in Table 1 below. (One revolution is the length of time required for a planet to make one complete trip around the Sun; one rotation is the length of time required for a planet to make one complete turn on its axis.)

Table 1

Planet	Diameter (km)	Average distance from Sun (millions of km)	Period of revolution (Earth time)	Period of rotation (Earth time)	Average surface temperature (°C)
Mercury	4,875	58	88 days	59 days	230*
Venus	12,180	108	225 days	243 days	450
Earth	12,753	149	365 days	24 hrs	10
Mars	6,786	228	687 days	25 days	–50
Jupiter	142,718	778	12 yrs	10 hrs	–130
Saturn	120,020	1,427	29 yrs	10 hrs	–180
Uranus	50,500	2,871	84 yrs	18 hrs	–210
Neptune	48,600	4,497	165 yrs	19 hrs	–220
Pluto	2,200	5,914	249 yrs	6 days	–230

*Mercury's average temperature is the average of the day and night side temperatures.

Use the information in Table 1 to help you answer the following questions.

1. Which of the following planets has the shortest day (measured in Earth time)?

A. Pluto
B. Earth
C. Jupiter
D. Mercury

2. Which of the following planets has the longest year (measured in Earth time)?

A. Jupiter
B. Mars
C. Venus
D. Moon

3. Using a scale in which 1 mm is equal to 1 million km, which planet would be about 6 cm from the Sun?

A. Mars
B. Mercury
C. Pluto
D. Neptune

Star Trek Voyage

4. For which of the following planets is the period of rotation closest to the period of revolution?

   A. Mercury
   B. Saturn
   C. Jupiter
   D. Venus

5. Based on the data for all the planets excluding Mercury, as the average distance from the Sun increases, the average surface temperature:

   A. increases.
   B. decreases.
   C. is unchanged.
   D. increases, then decreases.

6. The Star Trek expedition continued to a second star system that contained four planets. The planets, arranged in order of increasing distance from the central star, were Planets A, B, C, and D. Based on the data in Table 1, arrange the planets in order of increasing period of revolution.

   A. Planet A, Planet B, Planet C, Planet D
   B. Planet B, Planet A, Planet C, Planet D
   C. Planet C, Planet B, Planet D, Planet A
   D. Planet D, Planet C, Planet B, Planet A

7. Explain and justify your answer to **Question 6.**

Short Answer

8. The planets Mercury, Venus, Earth, and Mars are composed mostly of rocky materials while Jupiter, Saturn, Uranus, Neptune, and Pluto are composed mostly of frozen materials. Using the information provided in Table 1, briefly explain why the two groups of planets are different in composition.

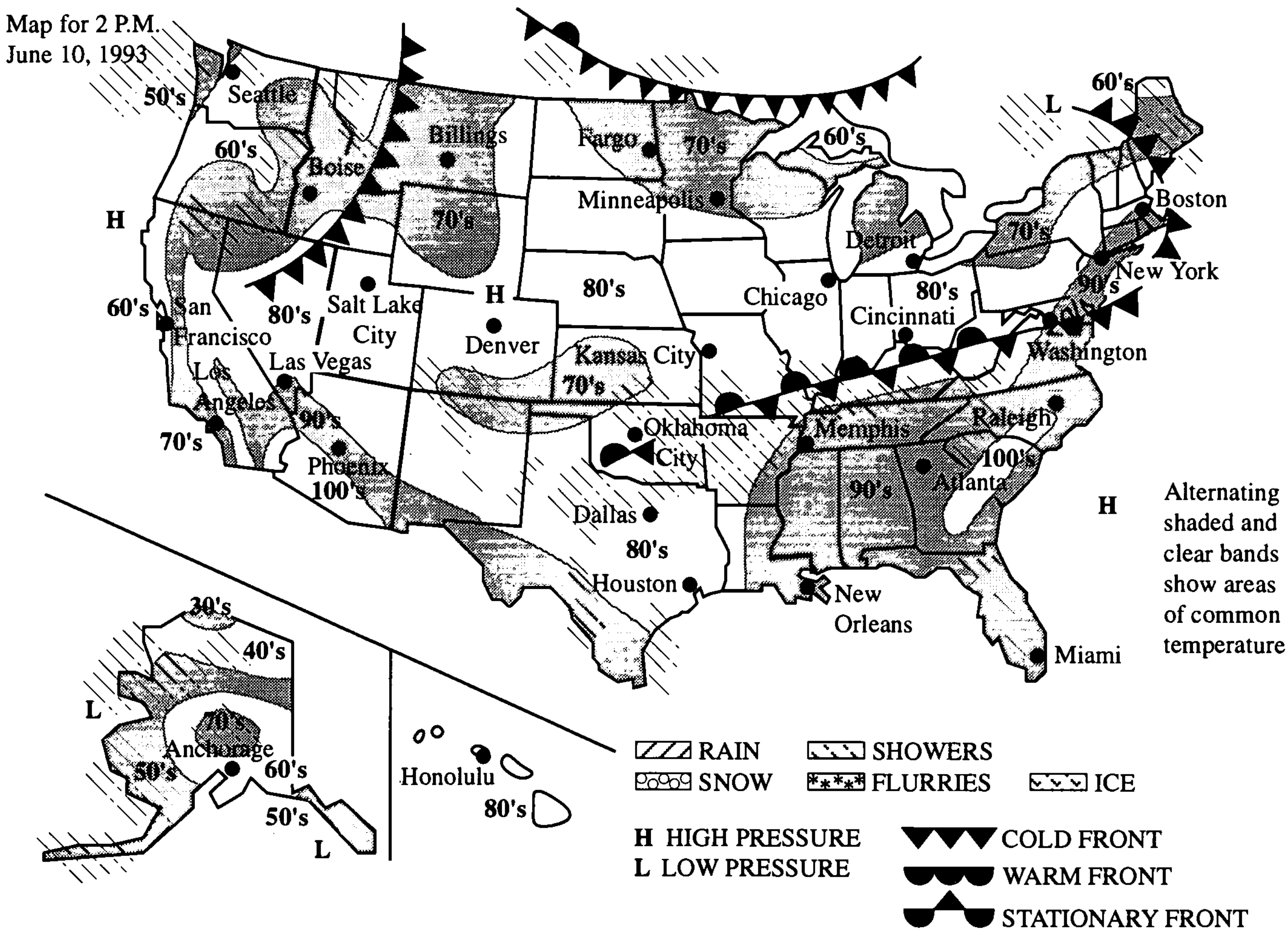
Extended Response

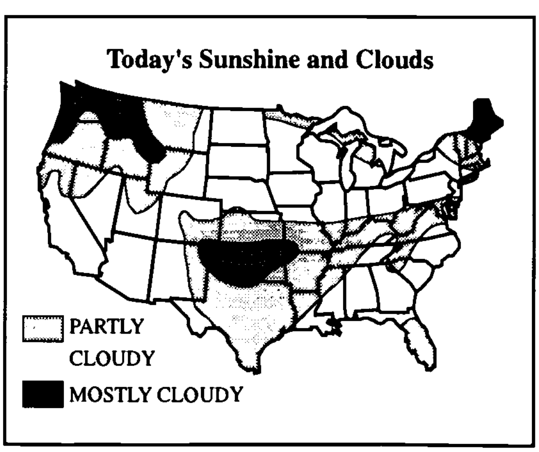
9. Table 1 shows the distances from the Sun, the periods of rotation, the periods of revolution, and the average surface temperatures of the planets. How do you think these factors would affect the possibility of life on planets other than Earth?

Predicting Weather

On June 11, regional skateboard championships will be held, and you will be a contestant. Weather conditions on that day will determine what you wear. Therefore, you consult the maps on the weather page of your newspaper for June 10 to predict the weather for June 11.

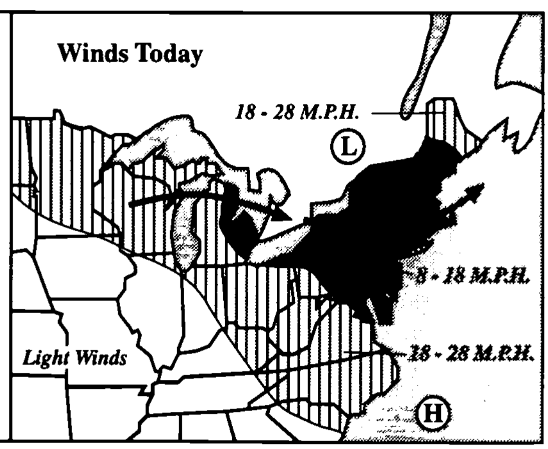
Today's High Temperatures and Precipitation





Weather Highlight

Low pressure in Quebec will direct very warm air across the Northeast today on gusty winds. West winds could gust above 25 miles an hour.



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Predicting Weather

Use the information in the weather maps to help you answer the following questions.

1. Assume that cold fronts can move across an average of 2 to 3 states per day. Based on the weather maps, which of the following cities is most likely to have cooler weather on June 11 than on June 10?

   A. Atlanta
   B. Dallas
   C. Denver
   D. Los Angeles

2. Consider the weather maps for June 10, taking into account sunshine, clouds, temperatures, precipitation, and weather fronts. One can generalize that at any given time, widespread cloudiness will most likely be found:

   A. in the northcentral United States.
   B. in the southwestern United States.
   C. close to a weather front.
   D. close to a large lake.

3. Atlanta, Phoenix, and Los Angeles are at approximately the same latitude. Based on the temperatures in these cities on June 10, one can conclude that:

   A. temperature consistently increases as one travels from Atlanta to Los Angeles.
   B. temperature consistently decreases as one travels from Atlanta to Los Angeles.
   C. cities at the same latitude have the same temperature.
   D. latitude alone is not sufficient to determine temperature.

4. On the basis of the maps for June 10, the heaviest rains are most likely to fall in which of the following regions of the United States?

   A. Southwest
   B. Southcentral
   C. Southeast
   D. Northcentral

5. From June 10 to June 11, weather conditions are LEAST likely to change in which of the following regions?

   A. Great Lakes
   B. New England
   C. Pacific Northwest
   D. Southcentral

Predicting Weather

6. Winds rotate in a clockwise direction around high pressure areas. Therefore, skateboarders in Denver will most likely be moving against the wind when they are traveling in which of the following directions?

   A. Northeasterly
   B. Northwesterly
   C. Southerly
   D. Southwesterly

7. Explain and justify your answer to **Question 6.**

Short Answer

8. Based on the weather map for June 10, advise skateboarders in Minneapolis on the weather for June 11. Explain why you are making this prediction. What clothes should skateboarders wear on June 11? Use the data from the weather map to explain your answers.

Phase Equilibrium

To investigate solid-liquid equilibrium, students used water and ice. Before the water and ice were mixed, the students measured the initial temperatures and masses of the water and the ice. The results are shown in Table A.

Table A

	Ice	Water
Temperature (°C)	–2	20
Mass (g)	50	150

The students added the ice to the water in a glass vessel and immediately began to heat the vessel. The vessel was heated gradually and the mixture was stirred until all the ice had melted. The students measured the temperature of the mixture at various times during the heating process, as shown in Table B.

Table B

Time (min)	Temperature (°C)
0	20
1	10
2	6
3	2
4	0
5	0
6	0
7	0
8	6
9	12
10	18

The students obtained another 50 g of ice and 150 g of water at the initial temperatures given in Table A. They dissolved 3 g of table salt in the water and brought the solution back to 20° C. Then they added the ice to the salt solution and immediately began heating the mixture at the same rate as before and recorded the temperature of the mixture over time. They repeated this procedure with 6 g of salt. The temperatures of the two mixtures at the different times are recorded in Table C.

Table C

Time	Temperature (°C)	
	With 3 g salt	With 6 g salt
0	20	20
1	10	10
2	6	6
3	4	4
4	2	2
5	–2	–2
6	–2	–4
7	–2	–4
8	2	–4
9	6	0
10	10	4

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Phase Equilibrium

Use the information in Tables A, B, and C to help you answer the following questions.

1. Consider the data in Table C. During the time that the temperature remained constant, heat energy was being used to:

   A. change ice to water.
   B. increase the total mass of ice and water in the vessel.
   C. increase the volume of ice.
   D. dissolve salt in the water.

2. Consider the data in Table B. If another 50 g of ice at –2° C had been added 8 minutes after the heating began, how would the temperature of the mixture most likely have been affected?

   A. The temperature would have increased more rapidly than it did before the new ice was added.
   B. The temperature would have increased at the same rate as it did before the new ice was added.
   C. The temperature would have decreased, stayed constant for a while, then increased again.
   D. The temperature would have continued to decrease at the same rate as it did before the new ice was added.

3. Explain and justify your answer to **Question 2.**

4. Consider the data in Table B. Nine minutes after the heating began, how was the heat energy being used?

   A. To change ice to water
   B. To increase the mass of ice and water in the vessel
   C. To change the temperature of water
   D. To increase the volume of ice

5. Consider the data in Table A and Table B, and the procedures the students followed to collect this data. As the ice melted, what happened to the mass of the ice and water? (Note: Ignore the effects of evaporation.)

   A. The masses of the ice and water both increased.
   B. The masses of the ice and water both decreased.
   C. The mass of the ice increased and the mass of the water decreased.
   D. The total mass of the ice and water remained the same.

6. Based on the data in Table C, predict the amount of salt necessary to reduce the freezing temperature of the mixture to –8° C.

   A. 1.2 grams
   B. 8.0 grams
   C. 12.0 grams
   D. 24.0 grams

7. According to Table B, all the ice has melted by which of the following times?

   A. 2 minutes
   B. 4 minutes
   C. 6 minutes
   D. 8 minutes

Electromagnets

Mary and her friends remembered seeing a crane (a large machine used to lift heavy objects) picking up a car. They did not observe the crane grabbing the car with a mechanical claw. This puzzled Mary and her friends. They asked their teacher how the crane worked. The teacher suggested the crane was picking up the car with an electromagnet. (An electromagnet is an object that becomes magnetic when electrified.) Mary was amazed. She wanted to find out how the electromagnet worked, so she conducted some experiments.

1. Mary connected a coil of wire to a galvanometer (a device used to measure small amounts of electrical current), as shown in Figure 1.

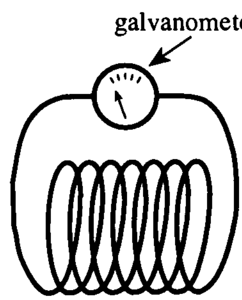

Figure 1

Figure 1

Mary wanted to get a current to flow through the galvanometer circuit with a single magnet. To do this, she could:

A. shine a beam of light on the magnet.
B. place the stationary magnet far away from the coil.
C. have the stationary magnet inside the coil.
D. move the magnet through the coil.

2. After Mary got a current to flow through the galvanometer circuit, the galvanometer registered a reading of 5. Next, she found a second magnet that was identical to the first. She joined the two magnets together, as shown in Figure 2 below.

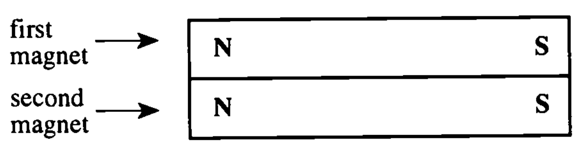

Figure 2

Figure 2

Using the two joined magnets, she repeated the procedure discussed in Question 1. Mary most likely obtained which of the following galvanometer readings?

A. Approximately 0
B. Less than 5
C. More than 5
D. Cannot be determined from the information given.

Electromagnets

Mary read in her science book that an electromagnet can be made from a coil of wire, a material placed inside the coil of wire (a *core*), and a battery. She assembled an electromagnet and used it to lift paper clips, as shown in Figure 3.

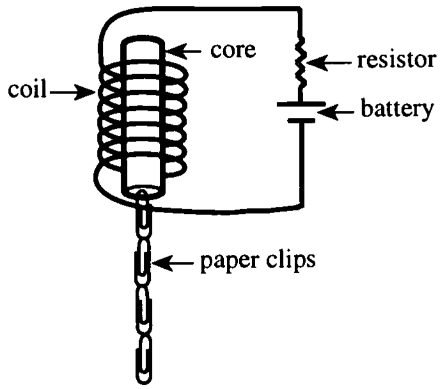

Figure 3

She collected the data shown in Table 1.

Table 1

Factors affecting magnetic field strength	Experiment			
	A	B	C	D
No. of coils in wire	10	10	20	20
Type of core	pencil	nail	nail	nail
Battery voltage	6 volts	6 volts	6 volts	12 volts
Number of paper clips lifted at one time	5	9	17	31

3. What can be concluded from the data in Table 1 about the effect of the type of core on the strength of the magnetic field?

A. A coil with a nail core contained a stronger magnetic field than the same coil with a pencil core.
B. A coil with a nail core contained a weaker magnetic field than the same coil with a pencil core.
C. A coil with a nail core contained the same magnetic field as the same coil with a pencil core.
D. The type of core had no effect on strength of the magnetic field.

4. Based on the data in Table 1, which of the following procedures should Mary follow to increase the strength of a magnetic field?

A. She should increase both the number of coils and the voltage.
B. She should increase the number of coils and decrease the voltage.
C. She should decrease the number of coils and increase the voltage.
D. She should decrease both the number of coils and the voltage.

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Electromagnets

5. Based on the data in Table 1, which of the following procedures most likely will produce the greatest increase in the strength of the magnetic field?

   A. In Experiment A, changing the pencil core to a nail core
   B. In Experiment B, increasing the number of coils from 10 to 20
   C. In Experiment C, changing the number of coils from 20 to 10
   D. In Experiment D, changing the battery voltage from 12 to 6

6. In Experiment B, suppose Mary increased the voltage from 6 to 9. How many paper clips might she expect to attract?

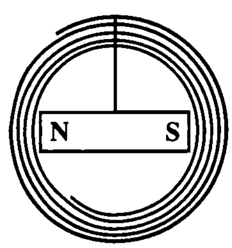
   A. Less than 5
   B. Between 5 and 8
   C. Exactly 9
   D. More than 9

Short Answer

7. Describe how life on Earth would change if Earth's magnetic fields suddenly disappeared. Explain with examples.

Extended Response

8. Mary's teacher asks her to build and test a simple electric generator circuit using a magnet. Figure 4 shows her progress. She hung a magnet in the opening of a coil of wire. She needs some ideas how to finish the circuit. Please assist Mary by suggesting additions and/or changes to complete the circuit design. Explain your suggestions and write instructions for Mary to follow to test the operation of the simple electric generator circuit. Suggest additional steps to design and test an electric generator for producing larger electric currents.



front view of coil

Figure 4

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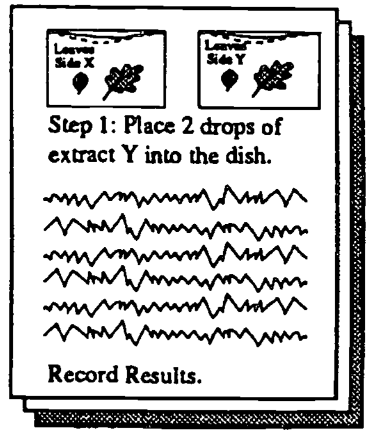
Type 2
Seventh Grade Science
Competency-Based Education Assessment Series

SCIENCE Ohio's Model Competency—Based Program



° On Demand Problem-Solving Events °

(Performance-Like)

Characteristics

- Experimental and non-experimental research, requiring more than a single session and some out-of-class time
- Scoring Options: Holistic scoring (i.e., portfolio scoring guide and interviews); scoring with rubrics, check-lists, and/or interviews

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart.* Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments are focused on *Science Portfolio Scoring Guide* parameters, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with *Science Portfolio Entry* types, instructional strands, and organizing concepts.

Refer to the *Content Summary Chart.* It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics*.
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Seventh Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)* *Ninth Grade*
Page(s) 1 - 2							
Who Am I?	1	See Discussion	Processing	6	I: 8, 9 K: 2 C: 5 A: 1, 2	Patterns	N: 1, 2 P: E: L: 14
	2	See Discussion	Extending				
	3	See Discussion	Extending				
Page(s) 3							
Microscopes and Measurements	1	See Discussion	Processing	3, 7	I: 5, 6, 8 K: 11 C: 5 A: 6	Models and Scale	N: 2, 4 P: E: L:
Page(s) 4 - 5							
Scale Model of the Solar System	1	See Discussion	Processing	6, 7	I: 4, 6, 7, 8, 9 K: 2, 4, 5, 6, 10, 11 C: 1, 5 A: 2	Patterns Models and Scale	N: 2, 4 P: E: L:
	2	See Discussion	Processing				
	3a	See Discussion	Processing				
	3b	See Discussion	Processing				
Page(s) 6 - 7							
Predicting Weather	1	See Discussion	Extending	1, 3, 6, 7	I: 6, 7, 8 K: 2, 3, 4, 6 C: 3, 10 A: 1, 2, 7	Constancy	N: 2 P: E: 7 L:

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Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗀, at the top of the *Answer* column are possible portfolio entries.

• Seventh Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)* *Ninth Grade*
Page(s) 8 - 10	🗀						
Insulating Materials	1	See Discussion	Processing	2, 3, 6, 7	I: 1, 4, 6, 8, 9 K: 3, 7, 9 C: 1, 5, 7 A: 2, 6	Systems and Interactions	N: 2, 4, 19 P: 10, 12 E: L:
	2	See Discussion	Extending				
	3	See Discussion	Extending				
Page(s) 11	🗀						
Density	1	See Discussion	Processing	2, 3, 6, 7	I: 1, 2, 4, 6, 8, 9 K: 2, 7, 9 C: 1, 5, 7, 8 A: 1, 2, 6	Patterns	N: 2, 4, 17, 19 P: 9 E: L:
	2	See Discussion	Processing				
	3	See Discussion	Extending				
	4	See Discussion	Extending				
Page(s) 12 - 15							
Phase Equilibrium	1	See Discussion	Processing	3, 5, 6, 7	I: 4, 6, 8, 9 K: 2, 3, 9 C: 7 A: 1	Constancy	N: 2, 4, 19 P: 12 E: L:
	2	See Discussion	Extending				

• Performance Objectives: Grade 7 ***Ohio's Model Competency-Based Science Program***

1. The learner will analyze and critique the science presented in the media (e.g., periodicals, advertisements, literary works, cinema, public documents).
2. The learner will design and use procedures to test the suitability of various materials for different purposes.
3. The learner will choose and use appropriate technologies to collect observations regarding a complex system (e.g., the atmosphere or an ecosystem) and use the observations to make predictions about the effects of changes made in various components of the system.
4. Presented with data on the consumption pattern of a resource in the local community, the learner will propose (e.g., written proposal, persuasive materials, videos) a strategy to manage the resource more efficiently and economically.
5. The learner will construct, test, and trouble-shoot a set of procedures for younger learners to use to investigate a common natural phenomenon.
6. Given a set of data on an event or phenomenon, the learner will summarize the data in several meaningful ways (e.g., graphs, tables, narratives, models).
7. The learner will use scientific terminology appropriate to their developmental level to make predictions in a complex system (e.g., weather, ecosystems, inertial, energy).

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Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description			
	Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

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Item Discussion

Item discussion on the following pages pertains to **SEVENTH GRADE** SCIENCE TYPE 2 MODEL COMPETENCY ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content.

For student TYPE 2 ASSESSMENT work which is being considered as potential science portfolio entries, please consider using the parameters for holistic evaluation of student work that are suggested in the *Science Portfolio Scoring Guide*. Each student product or demonstration need not reflect all parameters or all indicators for all parameters in the *Science Portfolio Scoring Guide*. (i.e., the *Guide* is not intended for use as a check list).

Science Portfolio Scoring Guide used with permission from the *CCSSO SCASS* Science Portfolio materials.

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Item: Who Am I?

Item Description:

In the passage the student is introduced to the idea of using a "flow chart" or "key" to classify animals into categories. The student is given the first two steps of one possible dichotomous classification scheme and is asked, in Step 2, to continue classifying the animals in a similar manner until each animal is in a group by itself. **The student needs to be given a set of (10) animals (pictures).**

Using a *dichotomous classification scheme*, students split animals into two different groups at each branch point, depending on whether the animal has a particular characteristic or not. When building a dichotomous classification scheme, it is best to select characteristics that separate animals in a meaningful way.

From the point of view of a seventh grader, "meaningful" characteristics might reflect nothing about the evolutionary descent among a variety of species. Nevertheless, a similar strategy can be applied to *keep the most closely related animals together* — that is, the best characteristics for building a classification scheme are those that *can separate all individuals of one species (Species A) from all individuals of another species (Species B) despite the fact that there is variation among individuals of a both Species A and Species B.*

Questions 2 sets the stage for this level of understanding by providing an example of a characteristic that is not well-suited to classifying and explaining its limitations. This suggests to the student that the best characteristics are those that keep members of the same species together while separating them from other species. The student is left to decide which types of characteristics are well-suited to this task. The best answers will include not just a list of characteristics, but either a general statement or concrete example accompanied by an explanation.

A good response to Question 1, indicates that there is more than one possible way to classify a group of animals. There are numerous ways — some better than others, others equally good. Either different characteristics can be used or the characteristics can be used in a different order. Students may cite other classification schemes (such as those of classmates) or other traits (that they didn't use but could've used) to support this view.

Criterion	**Rubric Summary**
1.	In response to Step 2, builds a flow chart in which animals are classified according to a dichotomous classification scheme; or each of the animals ends up in a group by itself.
2.	In response to Question 1, responds "NO", and provides EITHER an explicit example of an alternative classification scheme OR a specific example of a trait not used in Question 1 but could have been.
3.	In response to Question 2, cites (or lists) more than ONE distinct dichotomous characteristics (or types of characteristics) that can be used to classify animals. No explanation/defense is required.
4.	In response to Question 2, explains why a certain trait (or set of traits or type of trait) is better suited than another. Provides a general statement of explanations or a concrete example accompanied by an explanation showing that the best traits are those that keep all members of one species together while separating them from all other species.

Item: Microscopes and Measurements

Item Description:

This item assesses the student's understanding of the concepts of scale and magnification and the student's ability to accurately reproduce a simple drawing on a different scale.

A good response will provide an accurate enlargement of the drawing of a cell presented in the prompt, using the graph paper provided.

Criterion	Rubric Summary
1.	Makes a legitimate attempt to respond, even though the response is not exactly correct.
2.	Response contains a figure that can be "eyeballed" to be between 3 and 5 squares long; and between 1.5 and 3.5 squares in height.
3.	Response contains a figure that is between 3.5 and 4.5 squares long; between 2 and 3 squares in height; roughly oval in shape: and contains a nucleus approximately 1 square in diameter.
4.	Response present an enlargement of the original drawing that is accurate to within 1/4 square in all dimensions, including the location of the nucleus (i.e., the center of the nucleus is located approximately halfway down the cell, and 1/4 to 3/4 of a square left or right of the horizontal center of the cell).

Item: Scale Model of the Solar System

Item Description:

This event asks students to answer questions and make a scale model of some of the planets based on a table of planetary distances. Students will have to know how to make a scale. Question 2 requires students to have some background knowledge about how the planets move and the space in between them.

Question 3 asks students to recognize that planets which move more slowly and have farther to go will take longer to travel around the sun. This is a logical conclusion from the information given — for the answer to Question 3 (a) **Pluto, Mercury,** and Question 3 (b) **Venus** respectively.

Question 2 has implications for students' needed previous knowledge. Straight line motion to a planet directly between Earth and the sun would be impractical for several reasons including: Both planets would be moving perpendicular to the line between them. Thus a ship leaving the Earth would have a large amount of momentum in the wrong direction. In the time you took to get to Venus, it has moved in its orbit. Even if you timed it to get there early, Venus is moving at more than 40 km/sec. A head-on collision with a planet moving at 40 km per <u>second</u> would be disastrous. Collisions with other objects — asteroids and meteors are also possible.

The best orbit is one which moves with the planets. The spaceship can use the momentum of earth's orbit to get to Venus. By slowing down slightly, the ship would go into an elliptical orbit with the closest point of the orbit being at Venus' distance to the sun.

Criterion	Rubric Summary
1.	Attempts to complete a scaled representation of the distance between the planets. The represent may not be complete or exactly correct.
2.	Completes a scaled representation of the distances between the planets. The scale used is included in the legend. If some planets don't fit on the sheet, the student lists the position the planet would have on a larger ruler.
3.	Makes a reasonable attempt to answer Questions 2 and 3.
4.	Justifies answers to Questions 2 and 3 by providing links between answers and relevant science similar to that in the item description.

Item: Predicting Weather

Item Description:

The student is asked to draw a map of the United States in the space provided and, based on the weather maps provided for June 10, show the position of fronts, rain and cloudiness one day later. The student is also asked to predict the high temperatures for six cities and to give an explanation for all predictions.

A good response will show that the student understands that stationary fronts may be expected to remain in place, that the cold fronts may be expected to move, and that the temperatures, cloudiness and rain associated with the fronts may be expected to affect the local weather near the new positions of the fronts. The predictions the student makes should be consistent with any assumptions made.

If the student uses the assumption given in the story, that cold fronts can move across an average of **2 to 3 states per day**, then the southeasterly movement of the NW cold front will lower Seattle and Billings temperatures. The southerly movement of the cold front shown on the US/Canadian border on June 10 will lower temperatures in Minneapolis and Kansas City on June 11.

Since the item requests a huge amount of work, few complete responses are expected.

The rubric should be designed to asses understandings of basic concepts, patterns, constancy's and changes in the weather, not completeness of responses.

Criterion	Rubric Summary
1.	Legitimately attempts some part of the changed weather map or description of front movement/constancy.
2.	Prediction(s) of likely regions of cloudiness and rain.
3.	Prediction(s) of likely high temperature (ranges)
4.	Explanation of and linkages made between and among predictions of changes and constancy in weather.

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Item: Insulating Materials

Item Description:

Students investigate insulating capabilities of different types of materials. Students are asked to test 3 different materials that might be used to make a container that would keep a drink cold. Students make a prediction about which one they think would be best and then test the materials (e.g., aluminum foil, cotton balls and plastic bubble wrap). The test consists of placing the insulating material around a cup of cold water and recording the temperature of the liquid at regular intervals.

Question 1 asks the students to graph the data for each insulating material. A good response would consist of three lines, one for each insulating material, graphed on the same axes. The student should differentiate between the three lines with labels on the temperature and time scales. A bar graph is not appropriate.

Question 2 asks the student to think about repeating the experiment with hot water and asks the student to predict, using a graph, how long it would take the water enclosed by each of the three materials to cool to room temperature. A good response will include for each material, calculations or estimates using the graph and should fully explain the method used to determine the answers given.

A good response to Question 3 will list and discuss the reasons behind the initial predicted material. The student will also list the material that was determined to be the best insulator. The student should give at least one reason why this material is best. Students will likely find that cotton is the best insulator, the bubble wrap may turn out to be the best insulator if a lot of cotton balls are packed between the two cups. However, the point of this question is to have students explain experimental outcomes that may or may not have turned out to be consistent with their predictions; and , in either case, speculate about conditions when the best insulator (as experimentally determined) may be less than adequate.

Criterion	Rubric Summary
1.	Graph(s) correctly complete according to the student data. One for each material and are properly differentiated with labels or a legend.
2.	Makes an appropriately complete attempt at making an accurate prediction and explanation of cooling time.
3.	Lists prediction before the experiment and explains why thinking about why it would be the best insulator. Then discusses the results of the experiment, in terms of what material was the best insulator.
4.	Explain why he or she thinks this is the best material. The student should also discuss conditions under which this material may not be the best insulator, or explain why they found a material different from their prediction to be the best insulator.

Item: Density

Item Description:

The purpose of this event is to assess student understanding of the concept of <u>buoyancy</u>. In the investigation students construct three boats of varying shapes out of three 15 centimeter square pieces of aluminum foil. The boats are placed in a tub of water and washers are slowly added to them until they sink. Students are expected to understand the concept of, including the formula for, <u>density</u>. As long as the body's density is less than 1 g/mL, it will float.

In Question 1, students are asked to calculate the density of one of the boats they made at the point that it sank and to show their work for the calculation. The students are then asked to compare the density they have calculated to that of water. There is a certain degree of experimental error involved with this event, the last part of question one asks; students are asked to explain results.

Question 2 poses a hypothetical situation in which two boats with different volumes are compared. The correct answer, of course, is Boat 1 - the boat with the volume of 500 cubic cm. Because density is inversely proportional to volume, a boat with a greater volume will be able to support more mass than a boat with less volume.

Criterion	Rubric Summary
1.	Question 1, Correctly calculates of the density of one of the boats. Students should show enough of their work.
2.	Question 1, States that the density of the boat and washers should have been higher than the density of water when the boat sank. AND Question 2, Identifies Boat 1, the boat with the volume of 500 cubic cm, as the boat that will support more mass before sinking.
3.	Question 2, Correctly explains that it is the larger volume of a boat that allows it to support more mass.
4.	Question 3, Explanation satisfactorily demonstrates understanding of how a boat's buoyancy would change in sea water because sea water has a greater density. AND Adequately describes that a *boat* (air ship) design that could float in air would give it a density less than air.

Item: Phase Equilibrium
#1 • Short Answer

Item Description:

The student is asked to plot three sets of time and temperature data (i.e., the first set come from Table B and the second and third set come from Table C). The axes (time in minutes vs. temperature in degrees Celsius) and each of the three plots must be clearly labeled. Two points on each plot must be marked with arrow, one arrow marking the point where ice is beginning to melt, and one arrow marking the point where all the ice has melted.

A good response will show the student can transfer data from a table to plot a graph, and use the plot to determine where changes in phase of water occur.

Criterion	Rubric Summary
1.	Both axes are labeled and a scale is marked.
2.	Attempts to plot the data sets and a scale is marked.
3.	Three data sets are plotted and a scale is marked.
4.	Axes and scales are marked, three data sets are plotted on one graph, the three lines are identified and arrows indicate where ice begins to melt and all ice is melted.

#2 • Extended Response

Item Description:

The item asks the students to use the information about melting of ice to discuss the change in temperature over time when water boils. A graph must also be drawn for water heated from 20 degrees C until it turns to steam and for salt water heated from 20 degrees C until it turns to steam.

A good response will show that the student understands that when energy (heat) is being added during a phase change, the energy is used to overcome the forces of attraction between the particles, and therefore the temperature stays constant.

The item also assesses the student's ability to graph and to recognize that solutes raise the boiling point of water.

Criterion	Rubric Summary
1.	Discusses what happens to water when it is heated.
2.	Discusses what happens to the temperature when water changes phase from liquid to steam.
3.	Attempts to graph the temperature changes over time when water is heated from 20 degrees C, with and without salt.
4.	Two graphs are drawn and labeled, one is water or without salt and the other is salt water. The graphs must both level off (temperature remains constant) after the water boils for a period of time, and show that the salt water will take longer to boil at a higher temperature.

Who Am I?

Biologists deal with information about thousands of animals. In order to work more efficiently with this information, they group or classify organisms into categories. Biologists devise flow charts or keys to assist in the identification process, as shown in the example below. Your task is to group some animal pictures and to design a flow chart to identify the individual animals. Your chart should be designed so that it can be used by others.

Begin Classification . The example flow charts in parts A and B provide some hints to help you begin. First observe all the animals. Then think about one characteristic from all the ones you can observe that you will use to separate the animals into the first two groups.

A. Select a characteristic for separating your set of animal pictures into two groups. The characteristic must be one that is observable. Start to sketch out something similar to the example flow chart shown below. (You can begin to sort your animal pictures using a different characteristic than *legs*.)

all animals

legs
(List of animals)

no legs
(List of animals)

B. Observe the animals in one of your first two groups. Now think about another observable characteristic you can use to separate one of the first two groups of animals into two more groups. Continue to sketch how the second characteristic divides one of your groups into two parts similar to the example flow chart below. (You can continue to sort your animal pictures using a different characteristic than the *number of legs*.)

all animals

legs
(List of animals)

no legs
(List of animals)

less than 4 legs
(List of animals)

4 or more legs
(List of animals)

Who Am I?

Performance

Create your own classification flowchart . Then continue to sketch out your classification pattern for organizing all your animals into separate groups. Continue to select a single characteristic to divide your animals into groups of fewer animals until each animal is in a category by itself. Diagram each step as you complete the chart. You may want to work this out on scratch-paper and then transfer your answer to your flow chart.

Questions

1. Is your classification chart the only one that could be used for your animal pictures? Explain your answer and give an example.

2. When developing a classification chart, you must be careful about which characteristics you select to separate the animals. For instance, if you chose color (for example, "white" and "nonwhite") as your first distinguishing characteristic, you would have a problem if you had a white rabbit and a brown rabbit. You may not be able to use your chart to correctly identify both animals as rabbits. Describe what types of characteristics are better suited for identifying animals. Be sure to justify your responses by citing examples from your observations of the animal pictures as well as examples from your experience.

3. Select a picture of an animal that you have not classified yet in the previous task. Explain how you use your flow chart to describe the characteristics of the animal. What if any changes would you recommend making to your flow chart?

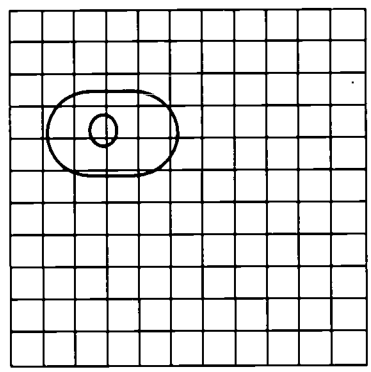
Microscopes and Measurement

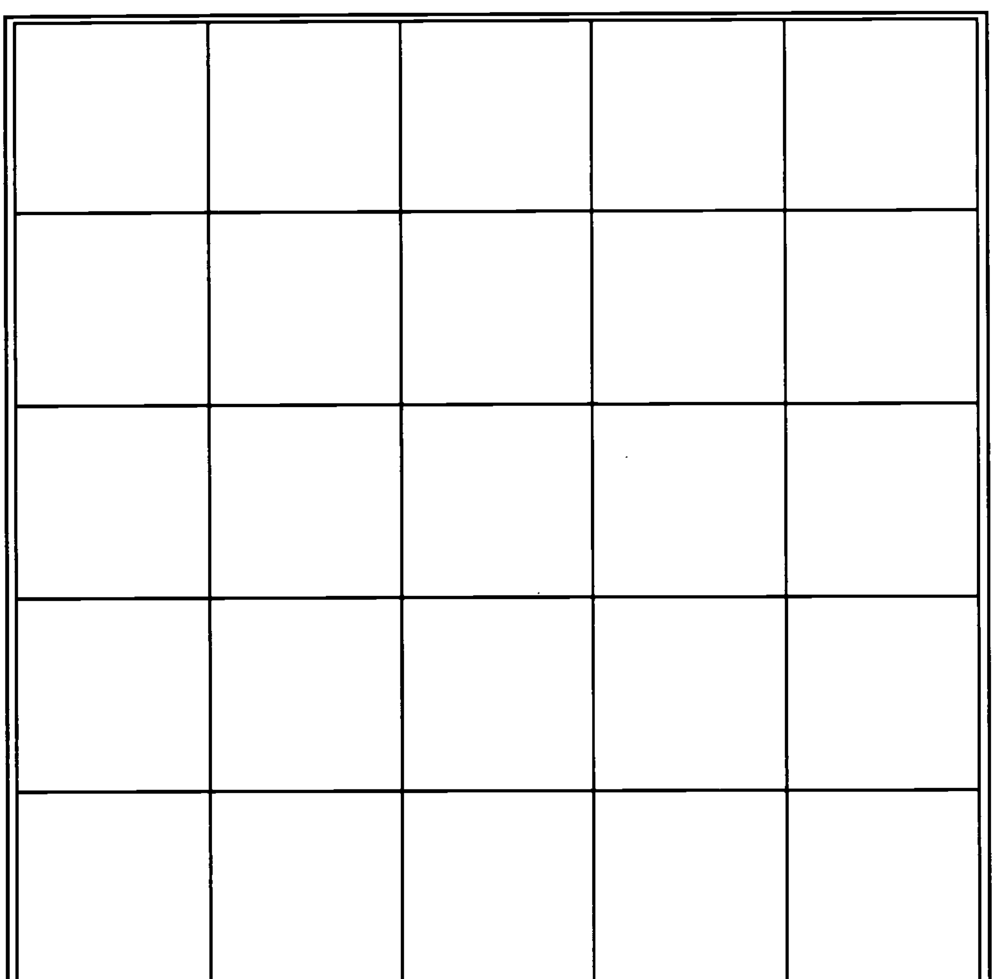
You are studying cells with a tool that magnifies the image of the cells. You realize that a cell is very small, but you do not know its actual size.

Performance

A cell is drawn on the graph paper immediately below. The graph paper has 0.4 cm x 0.4 cm squares. Suppose that the graph paper were enlarged so that the squares measured 2.5 cm x 2.5 cm. If the cell were enlarged by the same ratio, what would it look like? Use the graph paper below (with 2.5 cm x 2.5 cm squares) to draw the enlargement of the cell.

drawing of human cheek cell





Scale Model of Solar System

The National Aeronautics and Space Administration (NASA) is sponsoring a contest for students. The student who creates the best map of the planets in our solar system will get to go to a NASA Space Camp for a week. As a part of the contest, students are asked to make an accurate representation of the relative distances of the planets from each other. The average distances between the Sun and the planets are shown on the chart below, measured in kilometers.

Planet Distance Chart

Planet	Mean distance from Sun (km)
Mercury	5.8×10^7
Venus	10.8×10^7
Earth	15.0×10^7
Mars	22.8×10^7
Jupiter	78.0×10^7
Saturn	143×10^7
Uranus	228×10^7
Neptune	451×10^7
Pluto	592×10^7

Performance

Create a scale model.

1. Look at Figure 1 on the next page. You will notice that the Sun is placed in the upper right corner of the page. Determine where Earth, Mars, Jupiter, Saturn, and Pluto should be placed. Place labeled mark(ers) at the appropriate locations for each planet. Be sure to include a legend showing your scale. Your model should be drawn to scale.

Answer the following questions.

2. Suppose you were planning a space flight from Earth to Venus. The distance between the planets is 42,000,000 km. A friend of yours proposes traveling along a straight line between the planets, which are moving around the Sun at different rates. Explain why a straight line of travel between Venus and Earth is not practical. Be sure to justify your answer.

3. (a) The length of a planet's "year" can be defined as the amount of time, in Earth years, it takes a planet to go once around the Sun. If the average speed of a planet around the Sun decreases with distance from the Sun, which planet has the longest year and which planet has the shortest year? (Note: You do not have to specify the length of the planet's year.) Be sure to justify your answer.

   (b) Which planet has a "year" that is closest in length to Earth's year? Explain your answer.

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Scale Model of Solar System

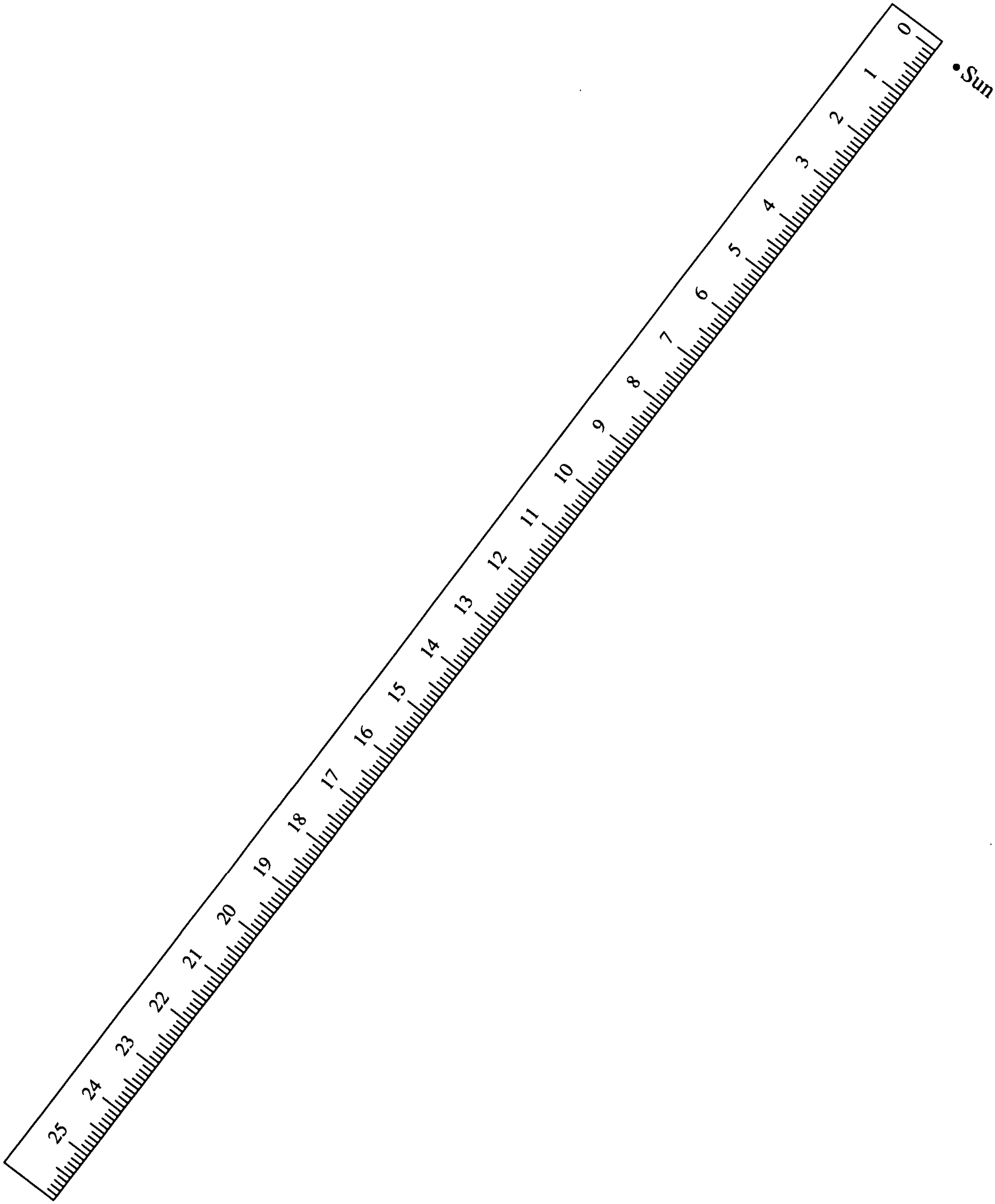

Figure 1

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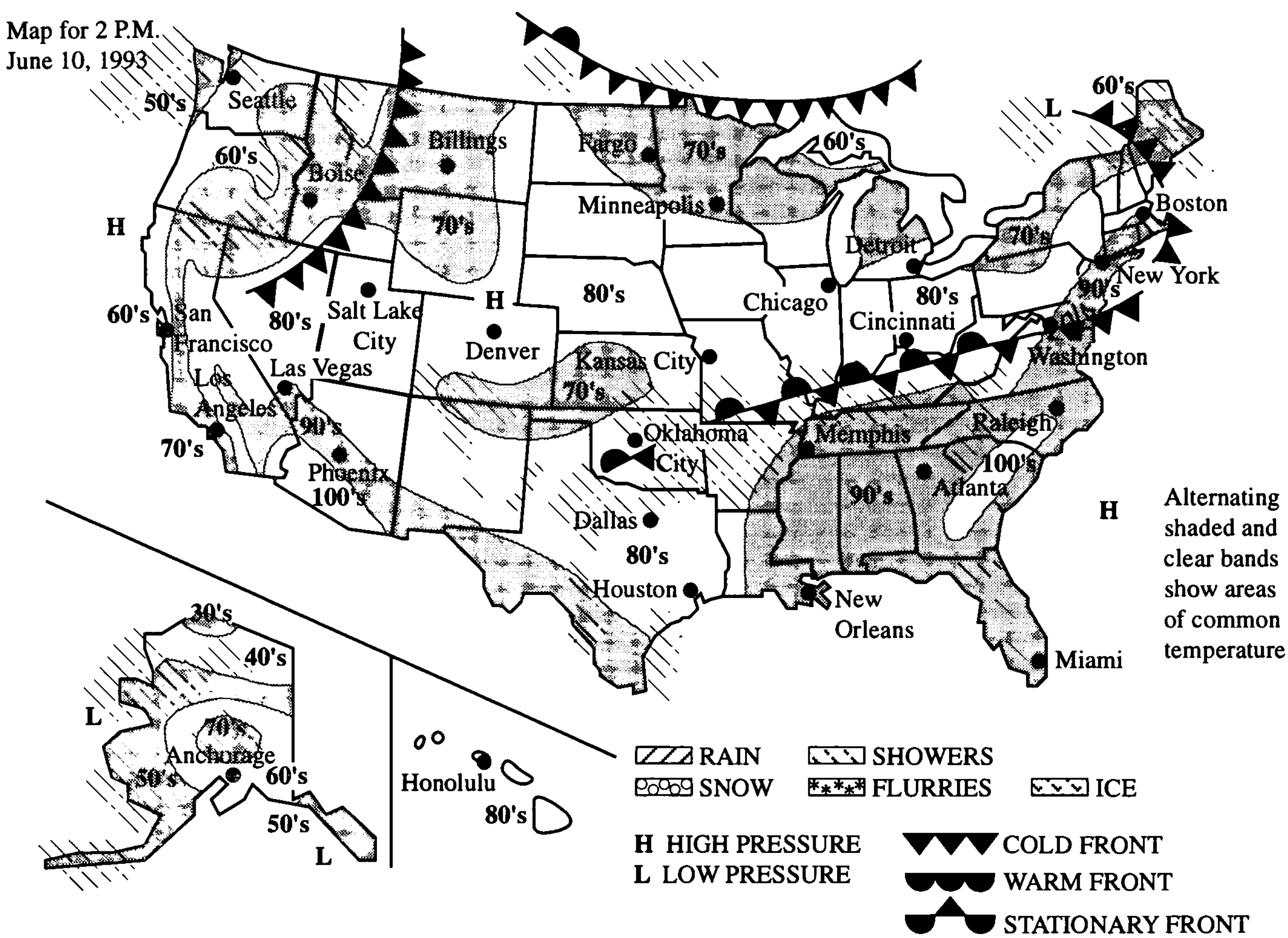
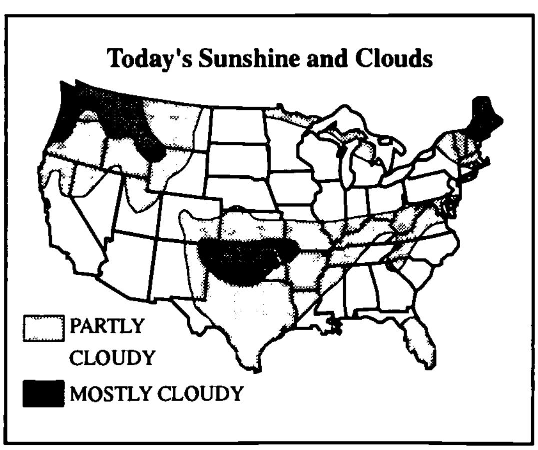
Predicting Weather

On June 11, regional skateboard championships will be held, and you will be a contestant. Weather conditions on that day will determine what you wear. Therefore, you consult the maps on the weather page of your newspaper for June 10 to predict the weather for June 11.

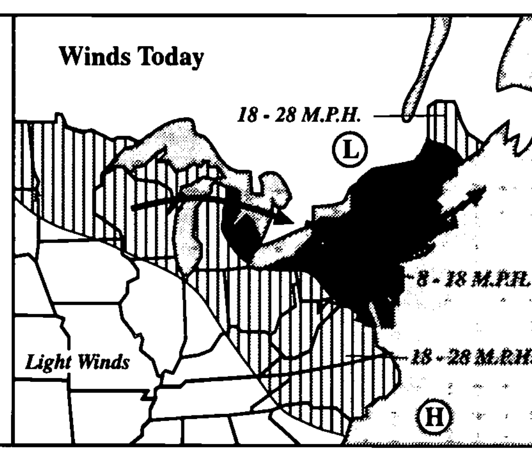
Today's High Temperatures and Precipitation





Weather Highlight

Low pressure in Quebec will direct very warm air across the North-east today on gusty winds. West winds could gust above 25 miles an hour.



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Predicting Weather

Use the information in the weather maps to complete the following question.

Performance

Prepare a map of the United States (you need NOT draw the states). Based on the positions of the weather fronts on June 10, predict the most likely positions of the same fronts on June 11. Draw the fronts on your map. Assume cold fronts move across an average of 2 to 3 states per day. Shade in areas that are most likely to be cloudy. Indicate areas of rain with hashmarks like those used on the map for June 10. Predict the high temperatures for the following cities: Miami, Houston, Kansas City, Minneapolis, Billings, and Seattle. List your assumptions, if any, and explain each of your predictions.

Explanation (and Assumptions):

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Insulating Materials

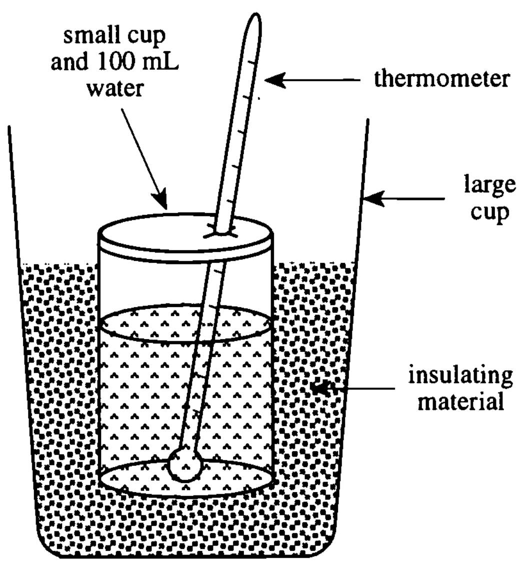
Suppose you bring a cold drink to school for lunch. You want to design a container or a package that will keep the drink cold. Think of a variety of materials available to use for designing this container. Your task is to select the best material to use in the container to keep the drink cold. Base your selection on data you collect from a fair test of the insulating characteristics of three different materials.

Complete the activities and answer the question(s) below as directed by your teacher.

Predict which of the three insulating materials will keep the drink cold the longest. Record your prediction on the data sheet.

Prepare to collect data on the change in temperature of water in a cup.

- Set up the equipment as shown in the diagram below. Pack one of the insulating materials into the space between a large and a small cup.



- Think about a procedure that you can replicate to collect time and temperature data. Use this procedure to help you collect reliable data to record in the data sheet.
    - Demonstrate proper experimental procedures, including safety, as directed by your teacher
    - Control variables and use tools properly.
- Repeat this procedure for a fair test of the insulating characteristics for other two materials.
- Describe the procedures that your group used to perform your study. This description should be clear and complete enough so that someone could easily repeat your study.

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Insulating Materials

Data Sheet

Which material do you predict will keep the water cold the longest?

____

Data Table: Record the temperature in the column under the appropriate cup.

Reading No.	Cup 1 Material 1	Cup 2 Material 2	Cup 3 Material 3
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

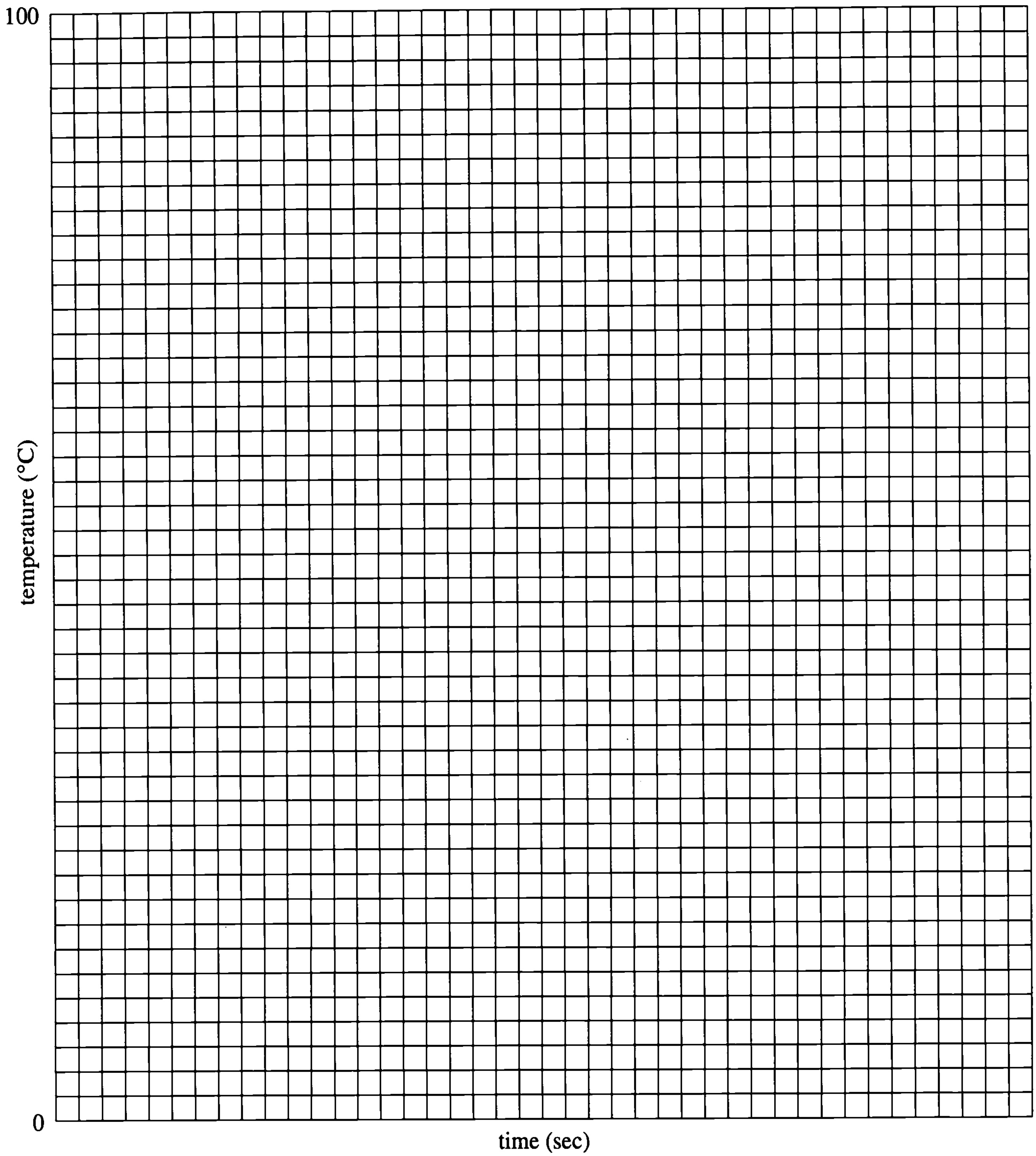
Questions

Analyze and describe the results; and apply understandings. Please answer the following questions by yourself.

1. On the graph paper, graph your data for each insulating material.
2. Suppose you repeated the experiment, except that you poured water at 50°C into the three small cups. Use the data in your graph to predict how long it would take the water in each cup to cool to room temperature (approximately 22°C). Explain how you arrived at each prediction.
3. What material did you predict would be the best insulator? Why did you make that prediction? According to the results of your experiment, which material is the best insulator? Why do you think this material is the best insulator? In any case, explain conditions when you may find this material not to be the best insulator (of the materials you investigated).

Insulating Materials

Graph



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Density

Submersible vessels, such as submarines, have long been used in underwater exploration. The vessels must be capable of descending and ascending to different levels in the water. This is accomplished by increasing or decreasing the vessel's mass, and therefore, its density. In this investigation you will have the opportunity to study how an object's density affects its ability to float in water (buoyancy).

Preparing for the investigation. You are going to make boats from aluminum foil to see how many washers they can support before sinking. You should follow the directions below and record the data in the data table below.

- Use a piece of aluminum foil 15 cm long x 15 cm wide to create a boat that will float in the aquarium.
- Measure the length and width of the bottom of the boat. Measure the height of the boat. Record this information in Table 1 below.
- Find the mass of the boat.

Investigate relationships for sinking and floating boats. Add washers to the boat, one at a time, until the boat sinks. In Table 1 record the mass of washers added to the boat to make it sink.

- Repeat this process, making boats of different shapes and determining how many washers they will hold before sinking.

Table 1

Boat	Length (cm)	Width (cm)	Height (cm)	Mass of boat without washers (g)	Mass of washers added to boat (g)
1					
2					
3					

Questions

Analyze and describe the results; and apply understandings. Please answer the following questions by yourself.

1. Calculate the density for one of the boats you made, including the mass of the washers that made the boat sink. Show your work. Compare the density you calculated for the boat and washers to the density of water. (The density of water is 1 gram/mL). When the boat sank, should the density of the boat and washers have been higher or lower than the density of water? Explain your answer.

2. Suppose that your lab partner creates two boats from two identical pieces of aluminum foil. The volume of Boat 1 is 500 cm^3. The volume of Boat 2 is 400 cm^3. Which of these boats will be able to support more mass before sinking? Explain your answer.

3. Based on the information above and the results of your investigations, predict and explain how a boat's buoyancy would change in a tub of sea water.

4. Based on the information above and the extending the principles your investigating, invent and explain a *boat* design that could float in air.

Phase Equilibrium

To investigate solid-liquid equilibrium, students used water and ice. Before the water and ice were mixed, the students measured the initial temperatures and masses of the water and the ice. The results are shown in Table A.

Table A

	Ice	Water
Temperature (°C)	–2	20
Mass (g)	50	150

The students added the ice to the water in a glass vessel and immediately began to heat the vessel. The vessel was heated gradually and the mixture was stirred until all the ice had melted. The students measured the temperature of the mixture at various times during the heating process, as shown in Table B.

Table B

Time (min)	Temperature (°C)
0	20
1	10
2	6
3	2
4	0
5	0
6	0
7	0
8	6
9	12
10	·18

The students obtained another 50 g of ice and 150 g of water at the initial temperatures given in Table A. They dissolved 3 g of table salt in the water and brought the solution back to 20° C. Then they added the ice to the salt solution and immediately began heating the mixture at the same rate as before and recorded the temperature of the mixture over time. They repeated this procedure with 6 g of salt. The temperatures of the two mixtures at the different times are recorded in Table C.

Table C

	Temperature (°C)	
Time	With 3 g salt	With 6 g salt
0	20	20
1	10	10
2	6	6
3	4	4
4	2	2
5	–2	–2
6	–2	–4
7	–2	–4
8	2	–4
9	6	0
10	10	4

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Phase Equilibrium

Use the information in Tables A, B, and C to help you answer the following questions.

Short Answer

1. On one piece of graph paper, **plot the time and temperature** data from Tables B and C. For each data set, draw a smooth line (for example, a straight line or a smooth curve) that comes close to all the data points. Make sure the axes of your graph are properly labeled. Using arrows, show the points on each line where the ice is beginning to melt and where all the ice has melted. Be sure to include a key that will allow the reader to identify each line.

Extended Response

The melting of ice is called a phase change. Another example of a phase change is water boiling. When water is brought to a boil or ice is heated and melted, certain characteristics of the graphs of temperature versus time for these processes are similar (but NOT identical).

Consider the information in Tables A, B, and C and the information about phase changes above. Suppose you heat water from 20° C until the water begins to boil.

2. On one piece of graph paper, draw a graph that shows how temperature changes over time when water is heated from 20° C until all the water has turned to steam. Clearly label the axes of your graph.

   Now on the same piece of graph paper, **draw a graph** of temperature versus time for salt water that has been heated from 20° C to boiling. Be sure to include a key that will allow the reader to identify each line on the graph.

   Discuss and compare the changes in temperature that occur over time when the water boils with and without salt in the water. Based on your interpretation of the shapes of the two graphs in Question 2, explain why some people believe, based on practical experience, that it is helpful to add salt to water when it is being brought to a boil for cooking stuff.

Phase Equilibrium

Graph 1

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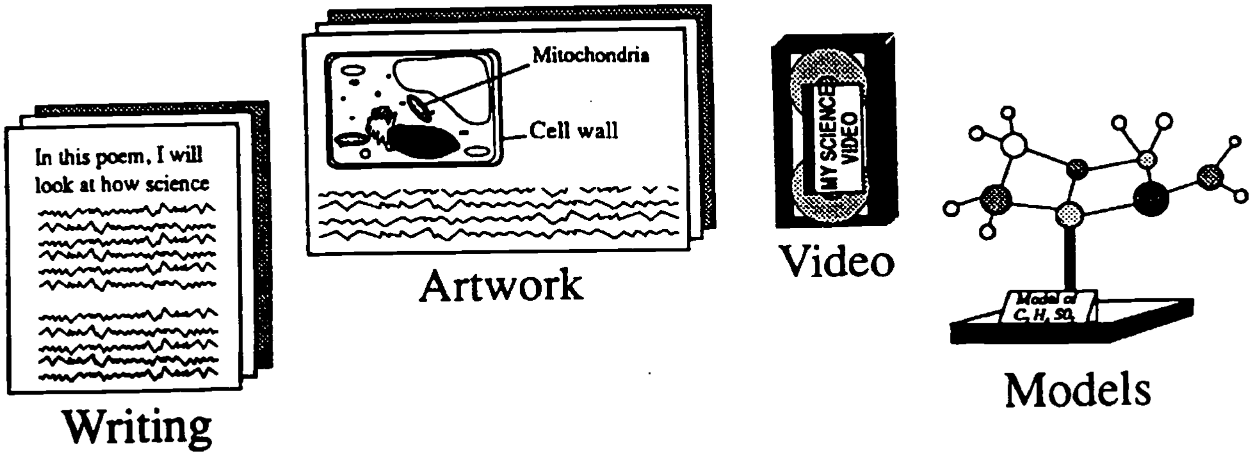
Phase Equilibrium

Graph 2

Type 3
Seventh Grade Science
Competency-Based Education Assessment Series



Substantive Application-Based Performance Tasks

(Open-Ended)

Characteristics

- Relevant inventive and creative applications, requiring experimental research, non-experimental research, and more out-of-class preparation
- Holistic scoring (e.g., portfolio scoring guide and interviews)

Item discussions provide an overview of items, pertinent content, and scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart.* Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments are focused on *Science Portfolio Scoring Guide* parameters, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with *Science Portfolio Entry* types, instructional strands, and organizing concepts.

Refer to the *Content Summary Chart.* It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Seventh Grade Type 3 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)* *Ninth Grade*
Page(s) 1	🗁						
Butterflies	1	See Discussion	Extending	2, 3, 7	I: 8 K: 4, 8 C: 5, 8 A: 3	Systems and Interactions	N: 1, 2 P: E: L: 13, 20
Page(s) 2	🗁						
Cells	1	See Discussion	Extending	3, 7	I: 5, 6, 8 K: 11 C: 5 A: 6	Models and Scale	N: P: E: L: 16
Page(s) 3	🗁						
Travel Agent to the Planets	1	See Discussion	Extending	1, 2, 3, 4, 6, 7	I: - All - (Except 5) K: - All - C: - All - A: - All - (Except 5, 6)	Models and Scale	N: 1, 2, 4, 19 P: E: 5, 6, 7, 18 L:
Page(s) 4	🗁						
Designing an Energy-Efficient Community Center	1	See Discussion	Extending	1, 2, 3, 4, 6, 7	I: - All - (Except 5) K: - All - (Except 6, 8, 10) C: - All - (Except 3) A: - All - (Except 5, 6)	Systems, Models and Scale	N: 2, 4, 19 P: 10, 11, 12 E: 6, 7, 18 L:
Page(s) 5	🗁						
How's It Working	1	See Discussion	Extending	1, 2, 3, 6, 7	I: - All K: -1, 3, 4, 7, 9, 11 C: -1, 2, 3, 4, 5, 7, 8, 9, 10, A: - All - (Except 3, 5)	Systems and Interactions	N: 2, 4, 19 P: 8, 9, 10, 11 E: L:

• Performance Objectives: Grade 7 ***Ohio's Model Competency-Based Science Program***

1. The learner will analyze and critique the science presented in the media (e.g., periodicals, advertisements, literary works, cinema, public documents).
2. The learner will design and use procedures to test the suitability of various materials for different purposes.
3. The learner will choose and use appropriate technologies to collect observations regarding a complex system (e.g., the atmosphere or an ecosystem) and use the observations to make predictions about the effects of changes made in various components of the system.
4. Presented with data on the consumption pattern of a resource in the local community, the learner will propose (e.g., written proposal, persuasive materials, videos) a strategy to manage the resource more efficiently and economically.
5. The learner will construct, test, and trouble-shoot a set of procedures for younger learners to use to investigate a common natural phenomenon.
6. Given a set of data on an event or phenomenon, the learner will summarize the data in several meaningful ways (e.g., graphs, tables, narratives, models).
7. The learner will use scientific terminology appropriate to their developmental level to make predictions in a complex system (e.g., weather, ecosystems, inertial, energy).

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Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description			
	Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

4C1

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Item Discussion

Item discussion on the following pages pertains to **SEVENTH GRADE** SCIENCE TYPE 3 MODEL COMPETENCY ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content.

For student TYPE 3 ASSESSMENT work which is being considered as potential science portfolio entries, please consider using the parameters for holistic evaluation of student work that are suggested in the *Science Portfolio Scoring Guide*. Each student product or demonstration need not reflect all parameters or all indicators for all parameters in the *Science Portfolio Scoring Guide*. (i.e., the *Guide* is not intended for use as a check list).

Science Portfolio Scoring Guide used with permission from the *CCSSO SCASS* Science Portfolio materials.

4E3

Item: Butterflies

Item Description:

This item assesses the students' ability to use data from Table 1 to understand the scenario presented, to recommend ways to change it, and to predict the outcome of those changes. It assumes that the student has knowledge of the butterfly life cycle. The student is also expected to understand the difference between number of individuals and number of species, and what variety means.

A good response will show that the student understands that by adding more plants and different types of plants, the butterfly population may be expected to increase. Since the only detailed information available is from Table 1, most responses will deal with the addition of plants listed in the table and the butterflies (adult or larval) that could be fed by those plants.

The greatest effect on population numbers may be expected by providing food for both larvae and adults in or near the flower and vegetable garden.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide.*

Scoring Parameters

- The student accurately discusses making provisions for both adults and larvae, accurately addressing knowledge of the butterfly life cycle, and demonstrating understanding of the difference between number of individuals and number of species, and what variety means.
- If students have prior/concurrent opportunities to adequately research pertinent information and/or participate in planting/managing a butterfly garden then it is reasonable to expect that students can support their recommendations to Ms. Harris' class and their predictions about what butterflies would likely appear with hands-on evidence. **Otherwise**, since the only detailed information available is from Table 1, most responses will deal with the addition of plants listed in the table and the butterflies (adult or larval) that could be fed by those plants.
- Student recommendation, using either text and/or a drawings, are consistent, clear, focused, and organized.
- If the item is further adapted at the local level to reflect local expertise, resources, and expectations, students can be expected to address the relevance of science pertinent to a butterfly garden. Otherwise, as designed attempts to make successful comparison of student response to this parameter is questionable.

Item: Cells

Item Description:

This item assesses the student's ability to formulate a rudimentary understanding of cell organelle function and interaction, and to use that understanding to develop appropriate analogies between organelle functions and the functions of departments of a city or factory.

A good response will analogize the functions of the organelles listed in Table 1 to the functions of various departments of a city or factory, citing both similarities and differences in function and acknowledging points at which analogies break down. While the number of reasonable and appropriate comparisons made should be considered, bear in mind a seventh grader's level of sophisticated understandings of organelle function. Additionally we want to avoid evaluating students on the basis of their understanding of a factory or city government and because a more appropriate and obvious comparison is difficult to think of.

Responses may include drawings to illustrate the comparisons made. Drawings alone will be insufficient for some comparisons, as some "departments" are difficult to draw in a way that makes their functions clear. Explanatory text should accompany such drawings.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide.*

Scoring Parameters

- The student makes reasonable comparisons between an organelle from Table 1 and a department of a city or factory, accurately addressing form and function relationships of an organelle.
- Student discussion accurately explains connections to factory operation pertinent to science form- and function-based comparison, and acknowledges the point at which one of the analogies breaks down.
- Student analogies, using either text or a drawing, are consistent, clear, focused, and organized across Table 1.
- Student gives successful descriptions. While the number of reasonable and appropriate comparisons made should be considered, bear in mind a seventh grader's level of sophisticated understandings of organelle function. Additionally we want to avoid evaluating students on the basis of their understanding of a factory or city government and because a more appropriate and obvious comparison is difficult to think of.

Item: Travel Agent to the Planets

Item Description:

Successful students responses will demonstrate ability to evaluate planetary data for it's informational value in a pamphlet they are to design to advertise planetary travel. This item assesses the student's ability to identify and meaningfully organize pertinent data about planets (and moons) in the solar system. The successful response will also show evidence that students have formulated conclusions about the habitability of the planet (moon) and recommendations for provisions for visitors' survivability.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide*.

Scoring Parameters

- Student identifies and accurately organize pertinent data about planets (and moons) in the solar system organize pertinent data about planets (and moons) in the solar system.
- Student references multiple sources of relevant information and shows evidence of formulating logical conclusions about the habitability of the planet (moon) and recommendations for provisions for visitors' survivability.
- Student demonstrates ability to evaluate planetary data for it's informational value in a pamphlet they are to design to advertise planetary travel. Details are precise, clear, focused, and organized.
- (If students have opportunities to brainstorm consequences and alternatives for travelers to consider based on information researched about the solar system:) Student makes use of information about the planets relevant to an audience of potential travelers by referencing background information about the planets in the context of consequences and alternatives for travelers to consider (e.g., itinerary considerations, safety, survivability, necessary travel accessories and provisions, potential points of interest, inventive and logical predictions about possible recreational and sporting activities).

Item: Designing an Energy - Efficient Community Center

Item Description:

A good student response will address responses to the following:

- How well does the building design address the question of energy efficiency?
- Is the orientation of windows and doors addressed?
- Is the shape of the building considered?
- Are the building's dimensions included?
- Is the layout of individual rooms and areas within the community center designed within the plan?
- Are experiments designed and conducted to address the question?

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide*.

Scoring Parameters

- Student identifies and accurately organize pertinent data and information about energy efficiency (e.g., transmission and transformation of energy, properties of materials). The impact of sun's angle through the seasons and daily cycles on the design is discussed and reflected in the students drawing and experimentation.

- Student references multiple sources of relevant information and shows evidence of formulating logical conclusions about the energy efficiency of the design. An experiment must be included. Safety for self and others is demonstrated.

- Student demonstrates ability to evaluate data and prepare a drawing and written explanation of the design. Details are precise, clear, focused, and organized.

- Student makes use of information about building codes and 'lay-of-the-land considerations' relevant to the recommended house design in the context of consequences and alternatives for inhabitants to consider (e.g., safety, comfort, potential architectural points of interest, inventive and logical conclusion about possible arrangements of trees and other foundation plants).

Item: How's It Working?

Item Description:

Students explore the question: How do things work to meet the needs of people? This items assess a students' understandings of the interactions of people and technological systems. Students are expected to assess factors affecting a building's livability. They will design, build and test working models of structures and systems. During this process they will collect and use data to support recommendation on how to optimized the interaction between people and the various systems and subsystems (e.g., structural, lighting, electrical, ergonomic, furnishings, heating, and ventilation).

A good student response will address responses to the following:

- Are the type and shapes of the technological system being redesigned clearly identified?
- A description of the area of the building (room, door, hall, stair) is provided
- Focused discussion about the internal structures and devices that affect the ease of use and access (and safety)
- Has compliance with local building codes of the area and technical standards.
- Are experiments designed and conducted to address the question?

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide.*

Scoring Parameters

- Project contains a drawing and a written discussion in which both include detailed information about easier access and use due to a change or addition of a technology (e.g., simple machine, lighting fixtures, sound deadening material). The impact on the design is discussed and reflected in the students drawing(s) and experimentation.

- Student references multiple sources of relevant information and shows evidence of formulating logical conclusions about easier access and use of the design. An experiment must be included. Safety for self and others is demonstrated.

- Student demonstrates ability to evaluate data and prepare a drawing and written explanation of the design. Details are precise, clear, focused, and organized.

- Student make use of information about building codes and other data to optimized the interaction between people and the various systems and subsystems (e.g., structural, lighting, electrical, ergonomic, furnishings, heating, and ventilation) relevant to the recommended design in the context of consequences and alternatives for inhabitants to consider (e.g., safety, easier access and use).

Butterflies

Ms. Harris' class wanted to attract butterflies to their schoolyard. They knew that certain flowers are the butterflies' only source of food. Therefore, they decided to plant a butterfly (flower) garden. To prepare for this project, the students worked in cooperative groups to gather data on butterflies and flowers. The students also gathered information about the butterfly caterpillar (larval stage in the life cycle of an insect).

Mark and Melody visited three areas: a vegetable garden, a weedy lot, and a park. They found flowers and butterflies at each location. The information they gathered is shown in the following table.

Table 1

Name of butterfly	Flower to which butterfly is most attracted	Plant preferred by butterfly larvae for food
black swallowtail	clover	parsley
cabbage white	nasturtium	thistle
dwarf yellow	marigold	broccoli
fritillary	milkweed	violets
monarch	aster	milkweed
snout	butterfly bush	hackberry bush

Performance

Please complete the following by yourself.

In your friend's combination flower/vegetable garden, you have seen adult dwarf yellow and cabbage white butterflies. You have also seen some larvae on the broccoli in the vegetable garden. Explain in detail what you would recommend to increase the butterfly population (both in numbers and in variety). Predict what butterflies would likely appear in the garden if your recommendations were followed.

Cells

You are studying cells. Table 1 below lists some *organelles* (cell parts) and their functions.

Table 1

Organelle	Location	Function
cell membrane	outer surface of cell	controls what enters and leaves cell
nucleus	near center of cell	controls cell functions
mitochondrion	scattered around cell	produces energy for cell
endoplasmic reticulum	throughout cell	transports molecules within cell
ribosome	along endoplasmic reticulum	manufactures proteins
golgi apparatus	throughout cell	prepares molecules for export from cell

Performance

Please complete the following by yourself.

Compare and contrast the ways organelles function with the ways the departments of a city or a factory function. You may draw pictures to help illustrate your points.

Travel Agent to the Planets

Imagine that travel through space has become more common. Civilians are very curious about space. They want to see different planets and moons, and they wonder about what adaptations, if any, a human would need to make to visit or live there.

Your group has been selected by a local travel agent to design a travel brochure for one of the planets or moons in our solar system. The travel brochure for a given planet or moon will be comprehensive, including information about the planet's physical properties; what human life would be like there; what types of life might be indigenous (i.e., occurring naturally on or native) to the planet; and what things make this a unique place worthy of a vacation.

Part I: Collecting Background Information

First you must select and research your planet or moon. Before you imagine plant and animal life for your planet and describe interesting tourist attractions, you must research and record what the physical properties of the planet are (for example, location and climate conditions). In general, you will need to know how human life could be sustained on the planet and what plants and animals would have to be like to survive there.

Part II: Developing Your Brochure

You should review travel brochures and tour brochures for locations here on Earth. This will give you an idea as to the types of elements that are traditionally included in a travel advertisement. You may want to talk with a travel agent when you start the project.

The final brochure must include the time required for you to get to your destination and the scientific information about the planet you have selected, along with the usual type of travel brochure advertisements. It may include pictures, suggested tours and a calendar of events, diagrams, graphs, maps, or other visual aids. Be creative but be thorough. Also remember that your travel brochures will be mailed all over the world, so you will want to design something that can be shipped easily in a large envelope.

Part III: Selling Your Planet

The final brochure should convince people that your planet is very different from Earth and a place worth visiting.

When your group turns in the final travel brochure, it should include all research notes, interview notes, or other data you gathered in the process of making the travel advertisement.

Designing an Energy-Efficient Community Center

The United States uses more energy than any other industrialized nation, and our use of it is not very efficient. More energy than necessary is used in heating and cooling our homes and public buildings. There are a variety of things we could do to use energy more efficiently.

Your group works for an architectural company that is competing for a contract to design and build an energy-efficient community center. The center will be used by children and adults. It is expected that the building will be used from early morning until late at night. You are required to submit a written proposal, including a drawing (to scale) of the center, to the city council.

The city council has several requirements for the community center. The building must be energy-efficient and it must use some form of solar energy. The contract will be awarded to the design that meets all the guidelines for energy efficiency and is most complete.

The following must be addressed in your proposal:

- The shape of the building
- The area of the building (exactly 35,000 square feet)
- Walls and internal structures that efficiently capture energy from the Sun's rays and re-radiate heat into the environment*
- The number and types of windows and the directions they face*
- The roof's orientation and angle of inclination*
- Compliance with local building codes of the area, such as thermal insulation codes
- A description of the building's classrooms, gymnasium, game room, office space, locker rooms, and rest rooms

Your group's proposal, **including the drawing,** must be submitted along with all supporting data you collected during the process.

*You must conduct experiments to support these portions of your proposal. The data and your conclusions should be included in the report to the city.

How's It Working?

There are a variety of technological systems in public buildings. A building's livability can be optimized by improving the interaction between people and the various systems and subsystems (e.g., structural, lighting, electrical, ergonomic, furnishings, heating, and ventilation).

How do these things work to meet the needs of people? These systems should contribute, for example, to making rooms and corridors (doors, halls and stairs) easier and safer to access and use.

An architectural company is under contract to evaluate, and redesign if necessary, the various rooms and corridors in your school. The company is collecting the suggestions of students and teachers. Your job is to help prepare a suggestion for the architectural company. As you know your school is to be used by students, teachers, and community members. It is expected that some of these people will be elderly and/or disabled. Your suggestion, including a drawing (to scale) of your redesign, should completely explain how it will help make the room or corridor easier and safer to access and use.

The following must be addressed in your proposal:

- The type and shape of the technological system you are redesigning
- A description of the area of the building (room, door, hall, stair) you are redesigning
- Internal structures and devices that affect the ease of use and access *
- Compliance with local building codes of the area and technical standards.

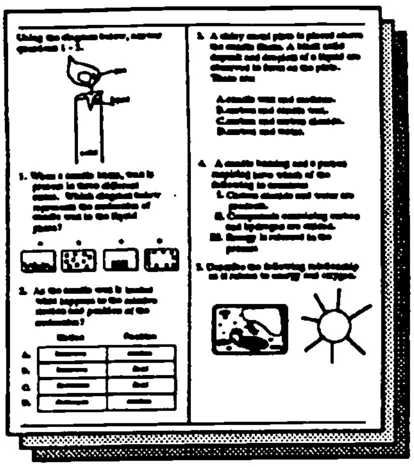
Your group's proposal, **including the drawing,** must be submitted along with all supporting data you collected during the process.

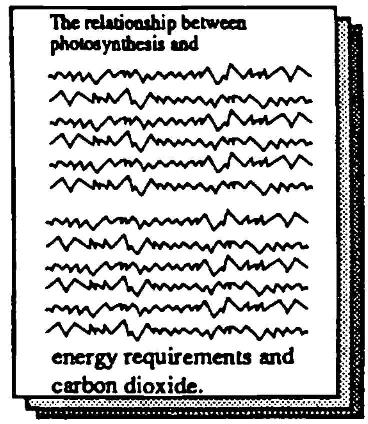
*You must design and conduct procedures to support and evaluate the suitability of these portions of your recommendation. The data and your conclusions should be included in the suggestion to the architectural company.

Type 1

Eighth Grade Science

Competency-Based Education Assessment Series





° Multiple Choice, Short Answer and Extended Response °

(Traditional)

Characteristics

- Requiring a minimum of a session
- Scoring with answer keys in combination with (interviews and) rubrics

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments reflect all performance levels, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure district assessments reflect a coherence with instructional strands and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*

• Eighth Grade Type 1 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)* *Ninth Grade*
Page(s) 1 - 2							
Pesticides	1	B	Processing	1, 6	I: 1, 4 K: 1, 2, 4, 8, 10, 12 C: 3, 6, 8 A: 1, 2, 3	Systems and Interactions	N: 19 P: E: L: 13, 15, 20
	2	C	Acquiring				
	3	A	Processing				
	4	See Discussion	Processing				
	5	D	Processing				
	6	See Discussion	Processing				
	7	See Discussion	Extending				
Page(s) 3 - 4							
Water Pollution	1	C	Processing	1, 6	I: 1, 4, 9, 10 K: 2, 3, 4, 12 C: 3, 6, 10, 11, 12 A: 1, 2, 3	Systems and Interactions	N: 2, 19 P: E: L: 20
	2	B	Processing				
	3	D	Acquiring				
	4	D	Acquiring				
	5	C	Acquiring				
	6	B	Processing				
	7	See Discussion	Processing				
Page(s) 5 - 6							
Diversity of Life	1	C	Processing	5	I: 4, 12 K: 6, 8, 14 C: 12, 13 A:	Systems and Interactions	N: 1, 2 P: E: L: 14, 16
	2	B	Processing				
	3	C	Processing				
	4	A	Acquiring				
	5	A	Acquiring				
	6	See Discussion	Processing				
	7	C	Processing				
Page(s) 7 - 8							
Rock Formations and Plate Tectonics	1	C	Acquiring	1, 6	I: 1, 4, 6, 12 K: 1, 2, 4, 6, 8, 10, 11, 12, 13 C: 3, 5, 12 A: 1, 2, 3	Change Over Time	N: 2, 17 P: E: 5, 7 L:
	2	C	Acquiring				
	3	See Discussion	Processing				
	4	A	Processing				
	5	D	Acquiring				
	6	See Discussion	Processing				
	7	See Discussion	Processing				
Page(s) 9 - 10							
A Stellar System	1	D	Processing	1, 3	I: 1, 5, 12 K: 1, 4, 8, 11, 12, 13 C: 12 A:	Models and Scale	N: P: E: 6 L:
	2	A	Processing				
	3	A	Processing				
	4	See Discussion	Processing				
	5	See Discussion	Processing				
	6	See Discussion	Extending				

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Content Summary Chart

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• Eighth Grade Type 1 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s) Ninth Grade*
Page(s) 11 - 13							
Physics In Action	1	C	Processing	1, 3	I: 1, 5, 12 K: 1, 3 C: 1, 3, 4, 7, 12, 13 A:	Constancy	N: 2 P: 9, 10 E: L:
	2	B	Processing				
	3	See Discussion	Processing				
	4	B	Processing				
	5	C	Acquiring				
	6	See Discussion	Processing				
	7	D	Processing				
	8	C	Acquiring				
	9	See Discussion	Processing				
	10	See Discussion	Extending				
Page(s) 14 - 15							
Nutrition	1	C	Acquiring	1, 4	I: 1, 3, 4, 8, 10, 12 K: 2, 9 C: 3, 5, 6, 8, 12 A: 1, 5, 6, 7, 8	Systems and Interactions	N: 4 P: 10, 12 E: L: 13, 16
	2	A	Acquiring				
	3	C	Processing				
	4	C	Processing				
	5	See Discussion	Processing				
	6	See Discussion	Processing				
	7	See Discussion	Processing				
Page(s) 16 - 17							
Exercise Physiology	1	B	Acquiring	1, 4	I: 1, 4, 5, 6, 9, 10, 12 K: 1, 4, 7, 8, 11, 13 C: 3, 5, 7, 13, 14 A: 1, 4, 5, 6	Systems and Interactions	N: 4 P: 8, 10 E: L: 16
	2	D	Acquiring				
	3	B	Acquiring				
	4	D	Extending				
	5	See Discussion	Extending				
	6	A	Processing				
	7	D	Processing				
	8	See Discussion	Processing				
	9	See Discussion	Extending				

• Performance Objectives: Grade 8 ***Ohio's Model Competency-Based Science Program***

1. Presented with a structure or series of events (e.g., amusement park rides, changes of phase, porosity, permeability, toxicity, hazardous waste removal, enzymes, oxidation and reduction, threshold limits), the learner will analyze features related to the constancy and rates of change represented.
2. The learner will construct a simple working model (e.g., Rube Goldberg apparatus, simple vehicles, energy conservation systems, stream tables, terraria, aquaria) of a macro-scale phenomenon.
3. Presented with data on the motion of several objects (e.g., celestial bodies, freely falling objects, projectile motion, vehicular motion), the learner will construct a visual representation that can be used to predict the motions of the objects at subsequent times.
4. Given a learner-identified issue of local community importance (e.g., air pollution, pesticides, chemical exposure, radon, abandoned hazardous waste sites, transmission lines, landfills), the learner will collect information and observations and take action on a decision made regarding the issue.
5. Provided with several objects or organisms and the appropriate key, the learner will identify the organisms or objects.
6. Given data collected by self and others regarding changes over long time frames (e.g., corrosion, succession, erosion, glaciation), the learner will construct a model of the changes that have occurred.
7. The learner will create a blueprint, sketch, or map (e.g., street, topographic, electric field, magnetic field, acoustical, thermal) for other learners to use and follow directions using a blueprint, sketch, or map provided by other persons.
8. The learner will construct a device or tool (e.g., exercise machine, robot, periscope, computer, scissors, radio, vehicle) that takes advantage of or enhances personal performance.

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Instructional Strands • Grade 8 •

Objectives	*Inquiry* • The learner will:	*Knowledge* • The learner will:	*Conditions* • The learner will be:	*Applications* • The learner will be:
1	use complex concepts to describe structures and events (e.g., geometric configurations, duration, rates of change, limits, cause and effect, constancy, conservation, dissipation).	investigate the principles that describe and predict motions of objects and functions of organisms.	suggesting and selecting topics and strategies for investigation.	resolving issues of personal interest, health, and safety utilizing various strategies (e.g., asking informed questions of authorities, formulating testable hypotheses).
2	approximate various irregular areas and volumes of solids by various means (e.g., graphical, physical).	investigate the influences of groups of objects, organisms and forms of energy on each other (e.g., light, sound, electricity and magnetism, heat, earth processes, predators, pesticides).	constructing, clarifying, and extending questions to improve investigative methods.	using, consuming, and disposing of consumer products properly.
3	identify statements that are misleading because they are absolute or general in nature (e.g., use a celebrity as an authority, or use vague attributions in place of specific references like "Leading physicists say...", "Everybody knows...", "Statistics show...").	investigate strategies that can be used to optimize the interactions between components of technological, social, and ecological systems (e.g., recycling, neutralizing, stress and friction reduction, buffering, modulating, impedance matching).	examining, and discussing different perspectives on physical and biological phenomena.	advocating the consideration of intersystem relationships (e.g., environmental, economic, social, industrial).
4	determine the likelihood of events, by identifying contributing and causal factors and estimate the confidence level of predictions.	investigate patterns in nature (e.g., symmetry, reflected and refracted light, life cycles, harmonic motion).	participating in group investigations of activities that include learners of different ages.	making decisions based upon the risks and benefits associated with various resource utilization and waste management strategies.
5	estimate lengths, weights, and time periods and judge whether the estimates or computations are reasonable.	investigate the heritability of attributes and the maintenance of diversity through a variety of reproductive strategies.	using activities, resources and concepts from other disciplines in investigations to broaden, enrich, and support his/her understandings.	recognizing and pursuing questions related to choices that can be investigated scientifically.
6	develop increasingly sophisticated logical thinking strategies (e.g., "If...Then" logic).	investigate various standard classification systems (e.g., the periodic table, Linnean classification, the HR series).	identifying issues and utilizing experts and information to generate courses of action for resolving community issues.	implementing appropriate wellness strategies that will contribute to personal satisfaction and growth.
7	produce quality instructions, recipes, maps, and plans for use in learning activities.	investigate historical understandings of the conservation of matter and energy (e.g., Lavoisier, Watt, Joule, Einstein).	assisting others (e.g., peers, persons younger and older) in doing tasks, solving problems, and understanding concepts.	planning menus and choosing products in light of various food production and consumption practices in different cultures.
8	perform risk analyses to inform personal decisions associated with personal safety and health.	investigate composition and level of organization of objects and organisms (e.g., rocks, minerals, compounds and elements; organisms, systems, organs, tissues, and cells).	using community resources to collect and analyze consumer product information.	manipulating the amounts and combinations of ingredients to observe the impact of different combinations on the effectiveness of common household products and quality of foods.
9	formulate personal explanations and inferences based on reliable data.	investigate models of macromolecular structures and the physical and biological implications of these structures (e.g., enzymes, DNA, hemoglobin, polymers).	communicating clearly scientific questions, purposes, procedures, and results.	
10	modify personal behaviors and understandings of scientific principles based on new information, experiences, and interactions with other learners.	investigate models and theories of change over time (e.g., natural selection and speciation, stellar evolution, plate tectonics, the rock cycle).	listening carefully to and analyzing the proposals and arguments of others.	
11	apply accepted ethical standards to the treatment of the subjects of investigations.	investigate very large scale objects, quantities, and phenomena (e.g., galaxies, glaciation, watersheds, the speed of light, interplanetary distances).	recognizing and critiquing presentations that lack distinction between fact and opinion.	
12	collect and analyze information from phenomena utilizing various techniques and technologies (e.g., slides, flash photography, videotape, multimedia, computer-based sampling devices, and simulations).	investigate concepts involving large and small time spans (e.g., hazardous waste disposal, relative life spans of stars and organisms, plate tectonics).	performing investigations over long and short time periods.	
13		investigate evidence of relative motion between and among objects (e.g., Doppler effect, frames of reference).	performing investigations responsibly and safely in a safe and healthful environment.	
14		investigate dichotomous keys for artifacts and objects.	constructing a portfolio of products and self-evaluations of his/her own abilities, skills, and experiences.	

Item Discussion

Below is a summary list of items from the SCIENCE TYPE 1 MODEL COMPETENCY ASSESSMENT for the **EIGHTH GRADE** that begin with the "Explain and justify..." stem and immediately follow a related selected response item. In general, use of this "Explain and justify..." strategy is consistent with the questioning spirit of the Science Model (e.g., "How do we know?", "What is or reasonably can be inferred?", "How does it work?"). Secondly, this is another strategy for making a multiple choice item more interactive for students, and depending on how they respond, provide a wider window into their thinking.

The use of this strategy and the interpretation of student responses to this prompt, will depend upon numerous factors (e.g., the content of the district science program, particular emphases placed on individual topics, differing expectations for student performance on particular topics, needs of teachers and students to collect and share deeper insight). In any event, a general rubric approach that can be used to interpret student responses follows:

Criterion	**Rubric Summary**
1.	Answer in any way addresses the prompting question relative to the context of multiple choice item. Any remotely reasonable assumption and scientific response to this question is acceptable (even if incorrect).
2.	Answer presents assumption and accurate scientific explanation that accounts for and successfully connects students' selected response to the information in the context of the item.

Summary List Items with the "Explain and justify..." Stem

• Eighth Grade Type 1 •		
Assessment Block	*Item*	*Answer*
P. 1		
Pesticides	4	Response Varies
P. 4		
Water Pollution	7	Response Varies
P. 6		
Diversity of Life	6	Response Varies
P. 8		
Rock Formations and Plate Tectonics	3	Response Varies
P. 10		
A Stellar System	4	Response Varies
P. 12 - 13		
Physics In Action	3	Response Varies
	6	Response Varies
P. 15		
Nutrition	5	Response Varies
P. 17		
Exercise Physiology	5	Response Varies

Item Discussion

The discussion on the following pages pertains to each of the **Short Answer** and **Extended Response** items on the SCIENCE TYPE 1 MODEL COMPETENCY ASSESSMENT for the **EIGHTH GRADE**. Discussion of these items include an **Item Description** which provides an overview of the item and the elements of an acceptable student response. The **Rubric Summary** further organizes these elements in a quick reference table reflective of suggested stages of an acceptable student response.

Item: Pesticides
#6 • Short Answer

Item Description:

This item assesses the student's ability to apply the 'academic' principles of adaptation and evolutionary pressures to a 'real-world' situation.

A good answer will correctly identify the insecticide as a force of (un)-natural selection that (over <u>many</u> generations) eliminates insects (and their potential off-spring) that are not resistant to insecticides, allowing insecticide-resistant insects to reproduce and increase as a percentage of the species population. All good answers should clearly demonstrate that this increasing resistance is a change of <u>populations</u>, rather than of <u>individuals</u>.

Criterion	Rubric Summary
1.	Answer in any way addresses the prompting question. Any remotely reasonable, scientific (cause and effect), response to this question is acceptable.
2.	Answer presents a reasonable, scientific explanation (even if incorrect) of what forces might account for the insects increased resistance to pesticides.
3.	Answer displays some understanding of the force involved in natural selection or of the process of adaptation.
4.	Answer shows clear understanding of evolutionary and adaptive processes and the forces driving such processes.

#7 • Extended Response

Item Description:

This item assesses the student's ability to interpret a food web and to forecast how changes in one part of that web will affect its other members.

A good answer will correctly identify and justify what the other animal populations might do in response to the elimination of one species, and will show some awareness of the complexity and difficulty of predicting what will happen to other parts of a food chain when one species is eliminated.

Criterion	Rubric Summary
1.	Correctly identifies and justifies Bird Species #1 as 1) decreasing or 2) staying the same or makes an attempt to answer the question.
2.	Correctly identifies and justifies - Insect Species #2 as 1) decreasing, 2) staying the same or 3) increasing.
3.	Correctly identifies and justifies - Bird Species #2 as 1) decreasing, 2) staying the same or 3) increasing
4.	Show a broader understanding of population changes in a changing food chain.

Item: Rock Formations and Plate Tectonics
#6 • Shorter Answer

Item Description:

This item assess the student's knowledge of the relationship between plate tectonics and volcanism, and their ability to predict the effect on volcanism if tectonic activity ceased.

A good response will state that volcanism will decrease because: a) there will be no more magma being formed from melting of subducted plates at convergent plate boundaries, b) plates will no longer drift apart allowing magma to rise to the Earth's surface, and c) volcanic islands such as Hawaii would stop "growing" because there would be no more hot spot/mantle plume activity within plates (or at least hot spot activity should eventually cease because hot spots are believed to be caused by convection (heat) currents on the mantle similar to those that produce plate movement, but this is uncertain).

Criterion	Rubric Summary
1.	Student states at least one effect of plate tectonics on volcanism, even if incorrect, or states how volcanic activity will change.
2.	Student states that volcanic activity will decrease (or stop) and connects plate movement to volcanic eruptions (release of magma) in at least one way.
3.	Student meets Criterion 1 and specifically links volcanism to plate boundaries or hot spots.
4.	Students meets Criterion 1 and demonstrates advanced knowledge of plate tectonics and the student must demonstrate no misconceptions about volcanism and plate tectonics.

#7 Extended Response

Item Description:

This item assess the student's ability to apply the Laws of Superposition and Cross-Cutting Relationships to interpret the relative ages of rocks in an outcrop.

A good response will recognize that the oldest sedimentary rocks are on the bottom, and become progressively younger toward the top of the diagram because younger layers are always deposited on top of pre-existing layers. They will also discuss the fact that the igneous rock cuts across layers Q, P and O (therefore it is younger), but does not cut across M and N (therefore it is older), and the metamorphic rock was caused by the igneous intrusion, so they are about the same age. The order, from oldest to youngest, is best listed as Q-P-O-(S, R)-N-M.

Criterion	Rubric Summary
1.	Student describes the relative ages (older than, younger than) of at least 2 rocks or makes a general statement about relative ages of rock layers on the diagram, even if incorrect.
2.	The student recognizes that the oldest sedimentary rocks are on the bottom of the diagram, and the sedimentary rocks become progressively younger toward the top (Law of Superposition). The use of this concept must be consistent. The students may have R and S out of order and still meet Criterion 2, because igneous and metamorphic rocks do not always follow the Law of Superposition. On this diagram, they follow the Law of Cross-Cutting Relationships.
3.	The student meets Criterion 2 and states that sedimentary rocks get progressively younger towards the top of an outcrop (or progressively older toward the bottom) because that is the way sedimentary rocks are deposited.
4.	The student meets Criterion 2 and correctly orders the igneous/metamorphic rocks: "Q-P-O-S-R-N-M", and explains the impact of igneous intrusion or cross-cutters.

Item: A Stellar Systems
#5 • Short Answer

Item Description:

This item requires students to interpret a diagram and a table and use the information in them to determine the relationship between a planet's distance from the star it orbits and its orbital period, and to explain how they achieved their solutions. At the basic level, it is apparent that the relationship is that the farther away from its star a planet is, the longer its period will be. Difference among student ability to explain how they reach their conclusions and how thoroughly they demonstrate their understanding of the quantitative implications of the values in the diagram and table may appear. Although a student need not create a chart or diagrams to formulate and hypothesize suitable solution to the problem, it is especially helpful to do so.

Criterion	Rubric Summary
1.	Any genuine attempt to answer the question. A genuine attempt must try to answer the question asked, even totally incorrect.
2.	Correctly identifies Saturn as the planet which takes longer to orbit the sun and justifies that answer with some further elaboration. OR Demonstrates the proper understanding that the planet farther from the Sun will take longer to orbit.
3.	Makes an explicit connection with the chart or diagram in Figure 1 in justification of a correct response.
4.	Derives values within correct parameters.

#6 • Extended Response

Item Description:

This question requires students to asses limitations of one model of the innermost four planets of the Solar System. Students must apply concepts of the Earth's revolution around the Sun and tilt on its axis to an understanding of time of the year and seasons. Students are asked to explain the changes and/or additions they would make to the illustration to better model why the Northern Hemisphere of the Earth is colder in January than in July. To receive full credit a sketch or drawing must accompany a student's explanation..

A completely successful answer will include necessary discussion and illustration to overcome limitations of the given model to explain why the Northern Hemisphere of the Earth is colder in January than in July. The student correctly identifies the Earth as planet C in the original illustration. The student adds the tilt of the Earth's spin axis relative to the plane of the planets orbits. The student accurately refers and/or illustrates the Earth's location in it's orbit in January and July. The students correctly associates the major difference in the seasons with the difference in the angle of the Sun's light incident on the Northern Hemisphere resulting from the tilt of the Earth's spin axis relative to the plane of the planets orbits. When evaluating a response, note any such instance of written demonstration, which might easily be overlooked.

Criterion	Rubric Summary
1.	Any attempt to precisely discuss/illustrate the tilt of the Earth spin axis relative to the plane of the Earth's orbit.
2.	Correctly discuss/locate the Earth during the months of January and July in its orbit at two distinct locations about 1/2 orbit apart; AND does not incorrectly associate the major difference in the seasons with a seasonal difference in distance between the Earth and Sun.
3.	Correctly discuss/associate the major difference in the seasons with the difference in the angle of the Sun's light incident on the Northern Hemisphere resulting from the tilt of the Earth's spin axis.
4.	A correct answer which shows how all the proposed additions/changes overcome the limitations of the given model.

Item: Physics In Action
#9 • Short Answer

Item Description:

This question requires students to identify the forces influencing a roller coaster ride after it has been accelerated by gravity to its maximum speed and has begun to brake as it travels along a section of straight, level track. A constant braking system is reducing the speed of the car from its maximum at X to zero at Y.

Criterion	Rubric Summary
1.	Any genuine attempt to answer the question.
2.	Any response which contains a correct statement of one of the forces in action.
3.	Contains a correct statement about one of the forces in action AND Correctly identifies how at least one of those forces influences the riders' speed.
4.	States a correct quantitative relationship of the riders' changing speed. AND States most of the force acting on the ride and correctly states how each force affects the riders' speed; the discussion of how must be more than just saying, "It slows them down", or "Keeps them going", to qualify.

#10 • Extended Response

Item Description:

This question requires students to identify the forces influencing a roller coaster ride as it is accelerated by gravity to its maximum speed (between points A and M), is maintained in motion along a fixed path by the curved track (between points M and X), and has begun to brake as it travels along a section of straight, level track (between points X and Y).

A complete response qualitatively describes how each force affects how the rider feels apparent changes in their weight between points A and Y. Correct description would include the following ideas, but not be limited to these exact words, Between points A and M: "The riders feel *weightless* as they are falling due to gravity"; between points M and X: "The riders feel *heavier* than normal while being pressed into their seat by the track curving underneath them."; and between points X and Y: "The riders feel like their weight is being *thrown* forward as the brakes(friction) brings the ride to a stop."

Criterion	Rubric Summary
1.	Any genuine attempt to answer the question.
2.	Any attempt to show different forces and feelings of weight at different points in the ride.
3.	Contains some correct statement about forces of gravity to accelerate, and friction to stop.
4.	States a correct qualitative relationship of the riders' changing position and the effect of those forces acting at various parts of the ride between points A and Y. AND States correctly how each force affects how the rider feels; the discussion of how the riders feel must be more than just saying, "It feels like they slow them down", "...keeps them going", or "...make them stop." to qualify.

Item: Nutrition
#6 • Short Answer

Item Description:

This item assess a student's basic knowledge of human nutritional needs in the context of selecting food by looking at consumer labels.

A good response should show that the student understands what information is presented on a label and its relationship to human nutrition and/or health. The response should correctly describe four types of nutritional information typically listed on food labels and can explain how each item is critical to human nutritional needs.

Criterion	Rubric Summary
1.	List one nutritional characteristic (e.g., protein content, fat content, vitamin, mineral, etc.) and discusses correctly its importance to human nutrition or health. OR List two nutritional characteristics without correctly describing their importance.
2.	Lists two nutritional characteristics and discusses correctly their importance to human nutrition or health. OR Lists four nutritional characteristics without correctly describing their importance.
3.	Lists three nutritional characteristics and discusses their importance to human nutrition or health
4.	Lists four nutritional characteristics and discusses correctly their importance to human nutrition or health.

#7 • Extended Response

Item Description:

This item assesses the student's ability to trace the energy transformations which occur within a particular food chain to demonstrate an understanding of how energy is transformed and utilized by biological organisms.

A good response correctly shows the conversion of thermal energy from the sun to chemical energy within plants to food (chemical) energy within cows and humans. The response should also describe accurately how a hamburger is digested to produce energy for cellular metabolism.

Criterion	Rubric Summary
1.	Starts with the sun or plants as sources of energy.
2.	Relates the transfer of energy from plants to the cow.
3.	Relates the transfer of energy from cows to humans.
4.	Describe energy transfers from digestion to the end user, the cell.

Item: Exercise Physiology
#8 • Short Answer

Item Description: This item assesses student understanding of how exercise increases the human body's sweat output and how sweating is beneficial.

A good response explains that exercise increases energy utilization and results in an increase in body temperature, relative to the body's resting state. The increased energy utilization results in an increase in body temperature. As a result of the body's temperature rise, sweat production increases which serves to carry away some wastes from the body and cool down the body as it evaporates from the skin.

Criterion	Rubric Summary
1.	Response explains that the body expends more energy during exercise. OR Exercise means the body is doing more work.
2.	Response explains that increase in heat produced by cells during exercise results in increase in body temperature
3.	Response explains that sweating cools the body off. OR Sweating removes wastes from the body.
4.	Response elaborates on the mechanism by which sweat cools the body (i.e., evaporation of sweat remove heat) OR Shows correctly the effects on the body of not sweating properly (i.e., heat exhaustion, heat stroke)

#9 • Extended Response

Item Description: This item assesses students understanding of how exercise results in changes of the body's energy requirements and the body's production of waste materials. The student is asked to explain how requirements for body metabolism during exercising decreases the length of time people can hold their breath.

A good response explains correctly that exercise increases the body's requirements for oxygen to produce more energy for muscle function and bodily metabolism. As a result of increased metabolism, production of metabolic wastes (e.g., C02). The response might include a discussion of the importance of oxygen in cellular respiration which is the process by which energy is released from food and bodily energy stores. The increased oxygen requirements during exercise will decrease the length of time a person is capable of holding their breath.

Criterion	Rubric Summary
1.	Response explains that the human body requires more oxygen (or air) as it expends more energy during exercise.
2.	Response explains that energy requirements increase during exercise.
3.	Response explains that the human body generates more metabolic waste.
4.	Response explains that because of increased need for oxygen requirements during exercise, the time a person can hold their breath decreases. OR Elaborate on the increased need for oxygen associated with the need for energy, by discussing how food and bodily energy stores are transformed by cellular respiration to release the needed energy (by metabolic processes which use oxygen).

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Pesticides

Billions of dollars worth of pesticides are used every year to prevent insect damage to food crops and other vegetation. Only a small fraction of these pesticides reaches its intended targets, but all of it ends up in the environment, often leading to unknown consequences. The following questions ask you to consider some important aspects of pesticides and their use.

1. Which of the following would be a likely consequence of increasing a pesticide's solubility in water?

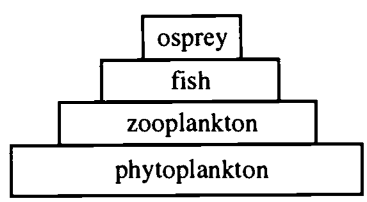
- **A.** It would be more toxic to insects.
- **B.** It would contaminate a larger area.
- **C.** It would linger in animal tissues longer.
- **D.** It would be more difficult to wash off of crops.

2. Once a pesticide has dissolved in water it can be difficult to remove. Which of the following would be the most effective method of removing a pesticide dissolved in a sample of water?

- **A.** Decanting or pouring water off
- **B.** Diluting the mixture in more water
- **C.** Heating the mixture until the water boils off
- **D.** Pouring the mixture through sand or filter paper

The diagram below represents a food pyramid with osprey (a fish-eating bird) at the top. Assume that the water supply for these organisms has been heavily contaminated by a pesticide.

Use this diagram to answer Questions 3 and 4.



3. The concentration of the pesticide in the fish after a number of years would be:

- **A.** higher than the concentration of the pesticide in the water supply.
- **B.** lower than the concentration of the pesticide in the zooplankton.
- **C.** lower than the concentration of the pesticide in the phytoplankton.
- **D.** approximately the same as the concentration of the pesticide in the water supply.

4. Explain and justify your answer to **Question 3.**

Pesticides

5. Which of the organisms would most likely have the highest concentration of pesticides in their tissue/cells after a number of years?

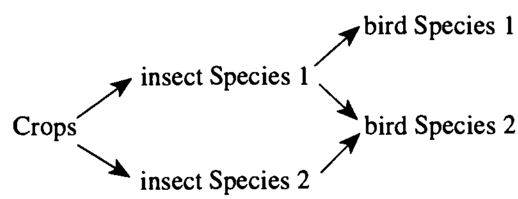
   A. Phytoplankton
   B. Zooplankton
   C. Fish
   D. Osprey

Short Answer

6. Many insecticides are not as effective as they once were. In fact, it appears that many species of insects are now resistant to insecticides. Explain how this is possible.

Extended Response

7. The diagram below represents a simple food web. Assume that a new pesticide was introduced that killed all of the individuals of insect Species 1 but did not affect insect Species 2. What effect would the extinction of insect Species 1 have on the populations of insect Species 2, bird Species 1, and bird Species 2 ? Be sure to defend your answer.



Water Pollution

There is a proposal before the city council to stock a river with trout.

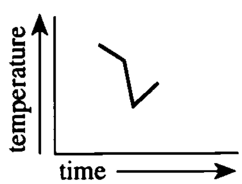
Fishing for trout and other game fish was very popular forty-five years ago, when the area around the river was heavily wooded. By 1964, however, housing had replaced the wooded area. While some fish species survived, no trout could be found. From 1964 to 1979, industry moved in and housing increased. Fish species continued to disappear from the river.

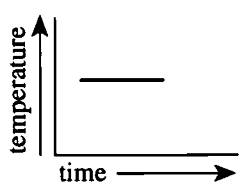
Recently, pollution controls have eliminated much of the pollution even though industry and housing have increased. As a result, carp and catfish are repopulating the river.

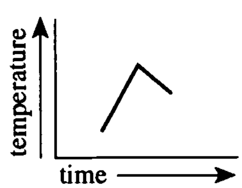
Year	Dissolved oxygen (ppm)	Temp. (°C)	pH	Fish species
1949	6	20	6.8	trout, bass, carp, catfish
1964	5	22	6.8	bass, carp, catfish
1979	4	24	6.5	none
1994	5	22	6.3	carp, catfish

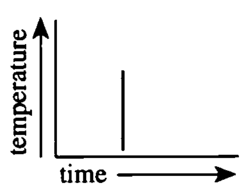
Use the data table to answer the following questions.

1. Which graph correctly represents the change in the river's temperature over time?

A.


B.


C.


D.


2. According to the data in the table, which of the following factors best explains the decrease in the dissolved oxygen level?

A. An increase in the number of fish species
B. An increase in temperature
C. An increase in pH
D. An increase in the fish population

3. Based on the data, if the dissolved oxygen level decreased again to 4 ppm, which of the following kinds of fish would be most likely to survive?

A. Trout
B. Bass
C. Carp
D. None

Water Pollution

4. According to the story, what was the major cause of the poor water quality?

   A. Housing development
   B. Industrialization
   C. Change in fish species
   D. Lack of pollution controls

5. According to the data, what is the minimum dissolved oxygen level required to support trout?

   A. 4 ppm
   B. 5 ppm
   C. 6 ppm
   D. 7 ppm

6. The survival of trout in the river most likely depends on which of the following factors?

   A. Dissolved oxygen level and pH
   B. Dissolved oxygen level and temperature
   C. Fish species and pH
   D. Fish species and temperature

7. Explain and justify your answer to **Question 6.**

The Diversity of Life

An apartment complex was scheduled for construction near a pond. Students wanted to determine the effects of human activity on the area. In order to do this, they first needed to identify the organisms living in the area. The students collected a group of specimens from the pond and the surrounding area. Next, they examined the specimens with the unaided eye and later under a microscope. Some of the data collected are shown below.

Table 1

	Organism						
Observation	A	B	C	D	E	F	G
collection site	pond	pond	wet rock	rotting log	moist soil	rotting leaves	forest floor
cell wall	√	√	√	√	√	√	√
unicellular	√						
multicellular		√	√	√	√	√	√
chloroplasts	√	√	√		√		√
roots					√		√
stems					√		√
leaves			leaflet		veined		veined
spores			√	√	√	√	
seeds							√
other characteristic	floating microscopic	floating threadlike	1-2 cm tall	white mass with cap	0.5 m tall	white filaments	2-3 m tall

Use the data table to answer the following questions.

1. To identify one from another, the organisms would best be grouped by:

A. color.
B. size
C. morphology (structure).
D. collection site.

2. Which of the following pairs of organisms are LEAST alike?

A. A and B
B. B and E
C. D and F
D. E and G

The Diversity of Life

3. In which of the following kingdoms should Organisms C, E, and G be placed?

   A. Protista
   B. Fungi
   C. Plants
   D. Animals

4. Which of the following organisms exhibits the *fewest* number of specialized traits?

   A. A
   B. C
   C. E
   D. G

5. Based on the information in Table 1, which of the following characteristics is *least* likely to contribute to the large size of Organisms E and G ?

   A. Cell walls
   B. Veined leaves
   C. Roots
   D. Stems

6. Explain and justify your answer to **Question 5.**

7. Which of the following pairs of organisms *cannot* produce their own food?

   A. B and C
   B. A and D
   C. D and F
   D. E and G

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Rock Formation and Plate Tectonics

Students on a field trip in the mountains discovered an outcrop with a variety of rock layers exposed. This mountain range was formed by the collision of two crustal plates at a convergent plate boundary. Figure 1 shows the relative positions of the rock layers and their composition.

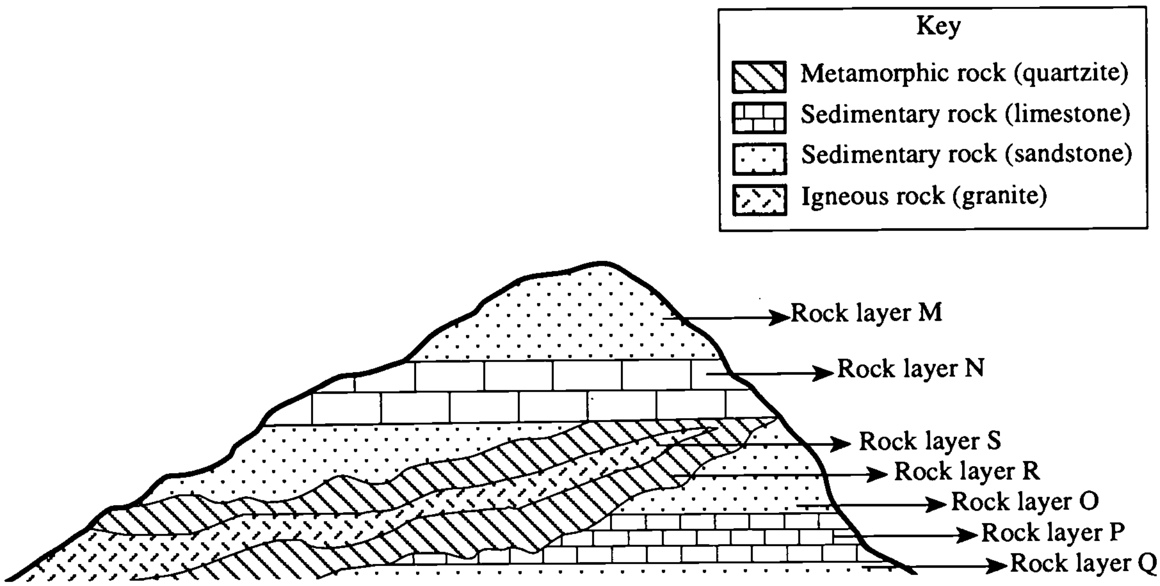

Figure 1

Figure 2 shows part of the rock cycle.

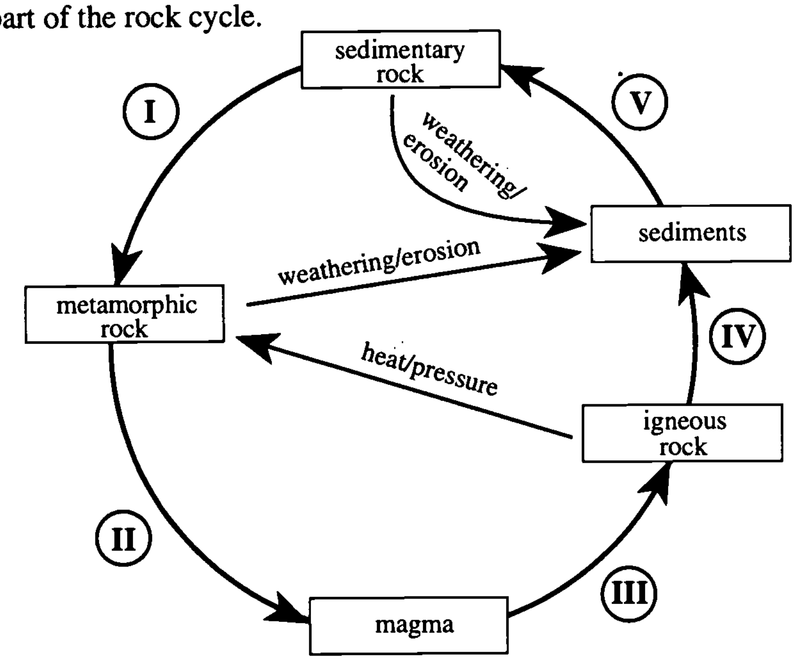

Figure 2

Note: Roman numerals I–V correspond to parts of the rock cycle that have not been labeled.

Use the information in the story and Figures 1 and 2 to answer the following questions.

Rock Formation and Plate Tectonics

1. At which of the following points in the rock cycle is heat energy lost from the system?

A. I
B. II
C. III
D. IV

2. Which of the following sections should be labeled as weathering/erosion?

A. II
B. III
C. IV
D. V

3. Explain and justify your answer to **Question 2.**

4. Which position in Figure 2 would correspond with the processes that created Rock layer R in Figure 1?

A. I
B. III
C. IV
D. V

5. Assume that the region of the outcrop were to be submerged under water. Which step in the rock cycle would be most directly affected by the submergence?

A. II
B. III
C. IV
D. V

Short Answer

6. Assume that all *plate tectonic* activity (movement of sections of the earth's crust) stopped on Earth. Explain how and why this would affect volcanic activity. Justify your answer.

Extended Response

7. Using the the information in Figure 1, write out the order of the rock layers from oldest to youngest. Include in your answer the reasoning you used to determine the relative ages of each rock layer.

A Stellar System

Consider Planets A, B, C, and D following circular *orbits* (paths) around a distant sun, as shown in Figure 1.

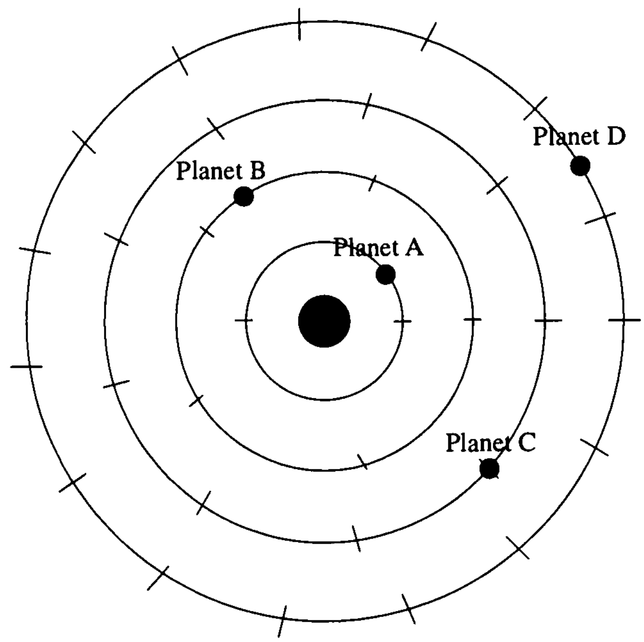

Figure 1

In Figure 1, the distance between two marks is the distance the planet moves in 3 months. The radii of the planets' orbits in AU (astronomical units) are given in Table 1 (1 AU = 150,000,000 km).

Table 1

Planet	Radius (AU)
A	0.6
B	1.2
C	1.7
D	2.4

Use the data table and the information above to answer the following questions.

1. How long will it take Planet B to go around its sun?

A. 3 months
B. 6 months
C. 12 months
D. 15 months

2. Suppose a new planet were discovered moving in a circular orbit around the same star. If the planet took approximately 3 months to go once around the star, the radius of its orbit would be:

A. less than 0.6 AU.
B. more than 0.6 AU, but less than 1.2 AU.
C. more than 1.7 AU, but less than 2.4 AU.
D. more than 2.4 AU.

A Stellar System

3. A spacecraft travels at an average speed of 80,000 km per hour. How long will it take the spacecraft to travel to a planet that is 800,000,000 km away?

   A. 1 year
   B. 3 years
   C. 5 years
   D. 7 years

4. Explain and justify your answer to **Question 3.**

Short Answer

5. The planets Jupiter and Saturn follow approximately circular paths centered on the Sun. The radius of Jupiter's path is approximately 5 AU while that of Saturn's path is approximately 9 AU (1 AU is approximately 150,000,000 km). Which planet takes longer to make a complete round-trip about the Sun? Using Table 1 and Figure 1 on the previous page and charts, tables, or graphs of your own design, justify your answer.

Extended Response

6. Figure 3 illustrates the positions of the four innermost planets of the Solar System in their orbits around the Sun (star). Explain the changes and/or additions you would make to this illustration to better model why the Northern Hemisphere of the Earth is colder in January than in July. To receive full credit include a sketch or drawing to illustrate your explanation.

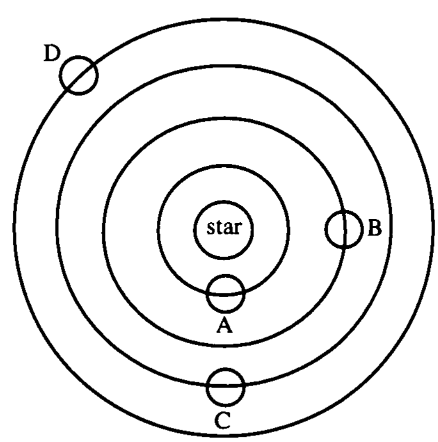

Figure 3

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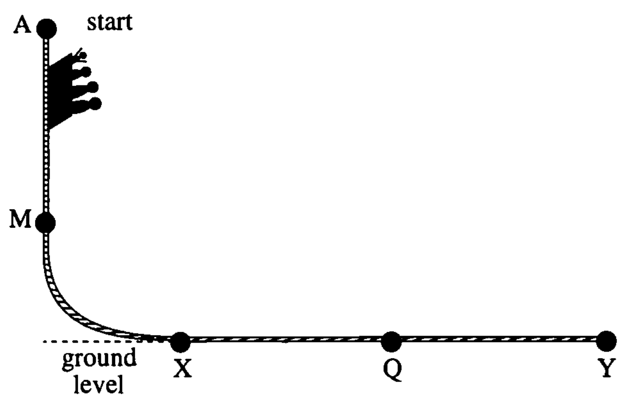
Physics in Action

An amusement park ride illustrated in the diagram below. A motor pulls a car fully occupied with riders up to point A from the ground. Then the car drops from rest. The car is guided in its fall by the tracks of the ride. Between Points A and X the ride is frictionless. Riders fall for 2 seconds between points A and M, and reach top speed at Point X. A braking system operates between Points X and Y, bringing the riders in the car safely to a complete stop at Point Y.



The information in Tables 1 and 2 resulted partly from data collected at the amusement park ride. Another part of the information resulted from student analysis of this data using various tools and technologies after returning from the park. Table 1 contains information about the motion of the amusement park ride as the riders fall between points A and M in the figure above. Table 2 contains information about the motion of the amusement park ride as the riders slow from point X to a complete stop at point Y in the figure above.

Table 1

Reference Points	Distance Fallen (m)	Time of fall (sec)	Speed (m/sec)
A	0.0	0.0	0.0
	1.2	0.5	4.9
	4.6	1.0	9.1
	10.4	1.5	14.0
M	18.9	2.0	18.9

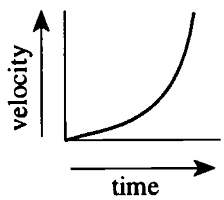
Table 2

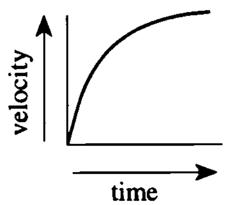
Reference Points	Distance Traveled (m)	Time (sec)	Speed (m/sec)
X	0.0	0.0	22.3
	10.4	0.5	19.2
	19.2	1.0	15.8
	26.2	1.5	12.8
	31.7	2.0	9.4
	35.7	2.5	6.4
	38.1	3.0	3.4
Y	39.0	3.5	0.0

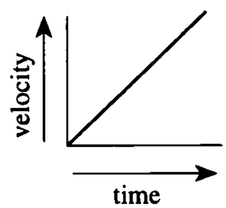
Physics in Action

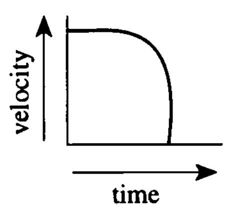
Use the information in the story, Table 1 and Table 2 on the previous page to answer the following seven questions.

1. Which of the following graphs best represents a rider's velocity while moving in free-fall from Point A to Point M ?

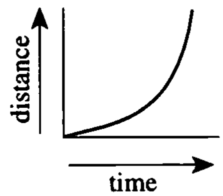
A.


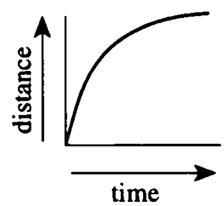
B.


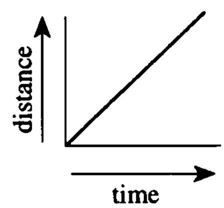
C.


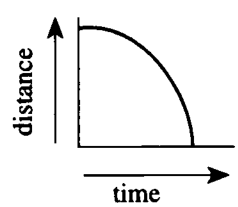
D.


2. Consider a rider moving from Point X to Point Y. The rider's distance from Point X over time is best illustrated by which of the following graphs?

A.


B.


C.


D.


3. Explain and justify your answer to **Question 2.**

4. At which of the following points is the kinetic energy of a rider highest?

A. A
B. X
C. Q
D. Y

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Physics in Action

5. The gravitational potential energy of the riders at Point A is equal to:

   A. the energy at Point Y.
   B. the energy at Point Q.
   C. the work done in lifting them from ground level to Point A.
   D. the force needed to lift them from ground level to Point A.

6. Explain and justify your answer to **Question 5.**

7. One of the riders holds a small camera by its strap as the ride moves between Point M and Point X. What would he probably notice about the camera during this time?

   A. The camera would appear to be weightless.
   B. The camera would rise above his grip.
   C. The camera would seem to be lighter.
   D. The camera would seem to be heavier.

8. How does a rider's total energy at Point A compare to the total energy at Point M ?

   A. A rider's total energy at Point A is greater than the total energy at Point M.
   B. A rider's total energy at Point A is less than the total energy at Point M.
   C. A rider's total energy at Point A is equal to the total energy at Point M.
   D. There is not enough information available to answer this question.

Short Answer

9. Discuss the forces acting on the riders at Point Q. Include in your answer a description of how these forces influence the riders' speed.

Extended Response

10. Discuss the forces acting on the riders as the move from Point A to Point Y. Include in your answer how the rider would feel in regard to his/her weight during the various parts of the ride.

Nutrition

An informed consumer should understand nutritional requirements and know how to select food products that meet the body's biological needs. Calorie requirements should be considered, as well as the specific nutrients necessary for energy, growth, and maintenance of the body.

In the laboratory, a food calorimeter is used to determine the number of Calories in food items. Nutritionists define a *Calorie* (Cal) as the amount of heat needed to raise the temperature of 1 kilogram of water 1° C. Answer Questions 1 and 2 on the basis of the food calorimeter shown below.

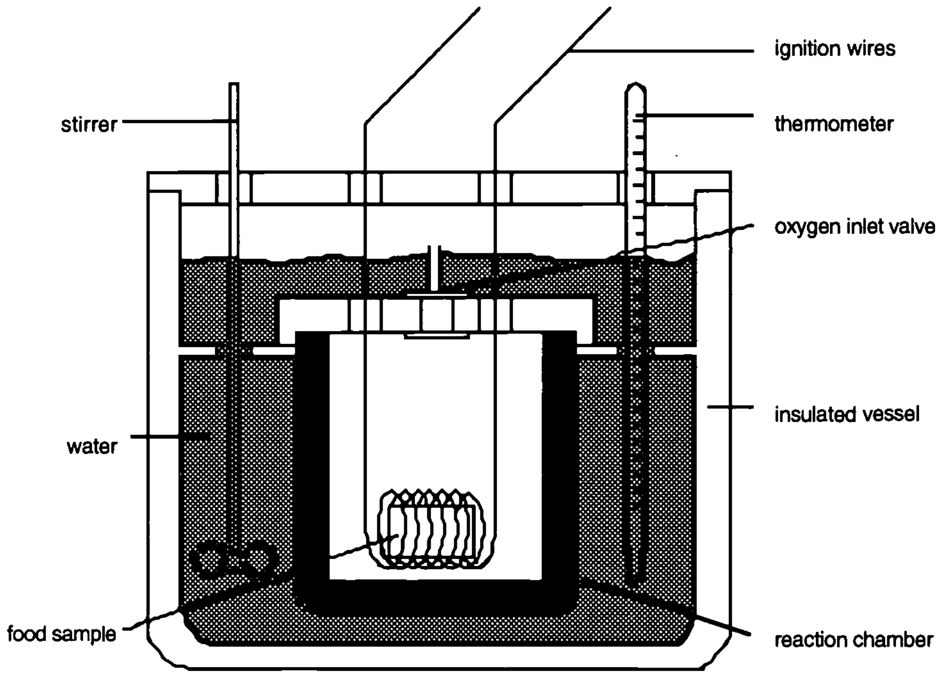


Figure adapted from Michael S. Matta and Anthony C. Wilbraham, *General, Organic, and Biological Chemistry.* ©1986 by the Benjamin/Cummings Publishing Company, Inc.

Use this information and drawing to answer the following questions.

1. The initial heat transfer from the burning of the food sample occurs between the food sample and the:

A. water.
B. thermometer.
C. walls of the reaction chamber.
D. exterior of the insulated vessel.

2. Which of the following represents a chemical reaction?

A. Burning of the food sample
B. Heating of the water in the surrounding vessel
C. Stirring of the water during the reaction
D. Rising of the mercury in the thermometer as the temperature increases

Nutrition

One of your classmates had a cheeseburger and a chocolate milk shake for lunch. *Study the calorie values shown below and answer Questions 3 and 4.*

Food Item	Serving size (g)	Calorie content (Cal)
Cheeseburger		
hamburger patty	113.4	330
hamburger bun	50	140
lettuce	8	1
onion	4	1
cheese	28.4	106
total		578
Milk shake	300	356
Total		934

3. Which of the following food items contains the greatest number of Calories per gram?

   A. Hamburger patty
   B. Hamburger bun
   C. Cheese
   D. Chocolate milk shake

4. Assume that walking at 2.5 mph burns 237 Calories per hour. Accordingly, approximately how long would your classmate have to walk at that rate in order to burn the caloric intake of the chocolate milk shake?

   A. 0.5 hours
   B. 1.0 hours
   C. 1.5 hours
   D. 2.0 hours

5. Explain and justify your answer to **Question 4.**

Short Answer

6. Most food items have nutritional information on their labels. Describe four nutritional characteristics you would look for on a label when choosing food at a grocery store. Discuss why each characteristic is important.

Extended Response

7. The human body needs energy to function. A hamburger can provide some of that energy. Explain where the energy contained in a hamburger originated and what happens to this energy when you eat the hamburger. Be sure to include the energy transformations that occur from the initial source of the energy through the digestion of the hamburger by your body.

Exercise Physiology

You notice as you run up a flight of stairs to your next class that your heart is pounding and your breathing is deeper and more rapid than when you started. The flight of stairs is illustrate in Figure 1 below. The top of the stairs is 4 m above the ground. Your weight is 500 N (1 N = 1 Newton or 0.22 lbs.). After a short time sitting in class, your respiration rate and heart rate seem to return to normal. You know that during exercise, your heart rate, respiration, blood pressure, and ability to hold your breath (maximum breath-holding time) change. You gather the data shown in Table 1 below.

Table 1

	Pulse or heart rate (beats/min.)	Respiration rate (breaths/min.)	Blood pressure (diastolic/systolic)	Maximum breath-holding time
Normal (standing)	75	12	110/80	55
Walking up stairs	90	15	120/80	45
Running up stairs	110	20	130/80	30

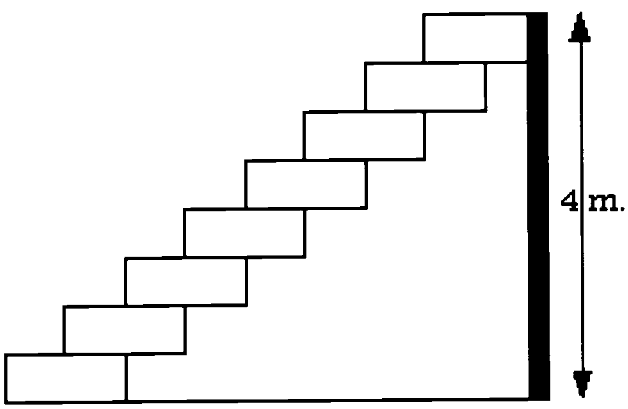


Figure 1

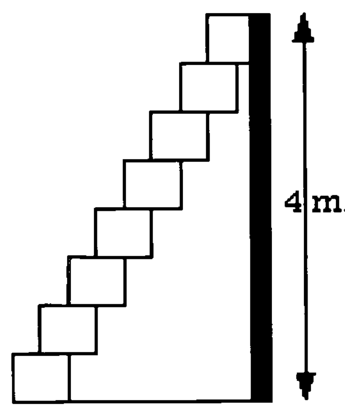


Figure 2

1. Consider the information in Table 1. As exercise becomes more strenuous, which of the following changes occur?

   A. Pulse rate, respiration rate, and diastolic blood pressure all decrease.
   B. Pulse rate, respiration rate, and diastolic blood pressure all increase.
   C. Pulse rate and respiration rate increase while diastolic blood pressure decreases.
   D. Pulse rate increases while respiration rate and diastolic blood pressure decrease.

2. As you exercise, why does your respiration rate increase?

   A. Your systolic blood pressure is increasing.
   B. Your diastolic blood pressure is decreasing.
   C. You are sweating and need more water vapor.
   D. More oxygen is needed to utilize the body's stored energy.

Exercise Physiology

3. According to the data in Table 1, what is the relationship between heart rate and diastolic blood pressure?

   A. As heart rate increases, diastolic blood pressure decreases.
   B. As heart rate increases, diastolic blood pressure increases.
   C. As heart rate increases, diastolic blood pressure remains constant.
   D. Heart rate and diastolic blood pressure are not related.

4. Notice the second flight of stairs in Figure 2 on the previous page. Suppose you repeat exactly the technique used to run up the original flight of stairs while you run up the flight of stairs illustrated in Figure 2. Compare your heart rate, breathing rate, and diastolic blood pressure immediately after you run up the stairs in Figure 2 with those same quantities in Table 1. Which of the following statements best describes the changes in these quantities?

   A. Heart rate and respiration rate would be higher, and diastolic blood pressure would be lower.
   B. Heart rate and respiration rate would be lower, and diastolic blood pressure would be higher.
   C. All of the quantities would be lower.
   D. All of the quantities would be higher.

5. Explain and justify your answer to **Question 4.**

6. You go from the bottom to the top of the flight of stairs as described in the introduction. What is the minimum amount of work required?

   A. 2,000 N•m
   B. 8,000 N•m
   C. 20,000 N•m
   D. 50,000 N•m

7. A person's *gravitational potential energy* is related to his or her location on the flight of stairs. If a person climbs from the bottom to the top of the stairs and then walks back down to the bottom of the stairs, the change in potential energy will equal:

   A. the change in potential energy when the person just climbs the stairs from the bottom to the top.
   B. the change in potential energy when the person just walks the stairs from the top to the bottom.
   C. twice the change in potential energy when the person just climbs the stairs from the bottom to the top.
   D. zero.

Short Answer

8. Explain why people sweat more when they exercise than when they are at rest. How does the human body benefit from this increase in the rate of sweating?

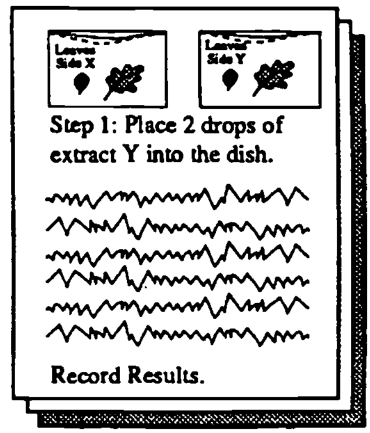
Extended Response

9. Explain why the length of time people can hold their breath decreases during exercise. In your answer, consider both the body's energy requirements and the body's production of waste materials.

Type 2

Eighth Grade Science

Competency-Based Education Assessment Series



On Demand Problem-Solving Events

(Performance-Like)

Characteristics

- Experimental and non-experimental research, requiring more than a single session and some out-of-class time
- Scoring Options: Holistic scoring (i.e., portfolio scoring guide and interviews); scoring with rubrics, check-lists, and/or interviews

Item discussions provide an overview of items, pertinent content, and scoring rubrics and/or scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart*. Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments are focused on *Science Portfolio Scoring Guide* parameters, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with *Science Portfolio Entry* types, instructional strands, and organizing concepts.

Refer to the *Content Summary Chart*. It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics*.
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Eighth Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 1							*Ninth Grade*
Water Pollution	1	See Discussion	Processing	1, 4, 6	I: 1, 4, 9, 10 K: 2, 3, 4, 12 C: 3, 6, 10, 11, 12 A: 1, 2, 3	Systems and Interactions	N: 2, 19 P: 12 E: L: 20
	2	See Discussion	Processing				
Page(s) 2							
Diversity of Life	A	Chlamydomonas	Processing	5	I: 4, 12 K: 6, 8, 14 C: 12, 13 A:	Systems and Interactions	N: 1, 2 P: E: L: 14, 16
	B	Spirogyra	Processing				
	C	Moss	Processing				
	E	Mushroom	Processing				
	F	Fern	Processing				
	G	Mold	Processing				
	H	Arrowood	Processing				
Page(s) 3 - 5							
Enzyme Concentration	1	See Discussion	Processing	1	I: 4, 8, 9, 10, 12 K: 2, 4, 9, 12 C: 1, 2, 3, 5, 7, 8, 9, 13 A: 1, 2, 7, 8	Systems and Interactions	N: 2, 3 P: 12 E: L:
	2	See Discussion	Processing				
	3	See Discussion	Processing				
	4	See Discussion	Processing				
	5	See Discussion	Processing				
Page(s) 6 - 9	🗁						
Plate Tectonics	1	See Discussion	Processing	1, 2, 3, 4, 6, 7	I: 1, 4, 7, 12 K: 1, 2, 4, 8, 10, 11, 12, 13 C: 3, 4, 7, 11 A: 3, 5	Change Over Time	N: 1, 17 P: E: 5 L:
	2	See Discussion	Processing				
	3	See Discussion	Processing				
	4	See Discussion	Processing				
	5	See Discussion	Processing				
Page(s) 10 - 11	🗁						
Effects of Speed	1	See Discussion	Processing	2	I: 1, 7, 8, 10, 12 K: 1, 3, 4, 13 C: 2, 3, 4, 6, 7, 8, 9, 13 A: 1, 5	Models and Scale	N: 3, 4 P: 8, 9, 10 E: L:
	2	See Discussion	Extending				
	3	See Discussion	Extending				
	4	See Discussion	Extending				
Page(s) 12	🗁						
Physics In Action	1	See Discussion	Extending	1, 2, 3	I: 1, 5, 12 K: 1, 3 C: 1, 3, 4, 7, 12, 13 A: 1	Constancy	N: 19 P: 8, 9, 10 E: L:

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Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗀, at the top of the *Answer* column are possible portfolio entries.

• Eighth Grade Type 2 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 13 - 14	🗀						*Ninth Grade*
pH Indicators	1	See Discussion	Acquiring	4, 5	I: 1, 4, 9, 12	Patterns	N: 1, 2, 3, 19
	2	See Discussion	Acquiring		K: 2, 3, 4, 6, 8, 10		P: 12
	3	See Discussion	Acquiring		C: 1, 3, 4, 5, 6, 9, 12, 14		E:
	4	See Discussion	Processing		A: 1, 2, 3, 4, 5, 8		L: 20
	5	See Discussion	Processing				
	6	See Discussion	Extending				
Page(s) 15							
Exercise Physiology and A Case for Stairs				1, 4, 8	I: 1, 4, 5, 6, 9, 10, 12	Systems and Interactions	N: 4, 19
					K: 1, 4, 7		P: 8, 9, 10
					C: 3, 5, 7, 13, 14		E:
	1	See Discussion	Extending		A: 1, 4, 5, 6		L: 16
Page(s) 16 - 17	🗀						
Classifying Materials	1	See Discussion	Acquiring	4, 5, 6	I: 1, 2, 4, 6, 7, 9, 10, 12	Patterns	N: 1, 3, 4, 19
	2	See Discussion	Acquiring		K: 2, 3, 4, 6, 7, 8, 12, 14		P: 10, 12
	3	See Discussion	Acquiring		C: 2, 3, 8, 9, 11, 13, 14		E: 18
	4	See Discussion	Processing		A: 1, 2, 3, 4, 5, 8		L:
	5	See Discussion	Processing				
	6	See Discussion	Extending				

• Performance Objectives: Grade 8 ***Ohio's Model Competency-Based Science Program***

1. Presented with a structure or series of events (e.g., amusement park rides, changes of phase, porosity, permeability, toxicity, hazardous waste removal, enzymes, oxidation and reduction, threshold limits), the learner will analyze features related to the constancy and rates of change represented.
2. The learner will construct a simple working model (e.g., Rube Goldberg apparatus, simple vehicles, energy conservation systems, stream tables, terraria, aquaria) of a macro-scale phenomenon.
3. Presented with data on the motion of several objects (e.g., celestial bodies, freely falling objects, projectile motion, vehicular motion), the learner will construct a visual representation that can be used to predict the motions of the objects at subsequent times.
4. Given a learner-identified issue of local community importance (e.g., air pollution, pesticides, chemical exposure, radon, abandoned hazardous waste sites, transmission lines, landfills), the learner will collect information and observations and take action on a decision made regarding the issue.
5. Provided with several objects or organisms and the appropriate key, the learner will identify the organisms or objects.
6. Given data collected by self and others regarding changes over long time frames (e.g., corrosion, succession, erosion, glaciation), the learner will construct a model of the changes that have occurred.
7. The learner will create a blueprint, sketch, or map (e.g., street, topographic, electric field, magnetic field, acoustical, thermal) for other learners to use and follow directions using a blueprint, sketch, or map provided by other persons.
8. The learner will construct a device or tool (e.g., exercise machine, robot, periscope, computer, scissors, radio, vehicle) that takes advantage of or enhances personal performance.

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Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description			
	Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

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Item Discussion

Item discussion on the following pages pertains to **EIGHTH GRADE** SCIENCE TYPE 2 MODEL COMPETENCY ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content. Parameters for holistic evaluation of student work are suggested in the *Science Portfolio Scoring Guide.*

Science Portfolio Framework

(Used with permission from the *CCSSO SCASS* Science Portfolio materials.)

RATIONALE. A science portfolio assessment strategy supports improved proficiency performance. A portfolio supports science program implementation, framing teachers' on-going guidance and suggestions to keep students' work manageable, productive, and relevant to the objectives for student learning. A portfolio interfaces with previous assessment development*. A portfolio allows holistic assessment of students' doing and knowing science. (*Note: Examples of potential science portfolio work included in the **EIGHTH GRADE** TYPE 2 MODEL ASSESSMENTS are marked with a folder icon, 🗁, in the accompanying *Content Summary Charts*.)

ASSUMPTIONS. Potential science portfolio entries will result from a combination of teacher initiated questions and student initiated questions. Students will learn and extend self-evaluation skills. The student's **final science portfolio** contains his or her choices of the best four products, with revisions, to represent his or her science learning. These products are selected from among all the learning activities and demonstrations he or she completes over a set time period (i.e., quarter, semester, year). Products are selected as **portfolio entries** and placed in one of the four categories of science work described below.

- 🗁 **Investigation** Experimental research: Requires students to design, carry-out, and report results of an observational and/or experimental process.
- 🗁 **Research** Non-experimental research: Requires students to access, analyze, synthesize, evaluate, and use the kind of information the average citizen might use to investigate and solve a problem of personal or societal significance. Students also identify alternatives, trade-offs, and make a decision regarding an issue.
- 🗁 **Application** Inventive or expressive in nature: Requires students to choose a manner of demonstrating what they *can do*, what they *can apply*, and how thoroughly they *can justify* their thinking. An inventive application allows students to show how scientific information can be used to solve real-world problems. An expressive application allows students to communicate scientific information in a medium of his or her choice. His or her work includes a written or verbal description of the scientific basis for the entry.
- 🗁 **Open Choice** Students may use this entry to provide further evidence of his or her science learning. This entry may be another piece of the previously described categories of science work.

Each entry is accompanied by the student's **entry summary** (self-evaluation). Students discuss how well the entry reflects the *Science Portfolio Scoring Guide's* **four parameters**

- Depth of Understanding
- Evidence of Inquiry
- Communication
- Relevance to Society

- 🗁 **Portfolio Summary** The *fifth entry* of the students' final science portfolio: The student writes his or her **portfolio summary** to illustrate how the final portfolio entries reflect one or more of the above **four parameters.**

Teachers, parents, and administrators can use the Portfolio Summary as a road map of the how students' final portfolios demonstrate progress toward the objectives of instruction. The act of scoring students' final science portfolios may be mediated by teachers (and others) holistically comparing students' final portfolios to the suggested parameters in the *Science Portfolio Scoring Guide*. In this process take into consideration that each student entry need not reflect all parameters or all indicators for all parameters in the *Science Portfolio Scoring Guide* (i.e., the *Guide* is not intended for use as a checklist).

EXAMPLE STUDENT PORTFOLIO: Constancy, and Patterns of Change Portfolio *

- 🗁 **Example Portfolio Summary Outline**

Students discuss examples from his or her portfolio entries that demonstrate their understandings of those processes in which some properties and behaviors of things change while other properties and behaviors remain constant. In this discussion, students present evidence from across his or her **four entries** to illustrate one or more of the **four parameters** (see *Science Portfolio Scoring Guide*). In the process students answer the following questions

- How well do I know science? ...(Depth of Understanding)
- What can I do in science? ...(Evidence of Inquiry)
- How well do I communicate what I know and can do in science? ...(Communication)
- How well do I show how science affects people's lives. ...(Relevance to Society)

- **Examples of Student Entries** (*Examples result from a combination of student and teacher generated questions*):

  🗁 **Investigation Entry** Students make observations, use tools, collect data, and use evidence to support conclusions about the behaviors and patterns of change of observable organisms (e.g., *Meal Worm Lab*).

  🗁 **Research Entry** Students devise and test models of objects and groups of objects to describe and make predictions about how things work and transform energy(e.g., *Solar Energy*).

  🗁 **Application Entry** Students make use of creative and inventive communication tools to illustrate constancy and make predictions of change in the biosphere, lithosphere, hydrosphere, and atmosphere (e.g., *The Globe*).

  🗁 **Open Entry** Students discuss a question of personal interest illustrating relevant science knowledge (e.g., *Chlorophyll and Red Plants*).

*In this example, the unifying concepts that glue the objectives of classroom instruction and learning activities are constancy, and patterns of change. These unifying concepts are not the topics of instruction. Separate topics that are taught in classrooms can be tied together with these unifying concepts.

START-UP SUGGESTIONS

DEFINE THE GOALS AND OBJECTIVES THAT YOU WANT THE PORTFOLIO TO DEMONSTRATE. Think about existing opportunities for students to become familiar with the targets of their science learning.

DECIDE ON THE LOGISTICS AND RESPONSIBILITY OF THE PORTFOLIO. Time and space needs for completion and storage of portfolios should be addressed. Also, think about existing opportunities for potential science portfolio entries to come from a combination of teacher initiated questions and student initiated questions. Teachers continue to offer on-going guidance and suggestions to make student's work manageable, productive, and relevant to the objectives for student learning.

BE SURE TO COMMUNICATE YOUR EXPECTATIONS CLEARLY TO STUDENTS, PARENTS, AND ADMINISTRATORS. Think about existing opportunities for sharing the parameters in the Science Portfolio Scoring Guide relevant to the science program objectives for student learning.

THINK BIG; START SMALL. EXPERIMENT UNTIL YOU FIND A FORMAT AND PACE THAT IS COMFORTABLE FOR EVERYONE. Think about existing opportunities for students to start, receive feedback, revise his or her work, and practice self-evaluation skills.

Item: Water Pollution
1(a) and (b) Create a graph and conclusions

Item Description:

This item assesses the student's ability to construct a graph of temperature vs. dissolved oxygen levels, that shows the relationship as temperature increases: dissolved oxygen levels decrease.

Two additional data points for temperatures not shown in the table must be plotted *and circled.*

A good response will show the student recognizes the linear relationship between temperature and dissolved oxygen levels. A line graph is drawn with a uniform slope, two data points are shown for temperatures not listed in the table, and the student draws the conclusion based on the graph — as temperature increases, dissolved oxygen levels decrease.

Criterion	Rubric Summary
1.	Attempt to graph.
2.	Graph shows correct relationship: as temperature increases dissolved oxygen level decreases.
3.	Two additional data points included *and circled.*
4.	Conclusion - Temperature increases and dissolved oxygen level decreases.

Item: The Diversity of Life
Using a Key

Item Description:

This item assesses the student's ability to use the data in Table 1 to identify the unknown organisms by means of a simple dichotomous key (Table 2).

The student must have some experience with keys or good reading comprehension, to know that one chooses either a) or b) of each numbered step, and that when you reach a noun you have identified the organism by name. The correct order of named organisms keyed from **A** to **G** is: **Chlamydomonas, Spirogyra, Moss, Mushroom, Fern, Mold, Arrowood Plant.**

Criterion	Rubric Summary
1.	Fills in at least one line on the key with the name of an organism from the list of answers shown above. The names need not be correctly paired with the organism's letter.
2.	Fills in at least two lines on the key and at least one organism's name or collection site is correct.
3.	Fills in all 3 lines of the key with organisms' names — at least 2 are correct.
4.	Fills in all 3 lines of the key correctly with the name of the organisms.

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Item: Enzyme Concentration

Item Description:

This exercise assesses student understanding of the relationship between the rate at which a chemical reaction takes place and the concentration of an enzyme catalyst. It also attempts to assess student understanding of how an experiment should be designed and carried out in order to test this reaction rate/catalyst concentration relationship.

The exercise uses an experiment investigating how the amount of rennin affects the rate at which milk curdles. Students are asked to make a prediction; graph results; compare experimental results with their prediction; describe relationships; and explain experimental procedures and safety considerations.

To answer these questions correctly, students should understand that an increase in the concentration of the catalyst, rennin, will increase the rate at which the curdling reaction occurs. The curdling time/rennin concentration experiment should be graphically depicted with curdling time on one axis and sample trials (ranked in order of rennin concentration) on the other. Students should be able to describe their experimental results and their bearing on the relationship between rennin concentration and curdling time. Students should show that the test on the pure mike (cup 1) was used as an experimental control and account for trials varying widely from the apparent relationship. Finally students should be able to discuss/assess needed safety considerations.

Criterion	Rubric Summary
1.	Explain that there is a proportional relationship between the concentration of the catalyst, rennin, and the rate at which the curdling reaction takes place.
2.	Produce a graph that shows a basic understanding of how the experiment tested the relationship between rennin concentration and curdling. Note: The time axis should depict elapsed time, not the start or end time for each trial. AND Accurately describe the results of the experiment and its relationship to curdling time and rennin concentration. Description must be consistent with data recorded in data table or graph.
3.	Explain the use of Cup 1 as an experimental control. AND Provides explanation(s) for wide variations in experimental from the apparent relationship.
4.	Discussion includes but not limited to the use of Material Safety Data Sheets and other product information sheets, personal protective devices, set-up - clean-up procedures, emergency protocols.

Item: Plate Tectonics

Item Description:

The purpose of this event is to introduce students to the concept and dynamics of tectonic plates. Students are asked to predict, model and describe changes in the earth's surface over long and short periods of time, resulting from three types of earth movements. Students are asked to cut apart models of towns along imaginary fault lines to demonstrate three different types of plate movement: colliding, sliding, and diverging.

To represent possible motions of the earth's surface during an earthquake students should position one half of Town 1 to overlap the other; one half of Town 2 should be shifted up or down from the other without noticeable overlapping or diverging, and the two halves of Town 3 pulled apart so that there is a noticeable gap. As a follow-up, students are asked to put into their own words how the plates moved, using the car as a focus to get students to think about the dynamics of plate movements.

Next, students are asked to redraw the west coast of North America showing what it might look like millions of years in the future, showing plate movement in the correct direction. To be successful at this step, students need to redraw the sliver of land (including Los Angeles, southern California and the Baja peninsula) so that it has moved up along the coast to the northwest. Then they should be able to explain the reasoning for their redrawing, addressing the relative motion owing to the sliding of the Pacific and North American Plates over millions of years.

Finally, students are asked to design the research they would need to conduct on earth quake activity in the world to decide which locations in the world should have building codes to better protect citizens and property from the damaging effects of earthquake activities.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide.*

Scoring Parameters

- Student identifies, accurately links pertinent data about plate tectonics and discusses/illustrates how the earth's surface has changed over time relating plates. Uses plate boundaries and types of plate movement (i.e., sliding, diverging) to make accurate predictions (e.g., making a model to describe results of plate movement on a neighborhood/car) and conclusions (i.e., decided where earthquake related building codes are needed).

- Student references multiple sources of relevant information and shows evidence of formulating logical conclusions about volcanic activity worldwide as a result of plate tectonics. Uses evidence and analysis of data to support conclusions about needs for earthquake related building codes.

- Student demonstrates ability to evaluate plate data to construct accurate maps/models to represents changes overtime.

- Student discusses the impact of plate tectonics on human beings and discusses the ease/difficulty with which predictions can be made about short term and long term impacts.

Answers to Questions

Question 1, a reasonable description of each of the three plate movements, OR Correct positioning of the models.

Question 2 Colliding => movement is along (East/West and/or Up/Down axis); Diverging> movement is along (East/West axis); Sliding=> movement is along (North/South axis)

Question 3, answers sliding plates for part A and diverging plates for part B.

Question 4, a map of the United States with the land along the coast west of the San Andreas Fault displaced in a northwest direction with no sizable gap of ocean between land on the Pacific Plate and the North American Plate. Explanation part of Question 4, states that the Pacific Plate is sliding northwest at an appreciable rate or uses language that recognizes the dynamic of sliding plates and not diverging or colliding.

Item: Effect of Speed on Car-Barrier Collisions

Item Description:

This event illustrates that carefully conducted investigations of phenomena in a scaled setting, in which a single variable is changed at a time, can reveal a relationship that can be generalized to similar phenomena in a different scale. Student will investigate the significance of speed as a variable regarding force of impact during collisions.

Students are asked to roll a car down a ramp and into a block of wood. The distance the car travels, the time until impact and the distance the block moves are recorded in Table 1. The speed of the car is then calculated, and averaged for two trials

The students are asked to design and perform a study to demonstrate the effect of speed on the collision and record the data and procedure in Question 2. They are then asked to draw conclusions on how speed relates to impact in Question 3. They are also asked to discuss whether their data gives an accurate reflection of the relationship between speed and impact and to justify their answer.

Criterion **Rubric Summary**

1. Correctly fills out Table 1.
2. Performs another study in which they change the experiment by either changing the slope of the ramp, changing the distance the car travels or both. The student must record the new speed of the car and the distance the block moved (Question 2).
3. Makes a conclusion regarding the relationship between the speed of a car and the force of impact it will have with the barrier or the distance it will move the barrier.
4. Gives at least one reason why the results of the investigation are generalizable. Students may refer to the specific situation with the toy car or make a general statement about real impacts on a different scale. (Question 3)

Items: Physics In Action

Item Description:

This item requires students to propose a practical solution to a problem involving bringing a ride moving at high speed to a safe stop within a relatively short distance.

A satisfactory response will include an illustration of the braking system and describe how it works. An exceptional response will go on to explain how it works based upon pertinent scientific principles, involving gravity, friction, air resistance, water resistance and other safe and practical as well as functional strategies to bring the ride to a stop.

Criterion	Rubric Summary
1.	Any genuine attempt to answer the question.
2.	Describes a braking system that would stop the car without injury to the passengers. It need not be practical. If the illustration is clear, the verbal response may be minimal.
3.	Describes a braking system which is practical and safe and illustrates it with sufficient details to make its main functional process apparent.
4.	Satisfies Criterion 3 and explains at least one of the scientific principles involved correctly. This explanation must be more than stating what the principle is.

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Item: pH Indicators

Item Description:

Acid rain is a problem in the U.S. and around the world. Acid rain is also responsible for the death of some plants and animals.

This event assesses the student's understanding of acids and bases, the role of acid-base indicators as a function of pH, and if they can apply this understanding to test the rain in your area to see if it is acidic.

A good response will show the student understands that the color of the indicator in the known solutions is directly related to the pH as measured with pH paper. The pH of the unknowns can be determined by comparing the color of the solutions plus indicator of the knowns to the unknowns.

Criterion	Rubric Summary
1.	Understands concept - An indicator can be used to approximate pH based on color change.
2.	Explains how pH or unknowns was determined. OR Explains why you would want to determine pH.
3.	Test described to see if a juice is a good indicator. OR Properties of a good acid-base indicator are described.
4.	Method to test rain. OR Method to compare rain from different areas.

Item: Exercise Physiology and a Case of Stairs

Item Description: This item assesses student understanding of how the original flight of stairs can be redesigned to make walking up the stairs a less strenuous and safer exercise. Students are asked to discuss and illustrate changes they would make to the stairs, and explain how these changes make walking the stairs a less strenuous and safer exercise.

A good redesign would include, but is not limited to making a less steeply inclined flight of stairs (inclined plane). A good response correctly explains the mechanical advantage of using a less steeply inclined plain. A good student explanation would include how each redesign feature contributes to a less strenuous walk up/down the stairs. Good answers consider the body's energy requirements and the body's production of waste materials. A combination of features (such as less steepness and adding friction treads to each step) could contribute to safer stairs, making injuries less likely due to slipping, falling or bodily-stress.

Criterion	Rubric Summary
1.	Response explains/illustrates a less steep flight of stairs to the second floor 4 m. above the first floor.
2.	Response explains that a less steep flight of stairs would require less effort (force) exerted over a greater distance
3.	Response explains that less bodily exertion results in lower levels of oxygen intake and lower rates of energy expenditure, resulting in less increase in pulse rate, respiration rate, and blood pressure; and a greater maximum breath-holding time;
4.	Response explains how less steep stairs would put less stress on body joints and bodily functions OR Adding more friction to the steps would result in less slipping when walking the stairs.

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Item: Classifying Materials

Item Description: (The two experimental procedures may be completed in a group.) Material samples can be determined by the teacher. Materials can be standard laboratory samples of pure elements such as Aluminum, Iron, Lead, Copper, Nickel. Common material substitutions could be made for each of the following (e.g., soda can (aluminum), nails (iron or aluminum), fishing sinkers (lead), water pipe sections (copper), electric and/or craft wire (copper, aluminum, steel), a Nickel ($0.05 piece), breakfast cereal (iron fortified)).

An experimental design would include students using a magnet (or electromagnet) to touch test the materials for magnetic attraction. Mass would be measured by a balance scale. Volume for irregular shaped samples would be determined by a displacement (wet or dry) procedure; or for regular shaped samples by dimension measurements and computation. Density would be established by computation (density = mass / volume).

Possible tests for two other properties of the samples could include the following for example:

• electric conductivity	volt/ammeter or simple DC continuity circuit
• heat conductivity and/or reflection	timing for heating/cooling transfer through a standard sample
• susceptibility to corrosion	acid (vinegar solution, tap water, or salty water) drop exposure
• disposal requirements	comparing substances/referring to Periodic table or product information/disposal sheets

Successful responses would include 1) elements grouped according to magnetic properties; 2) elements grouped according to densities; 3) explanation(s) of classification system used; 4) identification of procedure(s) to identify an unknown element, including how results of specific tests will lead to identification and use of comparisons to other elements in the Periodic Table; 5) proposed procedure for establishing the materials "tin" soup cans are made from, including assessment of why soup cans are (not) made of tin with reference to pertinent properties of materials/elements.

Scoring Parameters

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide.*

Water Pollution

There is a proposal before the city council to stock a river with trout. Some of the data collected reflecting changing river conditions over a time span of five decades is shown in the data table below.

Fishing for trout and other game fish was very popular forty-five years ago, when the area around the river was very heavily wooded. By 1964, however, housing had replaced the wooded area. While some fish species survived, no trout could be found. From 1964 to 1979, industry moved in and housing increased. Fish species continued to disappear from the river.

Recently, pollution controls have eliminated much of the pollution even though industry and housing have increased. As a result, carp and catfish are repopulating the river.

Year	Dissolved oxygen (ppm)	Temp. (°C)	pH	Fish species
1949	6	20	6.8	trout, bass, carp, catfish
1964	5	22	6.8	bass, carp, catfish
1979	4	24	6.5	none
1994	5	22	6.3	carp, catfish

Performance

Use the information in the story and the table to complete the following as directed by your teacher.

1. Consider the temperature and dissolved oxygen data that are given in the table. On the graph paper below, construct a line graph showing the relationship between temperature and dissolved oxygen levels. Include *and circle in the graph* data points for at least 2 temperatures not shown in the table. Identify the axes with appropriate labels.

2. What conclusion(s) can you make on the basis of your graph? Include in your response your recommendation(s) regarding restocking the river with trout. Support your recommendation(s) with data.

The Diversity of Life

An apartment complex was scheduled for construction near a pond. Students wanted to determine the effects of human activity on the area. In order to do this, they first needed to identify the organisms living in the area. The students collected a group of specimens from the pond and the surrounding area. Next, they examined the specimens with the unaided eye and later under a microscope. Some of the data collected are shown below.

Complete the following performance as directed by your teacher.

Table 1

	Organism						
Observation	A	B	C	D	E	F	G
collection site	pond	pond	wet rock	rotting log	moist soil	rotting leaves	forest floor
cell wall	√	√	√	√	√	√	√
unicellular	√						
multicellular		√	√	√	√	√	√
chloroplasts	√	√	√		√		√
roots					√		√
stems					√		√
leaves			leaflet		veined		veined
spores			√	√	√	√	
seeds							√
other characteristic	floating microscopic	floating threadlike	1-2 cm tall	white mass with cap	0.5 m tall	white filaments	2-3 m tall

Table 2

1	a	Has chloroplasts ....go to 3
	b	Lacks chloroplasts ....go to 2
2	a	Has a cap..................................Mushroom
	b	Lacks a cap ....Mold
3	a	Unicellular ....Chlamydomonas
	b	Multicellular ....go to 4
4	a	Has true leaves, roots, and stems............go to 5
	b	Lacks true leaves, roots, and stems..........go to 6
5	a	Has spores.. Fern
	b	Lacks spores......................... Arrowood plant
6	a	Aquatic .... Spirogyra
	b	Not aquatic.. Moss

Performance

Use the information in Tables 1 and 2 to identify the organisms. Write the name of the ***organism*** *next to the corresponding letter in the* ***key*** *below.*

Key		**Organism**
	=	A
	=	C
	=	E

Enzyme Concentration

Ancient shepherds often used pouches made from the stomachs of sheep or goats to carry milk into the fields where they worked. The shepherds found that the milk, which had been placed in the stomach in the morning, had curdled and formed cheese by noon. (Curdling occurs when the milk becomes thicker and somewhat lumpy.) Today, it is known that the curdling is due to the presence of an enzyme, rennin, in the animal's stomach.

In this experiment students investigated how the amount of rennin affects the time it takes milk to curdle. Students read the directions their teacher gave them before beginning. Each student filled in the data table on the following page with his/her observations. You are being asked to help organize and interpret the data they collected.

Begin your task by reading the *directions below that the students followed while investigating the effects of the presence of the enzyme rennin in samples of milk.*

1. Follow the laboratory safety rules as directed by the teacher.
2. Fill one plastic cup about half full of milk from the supply table.
3. Obtain one small bottle of rennin solution from the supply table.
4. Number the other five plastic cups (1-5) with the marker.
5. Set the cups out in numerical order.
6. Use the plastic pipette to add drops of rennin to each cup as follows:

   Cup 1 - no rennin
   Cup 2 - 5 drops of rennin
   Cup 3 - 10 drops of rennin
   Cup 4 - 15 drops of rennin
   Cup 5 - 20 drops of rennin

7. You are almost ready to add milk to the rennin. The procedure you will use is to add the milk to the rennin in the cup, using the coffee stirrer to mix the milk and the rennin. Stir until the milk begins to curdle or until 5 minutes have elapsed. Use a different stirrer for each cup. Do NOT use the same stirrer in more than one cup. Use the data table on the next page to record the time you begin to add the milk (the start time) and the *time* that the milk in each cup begins to curdle (the end time).
8. Now, use the graduated cylinder to measure 5 mL of milk and pour the milk into Cup 1. Repeat this procedure for the remaining four cups. Remember to record the times.

Complete the activities and answer the question(s) below as directed by your teacher.

1. Write your prediction how you think the number of drops of rennin affects the time milk takes to curdle.

Enzyme Concentration

2. Complete the following data table. To find the elapsed time for the milk in a given cup to begin to curdle, subtract the start time from the end time. Record the elapsed time, in seconds.

Data Table

Cup number	Number of drops of rennin	Start time (hr:min:sec)	End time (hr:min:sec)	Elapsed time (sec)
1	0	11:05:15	11:10:15	
2	5	11:10:52	11:14:57	
3	10	11:16:00	11:19:50	
4	15	11:20:18	11:24:18	
5	20	11:25:31	11:27:41	

3. To help you answer **Question 4**, draw a bar graph for enzyme concentration-elapsed time using information from the data table. Identify the axes with appropriate labels.

Questions

4. Based on the results of the experiment, what relationship, if any, exists between milk curdling time and the amount of rennin in the milk? Compare this relationship, if any, to the prediction you made earlier. Explain any experimental data that varies widely, if any, from the apparent relationship. Why was no rennin added to the milk in Cup 1 ?

5. Discuss at least four precautions you would recommend that students consider to assure personal safety, the safety of others and the environment before during and after this investigation.

Enzyme Concentration

Graph Paper

Please use this graph paper to complete your response to question number 3 from the previous page.

3. Complete the bar graph for enzyme concentration-elapsed time. Identify the axes with appropriate labels.

Plate Tectonics

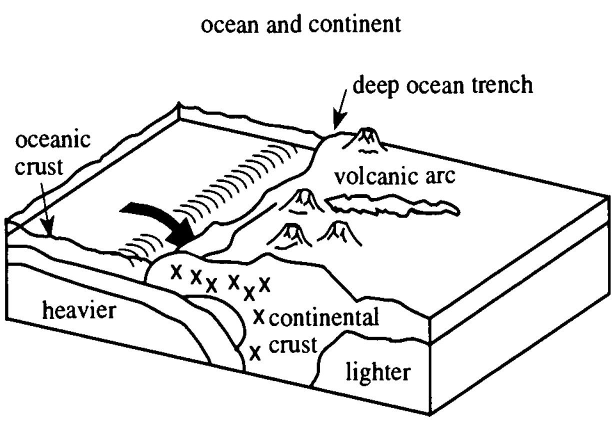
Earthquakes and volcanoes are often in the news. Both are due to enormous movements deep within the Earth. Earthquakes most often occur at places where huge plates of crustal rocks interact. The Earth is composed of several large plates that may interact by colliding, pulling apart, or sliding past one another (see figures below). All these are called *tectonic movements* and they cause earthquakes and volcanoes around the planet.

When plates collide, mountain ranges may form, such as the Andes or Himalayas (A). When they slide past one another, strong earthquakes can occur. The San Andreas Fault is such a region in California (B). When plates pull apart, hot, flowing mantle can rise to the surface. This occurs on the floor of the Atlantic Ocean in an area called the Mid-Oceanic Ridge (C).

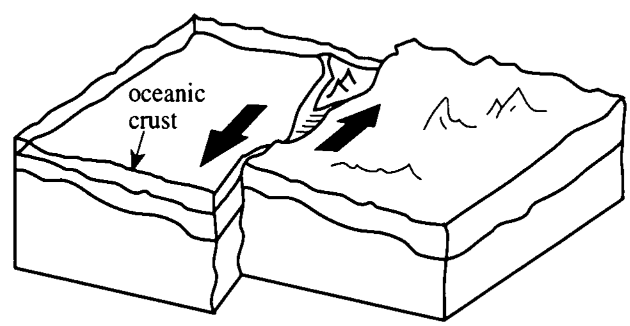
Today you will model plate tectonic activity and then, using what you have learned, predict how the west coast of North America may look millions of years in the future. Finally, you will design the research you would need to conduct on earthquake activity in the world to answer the following question. Which locations in the world should have building codes to better protect citizens and property from the dangerous and damaging effects of earthquake activity?

Complete the activities and answer the questions below as directed by your teacher.

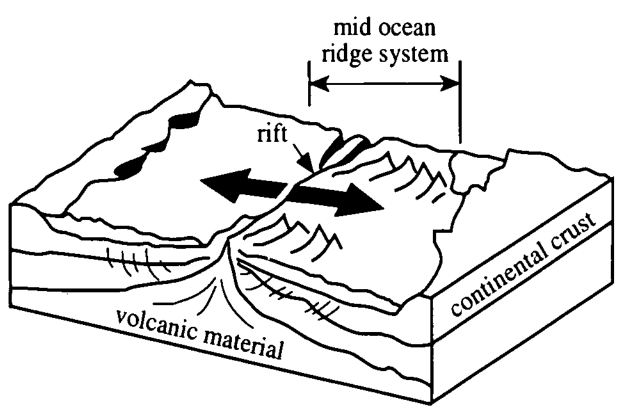
Types of Plate Movements Within the Earth



A. Colliding Plates
ex.: Andes



B. Sliding Plates
ex.: San Andreas Fault



C. Diverging Plates
ex.: center of Atlantic Ocean

Plate Tectonics

1. *Make a model.* On the next page are maps of neighborhoods in three towns (one map is extra and should be used only in case of a mistake). Each town has a street running north and south. Each town has sixteen houses and one car. Imagine that the west side of the town is on a large tectonic plate and the east side is on another. This could actually exist in places like California and Alaska. For each town, your task is to discover what would happen to the town if the town experienced an earthquake and had movement on both sides of the street. You will cut each town apart along the dotted lines and then tape it back together so that your picture (map) accurately reflects the changes caused by the earthquake. The numbers on the diagrams are to help you keep the pieces together.

- Cut each town apart along the street and around the outside edge. Keep the pieces together (one is extra in case you feel you have made a mistake).
- Carefully observe the three-dimensional drawings of the plate tectonic boundaries on the previous page. Imagine an earthquake has occurred and the towns all experienced movement. **Tape the two pieces together again on another piece of paper so that each reflects the type of plate movement mentioned above it.** Show movement of at least one town block (one house width).
- **Be careful; this movement may be north, south, east or west.**

Questions

Based on your model and the information provided in the story, please answer the following questions.

2. Describe how the location of the car has changed for each of the three types of earth movements.

3. Which of the plate boundaries would:

   a.) cause the car to move either north or south? Explain.

   b.) produce a ditch that would run from north to south? Explain.

Plate Tectonics

Model

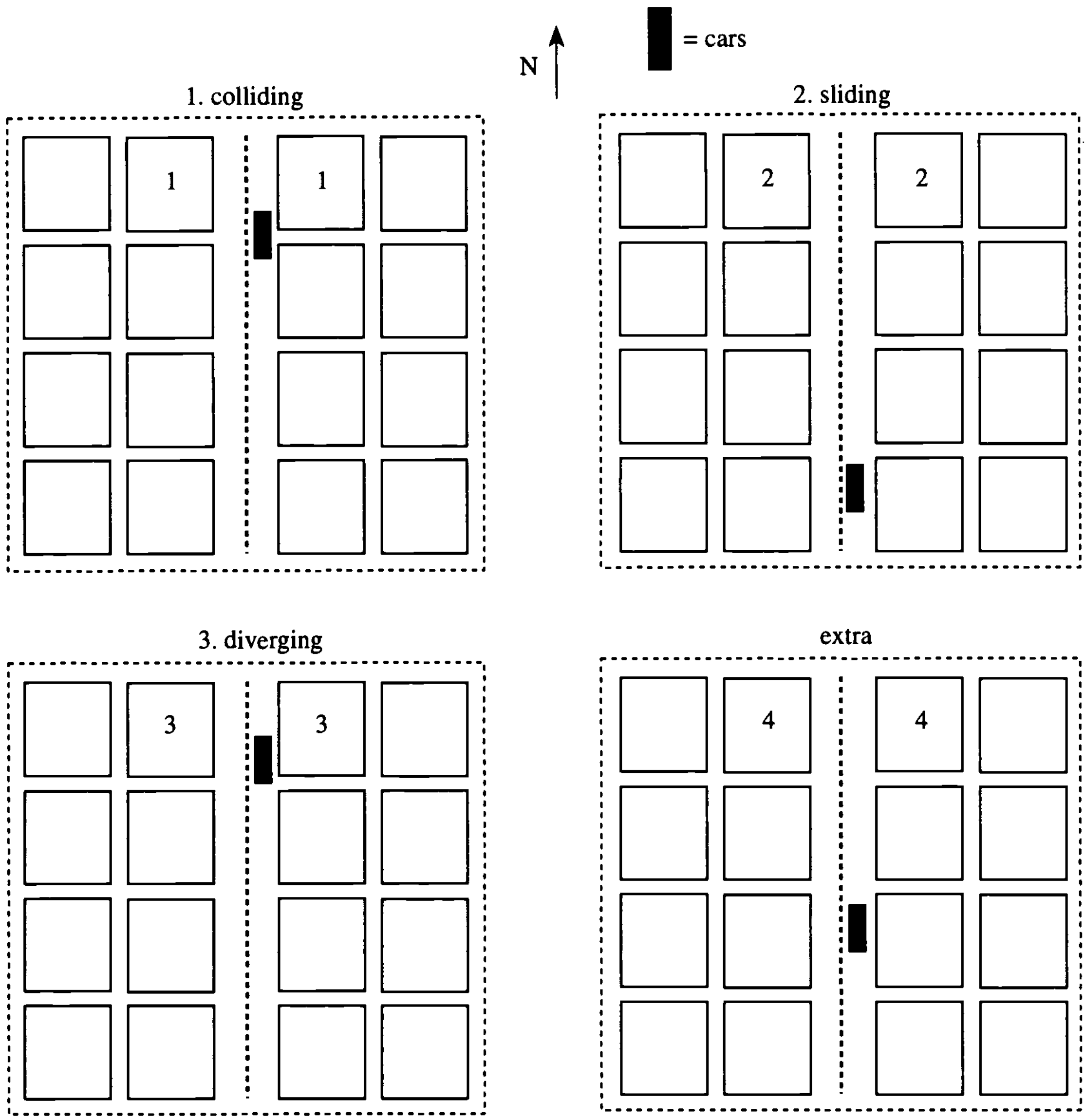


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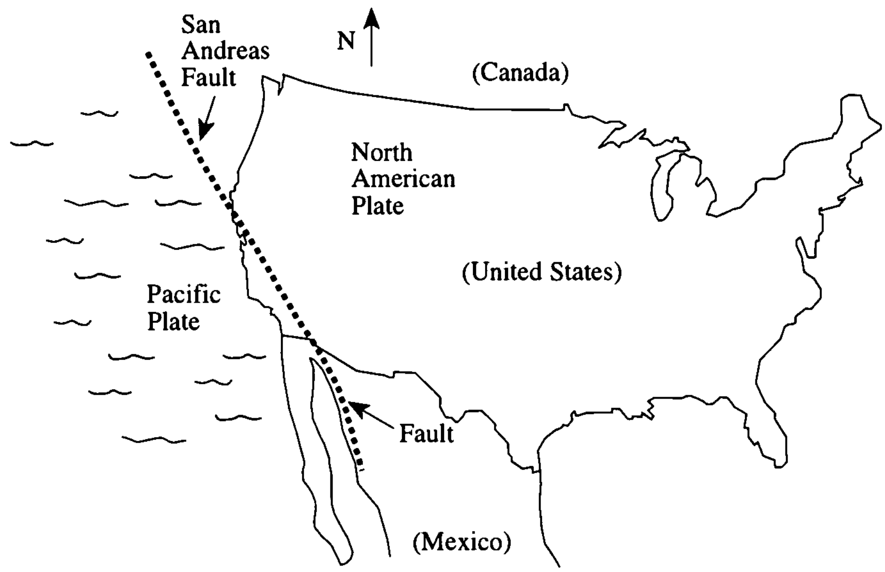
Plate Tectonics

4. *Make a prediction.* One of the most famous features of plate movement occurs in California at the San Andreas Fault. Here, the Pacific Plate moves northwestward against the American Plate at a rate of 1 to 2 cm per year. Over millions of years, this movement really adds up! Below is a diagram of North America as it appears now.



- Redraw below the west coast of North America, showing what this part of the continent might look like millions of years in the future. Show plate movement in the correct direction. Be sure to explain in detail below why you drew the picture the way you did.

5. *Design the research* you would need to conduct on earthquake activity in the world to answer the following question. Which locations in the world should have building codes to better protect citizens and property from the dangerous and damaging effects of earthquake activity? The research design should outline 1) What data you would collect, and the research methods and tools you would use. 2) What media you would use to clearly focus and organize the information/data you collect to support your recommendations (e.g., using tables, models, maps, text). 3) How you would explain the consequences and alternatives of your recommendation(s).

The Effect of Speed on Car-Barrier Collisions

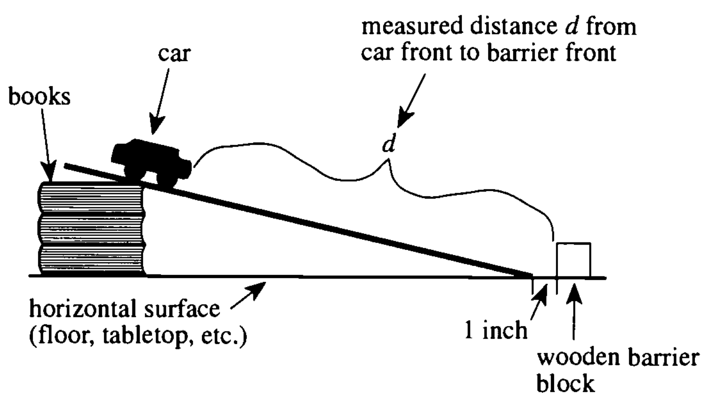
Cars are the most common means of transportation in this country. Although driving is usually safe, accidents do occur because of unsafe driving practices (such as speeding) or unsafe road conditions. Accordingly, car manufacturers have spent millions of dollars in an attempt to make cars safer to drive.

The laws of physics describe the interaction of force and mass in a collision. In this event you will use a model system to investigate how the speed of a car affects the results of the collision of the car with a barrier. You will begin by preparing an investigation for a car to reach the bottom of the ramp at the *same speed* on successive trials. Next you will design and perform a study that will demonstrate how *different speeds* of the car affect the results of the collision between the car and the barrier.

Complete the activities and answer the question(s) below as directed by your teacher.

1. Prepare to collect data for a car reaching the bottom of the ramp traveling at the *same speed* for more than one trial.

- Set up the equipment as shown in the diagram below.



- Explore finding a procedure that you can replicate. Use this procedure to help you collect reliable data to record in Table 1.
    - Demonstrate proper experimental procedures, including safety, as you roll the car down the ramp.
    - Control variables and use tools properly.
- Perform the necessary calculations to complete Table 1 once you have found a procedure that works.
- Describe the procedures that your group used to perform your study. This description should be clear and complete enough so that someone could easily repeat your study.

Table 1

Distance between car and barrier (cm)	Trial	Elapsed time (seconds)	Speed (cm/sec)	*Average** (cm/sec)	Distance barrier moved (cm)	*Average** (cm)
	A					
	B					

*Note: To calculate the *average* of the speeds for the two trials, add the speeds together and divide by two. Use this same method to calculate the average distance the barrier moved.

The Effect of Speed on Car-Barrier Collisions

2. Design and perform a study of the relationship between the car's *speed* and the distance the wooden block moves (i.e., how far the car pushes the block).

- Your group now needs to design and perform a study that will demonstrate how *different speeds* of the car affect the results of the collision between the car and the wooden block. You should test at least two other speeds. For each speed, perform two trials.
- Record the data that your group collected in an organized manner.
- Describe the procedures that your group used to perform your study. This description should be clear and complete enough so that someone could easily repeat your study.

Questions

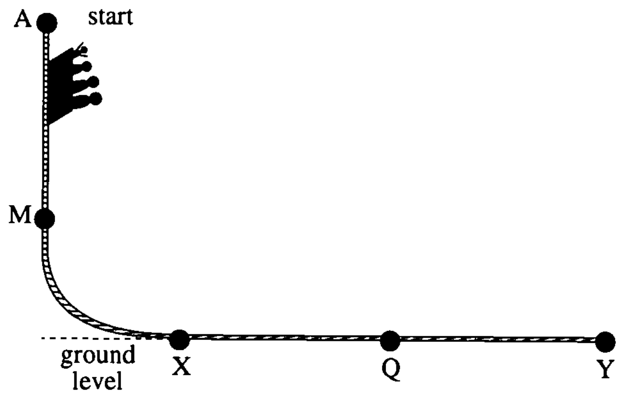
3. What conclusions (e.g., consequences or relevant applications) can you draw from the data you collected? Include in your answer a discussion of whether you believe your results are an accurate reflection of the relationship between the speed of the car and the distance the barrier moved. Be sure to justify your answer.

4. What further steps or investigations would you suggest?

Physics in Action

An amusement park ride illustrated in the diagram below. A motor pulls a car fully occupied with riders up to point A from the ground. Then the car drops from rest. The car is guided in its fall by the tracks of the ride. Between Points A and X the ride is frictionless. Riders fall for 2 seconds between points A and M, and reach top speed at Point X. A braking system operates between Points X and Y, bringing the riders in the car safely to a complete stop at Point Y.

Complete the activities and answer the question(s) below as directed by your teacher.



Performance

1. Design a safe and practical braking system for this amusement park ride. Include in your answer (1) an illustration of your braking system, (2) a description of how your braking system works, and (3) an explanation of the scientific principles upon which your braking system is based.

pH Indicators

The pH of a solution is a measure of its *acidity* or *alkalinity.* Acids have pH values less than 7. Bases have pH values greater than 7. A solution with a pH of 7 is said to be *neutral.* A substance whose color depends upon the pH of the material with which it is mixed can be used as an *acid-base indicator.* Paper that has been treated with an acid-base indicator is called *pH paper.*

Early chemists used plant pigments as acid-base indicators. If you were in the field and did not have pH paper with you, you could prepare an indicator by boiling the petals or leaves of some plants in water. The vial you received marked "INDICATOR" contains an acid-base indicator that has properties similar to those found in plants.

You have been given five liquids whose identities you know (baking soda solution, liquid soap, tap water, vinegar, lemon juice). Using the pH paper, you will determine the pH of each of these liquids. Next, you will add INDICATOR to each of these liquids and will record the color that results. Then, you will make a chart of the color of the liquids with INDICATOR versus the liquids' pH values.

After you have finished with the known liquids, you will determine the pH values of the four liquids (A, B, C, and D) whose identities you do not know, using only INDICATOR and the results of your experiment.

Complete the activities and answer the question(s) below as directed by your teacher.

- Follow clean-up and safety instructions given by your teacher. **BE CAREFUL WHEN USING THE CHEMICALS. DO NOT GET THE CHEMICALS ON YOUR CLOTHES OR SKIN. IF YOU GET ANY OF THE CHEMICALS ON YOUR CLOTHES OR SKIN, WASH IT OFF IMMEDIATELY WITH LOTS OF WATER AND NOTIFY YOUR TEACHER. CLEAN UP ANY SPILLS WITH LOTS OF WATER.**
- In the front of the room are containers of baking soda solution, liquid soap, tap water, vinegar, and lemon juice. Label 5 cups with the marker—one for each of the 5 solutions. Bring the 5 labeled cups to the front to get the chemicals. Place approximately 40 drops (2 mL) of each of the liquids into the appropriately labeled cups.

Investigate the relationship between the color of an INDICATOR and pH:

1. At your work station, dip a piece of pH paper into the baking soda solution and match the paper's color to the colors on the chart of pH values. Record the color of the paper and the pH value of the baking soda solution in Table 1. Also, record the pH value in the appropriate space in Table 2.

Table 1

Solution	Color of pH paper	pH of solution
baking soda solution		
liquid soap		
tap water		
vinegar		
lemon juice		

- Repeat the procedure with liquid soap, tap water, vinegar, and lemon juice.

Item: The Periodic Table of Elements

Item Description:

This open-ended scenario assesses a student's ability to extended their knowledge and skills associated with the history, development, and significance of the organization of the Periodic Table. Students will demonstrate their awareness and understanding of the connections and consequences of the attributes of elements belonging to particular groups in the Periodic Table.

Successful completion of the speech will require students to synthesize history and organization of the Periodic Table. Successful completion of the pamphlet will require students to synthesize pertinent scientific principles with researched information on related technical, economic, social, and feasibility issues in regard to the properties, production and safe handling of the elements from two groups in the Periodic Table.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide*.

Scoring Parameters

- Student identifies and accurately organize pertinent data about the history, development, and significance of the organization of the Periodic Table. Student demonstrates his or her awareness and understanding of the connections and consequences of the attributes of elements belonging to particular groups in the Periodic Table.

- Student references multiple sources of relevant information and shows evidence of formulating logical conclusions about the properties, production and safe handling of the elements from two groups in the Periodic Table.

- Successful completion of the speech will require students to synthesize history and organization of the Periodic Table. Successful completion of the pamphlet will require students to synthesize pertinent scientific principles with researched information on related technical, economic, social, and feasibility issues in regard to the properties, production and safe handling of the elements from two groups in the Periodic Table. The speech should be creative/inventive enough to make the information appropriate for a fifth-grade class of students.

- Student discusses the impact of pertinent scientific principles to economic, social, and feasibility issues in regard to the properties, production and safe handling of the elements from two groups in the Periodic Table.

Water Pollution

There is a proposal before the city council to stock a river with trout. Some of the data collected reflecting changing river conditions over a time span of five decades is shown in the data table below.

Fishing for trout and other game fish was very popular forty-five years ago, when the area around the river was very heavily wooded. By 1964, however, housing had replaced the wooded area. While some fish species survived, no trout could be found. From 1964 to 1979, industry moved in and housing increased. Fish species continued to disappear from the river.

Recently, pollution controls have eliminated much of the pollution even though industry and housing have increased. As a result, carp and catfish are repopulating the river.

Year	Dissolved oxygen (ppm)	Temp. (°C)	pH	Fish species
1949	6	20	6.8	trout, bass, carp, catfish
1964	5	22	6.8	bass, carp, catfish
1979	4	24	6.5	none
1994	5	22	6.3	carp, catfish

Performance

Please complete the following on your own as directed by your teacher.

Based on your interpretation of the data table and the information in the story above, prepare a letter to the city council that supports or rejects the proposal to restock the river with trout.

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The Diversity of Life

An apartment complex was scheduled for construction near a pond. Students wanted to determine the effects of human activity on the area. In order to do this, they first needed to identify the organisms living in the area. The students collected a group of specimens from the pond and the surrounding area. Next, they examined the specimens with the unaided eye and later under a microscope. Some of the data collected are shown below.

Table 1

	Organism						
Observation	A	B	C	D	E	F	G
collection site	pond	pond	wet rock	rotting log	moist soil	rotting leaves	forest floor
cell wall	√	√	√	√	√	√	√
unicellular	√						
multicellular		√	√	√	√	√	√
chloroplasts	√	√	√		√		√
roots					√		√
stems					√		√
leaves			leaflet		veined		veined
spores			√	√	√	√	
seeds							√
other characteristic	floating microscopic	floating threadlike	1-2 cm tall	white mass with cap	0.5 m tall	white filaments	2-3 m tall

Performance

Please complete the following on your own as directed by your teacher.

Using the information provided in the data table and your knowledge of science, choose which organism you believe is best suited for life on land. Defend your choice by specifically describing necessary adaptations and why the adaptations are important to the organism's survival on land.

Plate Tectonics: Movements Within the Earth

You and your team are a group of authors, scientists, and artists who have been hired by a publishing company to write a book on plate tectonics. This book is intended for use by students in grades 3 and 4. Therefore, it needs to be readily understood by students at that level.

The general theme of the book will be to show how "continents" move based on the theory of plate tectonics. Your group will need to indicate and explain changes that have occurred in Earth's past, how Earth looks today, and how Earth might look millions of years in the future. Since the book is aimed at young children, it should have numerous drawings, maps, diagrams, and other graphics that can be easily interpreted. Your drawings should be original (not traced from someone else's work) and accurate. They should include locations of the continents and oceans, climatic zones, *biomes* (regions with specific types of plants and animals, e.g., grasslands), land forms, and whatever else you feel is necessary for a complete explanation. Your team will research these various areas and produce global maps, figures, and diagrams that accurately reflect your findings. Children at this age do not have a sophisticated vocabulary, so the text of your book should be simple yet accurate. Your final product will be a book that contains your text, drawings, and other important information that could be easily used by a student at the elementary level.

General Guidelines for Book

Sections should include, but are **not** limited to, the following:

I. A story line that would cause the young student to wonder about the past, present, and future.

II. The internal structure of Earth and how this relates to plate tectonics. Include the major plates and their locations.

III. The different types of plate boundaries and their associated land forms (e.g., volcanoes, mountains, trenches, etc.).

IV. How the plates on Earth have moved over the past 250 million years and how Earth has changed in appearance as a consequence.

V. The different types of biomes found around the world today and the different types of climates. You should explain how these might change as the plates move.

VI. The impact of plate tectonics on human lives, property, costs, etc. around the world.

VII. Predictions of how Earth might look millions of years in the future.

As you research plate tectonics you may discover many different kinds of drawings and models. Your challenge is to be accurate and creative in your design so that a young student is able to understand your Plate Tectonics book. Be sure to identify and label all parts of your drawings.

Acid Rain and Its Effects

The lake near your school used to be a great place to go fishing and to see plants. Lately, very few fish have been caught, and those that are caught do not seem very healthy. The variety of plants in the area also has decreased.

You have read and heard a great deal about acid rain and all of its negative effects. You and your friends wonder if acid rain is responsible for the unhealthy fish and the loss of plants at the lake. Your group has decided to spend the next few weeks studying acid rain and some of its consequences. First you will need to determine if the rain in your area is indeed acidic. Then you will need to investigate the damage that acid rain can do to buildings, monuments, and plants, regardless of whether the rain in your area is acidic.

Prepare a report to your local government that details your findings.

Part I: Identifying the Problem, Collecting Data

You will need to design an experiment that determines if the precipitation in your area is acidic. You will need to graph amounts of precipitation, pH levels, and general weather conditions for the course of the experiment.

You will also need to design and carry out experiments that determine the effects of acid rain on monuments, plants, and buildings.

A description of your experimental procedures, observations, and conclusions will be included in your report to your local governmental body.

Part II: Locating the Source of the Problem

You will need to gather data about acid rain. What produces it? Does acid rain fall in your area? What industries in your area contribute to it? Are there laws regulating companies or cars that add to the acid rain problem? What weather patterns exist in your area? Are they responsible for bringing the acid rain to your area?

You may want to discuss this problem with local experts in addition to doing research on your own.

Part III: The Report to the Town Council

Once you have gathered all your information, you will need to write your report to the local government. The report should include your observations and other information you acquired while researching the problem. Illustrate your findings with graphs, diagrams, and/or tables of data. On the basis of your findings, provide an analysis of the problem. If you can identify the sources of acid rain, you may name them, but you must be able to substantiate your allegation. Conclude your report by offering a plan that the local governing body can follow to reduce the amount (or effects) of acid rain.

The report to the local government should be submitted to your teacher along with all your data and research notes.

Electric Switch

Your lab team has been hired to help remodel a house so people who do not have the use of their hands will be able to turn the lights on and off.

Complete the activities, follow safety instructions, and answer the question(s) below as directed by your teacher.

For the device to work you will need to:

- make a circuit that conducts electricity
- design a switch to turn the circuit on and off
- adapt your design for people who do not have the use of their hands

1. *Make sure you can light a bulb.* Use the materials you have been given to create the circuit shown in the diagram.

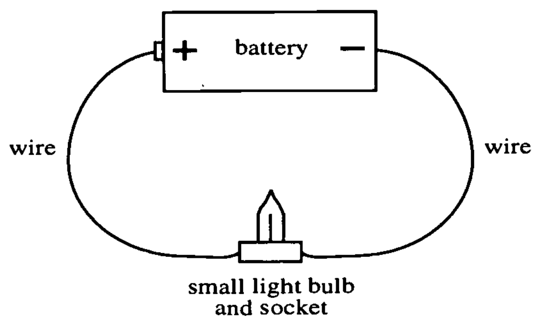

Figure 1

Does the light bulb light? If it does not, check to be sure that you have constructed the circuit properly and ask your teacher to make sure that your bulb and battery are working.

2. *Build a switch.* A switch is a device that can be used to connect and break the circuit so that the bulb will turn off and on. Once the bulb in your circuit lights, use the materials you have been given to create a switch. Work with your switch until you can use it to turn the light bulb on and off. Add the switch to the circuit.

- Each member of the group should draw a diagram of the circuit in his or her own booklet. In your drawing, you must show all parts of the circuit and the switch. Each of the parts must be clearly labeled.
- Explain how the switch works.

Questions

3. How could you change the design of the switch so that a person without the use of his or her hands could use it? Draw a diagram of your circuit showing the changes to the circuit and switch that would allow a person to turn it off and on without the use of hands. In your drawing, you must show all parts of the circuit and the switch. **Each of the parts must be clearly labeled.** Explain how this switch works.

4. When operating, ordinary incandescent light bulbs produce a lot of heat in addition to light. Fluorescent light bulbs produce much less heat when operating. How could you change the design of the circuit to conserve electricity? Draw a diagram of your circuit showing the changes to the circuit. In your drawing, you must show all parts of the circuit and the switch. **Each of the parts must be clearly labeled.** Explain how the modifications you made to the circuit contribute to saving energy.

Automobile Safety

Thousands of people are injured or killed every year as a result of traffic accidents. In fact, traffic accidents are the leading cause of death for people fifteen to twenty-five years old. This is a compelling issue, and it is taken very seriously by numerous groups in our society.

You and your team are safety engineers who have been hired to examine automobile safety. Based on the results of your analysis, you are to develop guidelines that would be submitted to automobile manufacturers for use in developing new cars. These guidelines should include consideration of how your proposed guidelines would make transportation safer. Your group's proposal should include, but is not limited to, the following sections:

I. **Safety:** In order to develop future guidelines, you need to know what is being done already. What sorts of safety features are used in cars today? Are they effective? If so, why? Include the scientific principles underlying safety considerations (e.g., inertia, momentum, velocity, mass, friction, forces, etc.). You may also want to consider why accidents happen. Is there anything that can be done to offset these factors?

   In this section you may want to design and perform experiments to examine how factors such as car velocity, mass, angle of impact, etc., affect the results of a car colliding with a barrier. Check with your instructor to see what equipment would be available for use. If you do perform experiments, incorporate the experimental designs, data, and conclusions in your proposal.

II. **Guidelines:** On the basis of your analysis of car safety, develop a set of guidelines that you believe all car manufacturers should follow. You will need to establish how your guidelines will make driving safer.

III. **Economics:** Changes in manufacturing and design specifications may have an economic impact. You should research and discuss the economic impact of your guidelines. For example, you may want to consider how your plan would affect the cost of building and driving automobiles.

IV. **Feasibility:** What problems might your plan encounter in the manufacturing, public (government), and private sectors? How might your design guidelines affect the performance (e.g., fuel efficiency, acceleration, comfort) of cars?

V. **Social Impact:** What societal impact does your safety plan have?

VI. **Bibliography:** Include all references cited in your proposal.

To prepare your proposal, draw on all available resources including professional experts; business, industrial, and governmental reports; and science texts. You must be able to support any conclusions you make with evidence. Document your group's efforts by maintaining a journal of your goals and your progress towards attaining them. Your group's final proposal will be submitted for review.

The Periodic Table of the Elements

Background Information

The ancient Greeks thought that all matter was composed of four elements: earth, air, fire, and water. In contrast, modern chemists view the chemical elements as the basic building blocks of the chemical world. To date, ninety-one chemical elements have been found on Earth and/or have been observed in stars. These elements exist in their uncombined states and as parts of mixtures, salts, and compounds. Nineteen additional chemical elements have been produced by scientists. A most recent, Element 110, was made in November, 1994, by scientists in Germany. This element has an atomic weight of 269 and is the heaviest one known. Element 110 decayed less than a thousandth of a second after it was produced.

In order to understand the properties of atoms and how they react with each other, people have arranged the elements into different groupings. The organizer used today is the Periodic Table of the Elements. Using the Periodic Table, people have been able to predict the existence and properties of elements that were subsequently discovered or made.

Your Task

A fifth-grade teacher has asked your class to speak to his students about the chemical elements. He wants your class to introduce his class to the Periodic Table of the Elements. You would also discuss the properties of the elements from each of the various chemical groups or families within the table.

Your class will work in groups of about six students. Each group will write a speech that describes the history, development, and organization of the Periodic Table. The speech should be written for a fifth-grade class.

In addition, your group will create pamphlets for two of the following groups of elements in the Periodic Table:

Group IA
Group IIA
Group IIIA
Group IVA
Group VA
Group VIA
Group VIIA
Group VIIIA
transition elements
lanthanide series
actinide series

Your pamphlets should describe the properties of the elements in the groups you have chosen, particularly with regard to their production or natural occurrence, everyday usage or presence in living stuff, and safe handling or disposal. These pamphlets will be made available to fifth-grade classes and can also be offered to other interested students, teachers, and parents. Be sure to submit copies of your three pamphlets along with your speech.

pH Indicators

2. Now add about 10 drops (0.5 mL) of the INDICATOR into the cup containing baking soda solution, and record the color in Table 2 below. Repeat the procedure for the other liquids.

Table 2

Solution	Color of solution plus INDICATOR	pH of solution
baking soda solution		
liquid soap		
tap water		
vinegar		
lemon juice		

Determining the pH of an unknown using an INDICATOR:

3. The four unknowns, Solutions A, B, C, and D, are in containers at the front of the room. In clean, labeled cups get a small amount (approximately 40 drops) of each unknown. Add 10 drops of INDICATOR to the cups containing Solutions A, B, C, and D. Record your observations in Table 3 below.

Table 3

Solution	Color of solution plus INDICATOR	pH of solution
A		
B		
C		
D		

Questions

4. Explain how you determined the pH values of the four unknown solutions. Why would you want to determine the pH of a solution?

5. Suppose that you were given a different acid-base indicator—one made from cranberries, blueberries, or red cabbage. How would you test the new juice to see if it would be a good indicator? Include in your discussion what properties you believe would make a solution a good acid-base indicator.

6. Acid rain is a problem in the US. and around the world. Acid rain is also responsible for the death of some plants and animals. How could you test the rain in your area to see if it is acidic? Explain the procedure. How could you determine if the rain in your area is more or less acidic than the rain in other parts of your state?

Exercise Physiology and A Case for Stairs

You notice as you run up a flight of stairs to your next class that your heart is pounding and your breathing is deeper and more rapid than when you started. The flight of stairs is illustrate in Figure 1 below. The top of the stairs is 4 m above the ground. Your weight is 500 N (1 N = 1 Newton or 0.22 lbs.). After a short time sitting in class, your respiration rate and heart rate seem to return to normal. You know that during exercise, your heart rate, respiration, blood pressure, and ability to hold your breath (maximum breath-holding time) change. You gather the data shown in Table 1 below.

Complete the activities and answer the question(s) below as directed by your teacher.

Table 1

	Pulse or heart rate (beats/min.)	Respiration rate (breaths/min.)	Blood pressure (diastolic/systolic)	Maximum breath-holding time
Normal (standing)	75	12	110/80	55
Walking up stairs	90	15	120/80	45
Running up stairs	110	20	130/80	30

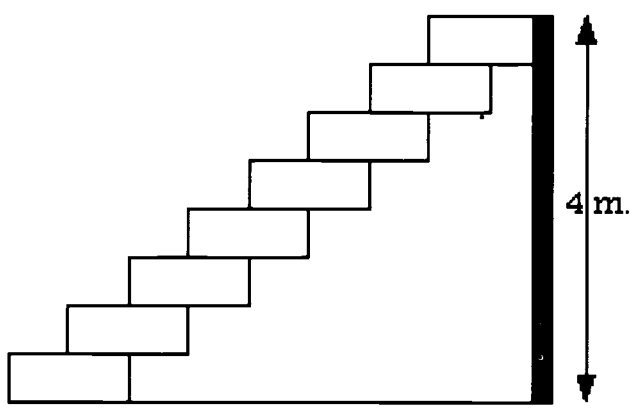

Figure 1

Performance

1. Consider the data gathered in Table 1 and the design of the flight of stairs in Figure 1. How would you redesign the flight of stairs to make walking the stairs between floors less strenuous and safer? Illustrate your redesign and explain how key features of the design make walking the stairs less strenuous and safer. Include in your answer (1) an illustration of your redesigned flight of stairs, (2) a description of how key features make walking the stairs less strenuous and safer, and (3) an explanation of the scientific principles upon which your redesigned flight of stairs is based.

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Classifying Materials

Chemical elements are substances that cannot be made into simpler substances by chemical means. Each element has properties that distinguish it from other elements. Each element also has properties that can be used to place it in a group with other elements.

You are studying the elements in school. Your teacher gives you several samples of materials and instructs you and your partners to determine some properties of these materials. You will study each material's *magnetic property* (how the material responds to the field of a magnet) and *density* (the amount of mass in a given volume of the material).

Use procedures, tools, and resources you find to be workable and safe. After you have finished your investigation, your teacher may assist you with identities of these materials.

Finally, you will design the investigations and/or research you would need to conduct on the first set of materials in Table 1 to determine a few additional properties of these elements (e.g., conductivity, susceptibility to corrosion, disposal requirements).

Note: *For each of the following procedures, complete the activities, answer the questions, and follow the clean-up and safety rules as directed by your teacher.*

1. To determine if the material is attracted to a magnet and find the density of each material:

- Explore finding a procedure that you can replicate. Use this procedure to help you collect reliable data to record in Table 1.
    - Demonstrate proper experimental procedures, including safety, as you find the mass and volume of each sample.
    - Control variables and use tools properly.
- Perform the necessary calculations to complete Table 1 once you have found a procedure that works.
- Describe the procedures that your group used to perform your study. This description should be clear and complete enough so that someone could easily repeat your study.

Table 1

Sample	Material	Attracted to a magnet Yes or No	Mass of Material (g)	Volume of material (cm^3)	Density of material (g/cm^3)
A					
B					
C					
D					
E					
F					

Classifying Materials

2. Design and perform the investigations and/or research necessary to determine two additional properties of the materials in Table 1(e.g., conductivity, susceptibility to corrosion, disposal requirements).

- Record the data that your group collected in an organized manner.
- Describe the procedures that your group used to perform your study. This description should be clear and complete enough so that someone could easily repeat your study.

Questions

Please answer the following questions by yourself.

3. Based upon the first set of experiments you have completed, group all of the samples from Table 1 according to their relative magnetic properties and their densities. Explain the basis for your classification system.

4. Based upon the second set of experiments you completed, regroup all of the samples from Table 1 according to their relative properties you established. Explain the basis for your classification system.

5. On an exploration of the Appalachian Mountains, suppose you find a solid material. When you break the material apart, you see that the inside of the material is silvery and shiny. Your teacher tells you that the shiny material consists of a single element. Using your knowledge of the Periodic Table and of investigative techniques, describe a procedure that you would use to classify and identify the shiny material.

6. You heard some people refer to an empty soup or vegetable can as a tin can. What would you do to find out if the can is made of tin? Provide justification why it is, or is not, made of tin.

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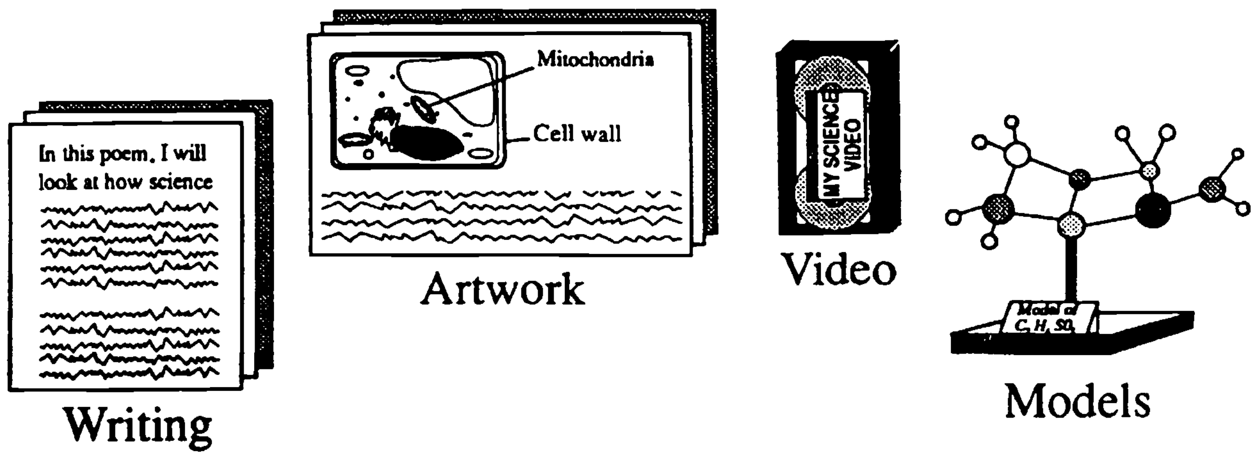
Type 3
Eighth Grade Science
Competency-Based Education Assessment Series



Substantive Application-Based Performance Tasks

(Open-Ended)

Characteristics

- Relevant inventive and creative applications, requiring experimental research, non-experimental research, and more out-of-class preparation
- Holistic scoring (e.g., portfolio scoring guide and interviews)

Item discussions provide an overview of items, pertinent content, and scoring parameters. A *Science Portfolio Scoring Guide* provides suggested parameters for holistic evaluation of potential portfolio work. Examples of potential science portfolio work are marked with a folder icon, 🗁, in the *Content Summary Chart.* Below are suggested action steps to implement a balanced CBE science assessment program.

Action Steps

- Select assessment blocks to assure that district assessments are focused on *Science Portfolio Scoring Guide* parameters, selected local performance objectives, and proficiencies.
- Select assessment blocks to assure that district assessments reflect a coherence with *Science Portfolio Entry* types, instructional strands, and organizing concepts.

Refer to the *Content Summary Chart.* It contains information to inform your planning and decision making. The *Chart* summarizes the variety of assessment blocks assembled in this instrument to assist district planning. The chart organizes assessment blocks by instructional topic for handy referencing by district staff and students. These topics **do not** constitute a content mandate for district CBE science programs.

Ohio Department of Education
1998

Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
- Assessments with folder icons, 🗁, at the top of the *Answer* column are possible portfolio entries.

• Eighth Grade Type 3 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 1							*Ninth Grade*
Water Pollution	1	See Discussion	Extending	1, 4, 6	I: 1, 4, 9, 10 K: 2, 3, 4, 12 C: 3, 6, 10, 11, 12 A: 1, 2, 3	Systems and Interactions	N: 2, 19 P: 12 E: L: 20
Page(s) 2							
Diversity of Life	1	See Discussion	Extending	5	I: 4, 12 K: 6, 8, 14 C: 12, 13 A:	Systems and Interactions	N: 1, 2 P: E: L: 14, 16
Page(s) 3	🗁						
Plate Tectonics Movements Within the Earth	1	See Discussion	Extending	2, 3, 4, 6, 7	I: 1, 2, 3, 4, 7, 12 K: 1, 2, 3, 4, 6, 8, 10, 12, 13 C: - All - A: 1, 3	Change Over Time	N: 1, 2, 17 P: E: 5, 7, 18 L:

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Content Summary Chart

- Assessment blocks (instructional topics) organized in this chart do not constitute a content mandate for district CBE science programs.
- Assessments for grades 3, 4, 5, 6, 7, and 8 were adapted from the CCSSO, SCASS Science Project *unless otherwise noted by names printed in italics.*
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• Eighth Grade Type 3 • • Competency-Based • Science Model Assessments • • Ohio •

Assessment Block	*Item*	*Answer*	*Performance Level*	*Performance Objective(s)*	*Instructional Objective(s)*	*Unifying Concept(s)*	*Proficiency Test Outcome(s)*
Page(s) 4	🗁						*Ninth Grade*
Acid Rain	1	See Discussion	Extending	1, 2, 4, 5, 6, 7	I: 1, 3, 4, 6, 7, 9, 10, 12 K: 1, 2, 3, 4, 6, 12 C: - All - A: 1, 3, 4, 5	Models and Scale	N: 2, 3, 4, 19 P: 12 E: L: 13, 20
Page(s) 5	🗁						
Electric Switch	1	See Discussion	Processing	2, 8	I: 1, 7, 11, 12 K: 2, 3 C: 3, 5, 6, 7, 8, 9, 10, 12, 13 A: 1, 3, 5, 7	Models and Scale	N: 3, 19 P: 10 E: L:
	2	See Discussion	Processing				
	3	See Discussion	Extending				
	4	See Discussion	Extending				
Page(s) 6	🗁						
Automobile Safety	1	See Discussion	Extending	1, 2, 3, 4	I: 1, 3, 6, 9, 10, 11, 12 K: 1, 2, 3, 4, 12, 13 C: - All - A: 1, 3, 5	Systems and Interactions	N: 2, 3, 4, 19 P: 8, 9, 10, 12 E: L:
Page(s) 7	🗁						
The Periodic Table of Elements	1	See Discussion	Extending	1, 5, 7	I: 1, 7, 9, 10 K: 2, 4, 6, 8 C: All - A: 1, 2	Patterns	N: 17, 19 P: 12 E: 18 L:

• Performance Objectives: Grade 8 ***Ohio's Model Competency-Based Science Program***

1. Presented with a structure or series of events (e.g., amusement park rides, changes of phase, porosity, permeability, toxicity, hazardous waste removal, enzymes, oxidation and reduction, threshold limits), the learner will analyze features related to the constancy and rates of change represented.
2. The learner will construct a simple working model (e.g., Rube Goldberg apparatus, simple vehicles, energy conservation systems, stream tables, terraria, aquaria) of a macro-scale phenomenon.
3. Presented with data on the motion of several objects (e.g., celestial bodies, freely falling objects, projectile motion, vehicular motion), the learner will construct a visual representation that can be used to predict the motions of the objects at subsequent times.
4. Given a learner-identified issue of local community importance (e.g., air pollution, pesticides, chemical exposure, radon, abandoned hazardous waste sites, transmission lines, landfills), the learner will collect information and observations and take action on a decision made regarding the issue.
5. Provided with several objects or organisms and the appropriate key, the learner will identify the organisms or objects.
6. Given data collected by self and others regarding changes over long time frames (e.g., corrosion, succession, erosion, glaciation), the learner will construct a model of the changes that have occurred.
7. The learner will create a blueprint, sketch, or map (e.g., street, topographic, electric field, magnetic field, acoustical, thermal) for other learners to use and follow directions using a blueprint, sketch, or map provided by other persons.
8. The learner will construct a device or tool (e.g., exercise machine, robot, periscope, computer, scissors, radio, vehicle) that takes advantage of or enhances personal performance.

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Science Portfolio Scoring Guide

Council of Chief State School Officers State Collaborative on Assessment and Student Standards Science Project, April '97

Parameter	Description			
	Level 4	Level 3	Level 2	Level 1
Depth of Understanding: How well do you know science? • Accuracy • Patterns and Trends • Connections	• Scientific information and ideas are accurate, thoughtfully explained, and accurately linked to major scientific themes or unifying concepts. • Patterns and trends are identified, discussed, and extended through interpolation or extrapolation. • Scientific connections are correctly identified and discussed.	• Scientific information and ideas are accurate and linked to major scientific themes or concepts. • Patterns and/or trends are identified. • Scientific connections are identified.	• Scientific information has occasional inaccuracies or is simplified. • Patterns or trends are suggested or implied. • Scientific connections may be implied.	• Scientific information has major inaccuracies or is overly simplified. • Patterns and trends are unclear or inaccurate. • Scientific connections are unclear or absent.
Evidence of Inquiry: What can you do in science? • Scientific questioning • Evidence and explanations • Methods and data • Analysis and conclusions • Future steps	• Questions are clearly identified and formulated in a manner that can be researched. • Evidence and explanations have a clear and logical relationship. • Methods generate valid data to address or resolve questions. Where appropriate, variables and controls are specified. • Analyses are accurate. Conclusions are valid, detailed, and consistent with data. • Future steps are proposed and linked to previous steps.	• Questions are clearly identified. • Evidence and explanations have a logical relationship. • Methods generate valid data related to the question. Where appropriate, variables and controls can be identified by the reader. • Analyses are accurate. Conclusions are valid and consistent with data. • Future steps are proposed.	• Questions are implied. • Evidence and explanations have an implied relationship. • Methods generate data related to the question. • Analyses are mostly accurate. Conclusions are related to the data. • Future steps may be implied.	• Questions are unclear or absent. • Evidence and explanations have no relationship. • Methods generate questionable data. • Analyses are unclear or inaccurate. Conclusions are unclear or unrelated to the data. • Future steps are unclear or absent.
Communication: How well do you communicate what you know and can do in science? • Clarity • Focus and organization • Medium	• Scientific information is communicated clearly and precisely but may also include inventive/expressive dimensions. • Presentation is effectively focused and organized (e.g., using tables, models, texts, figures). • A variety of media enhance communication.	• Scientific information is communicated clearly. • Presentation is focused and organized. • Medium facilitates communication.	• Scientific information has some clarity. • Presentation has some focus and organization. • Medium permits communication.	• Scientific information is unclear. • Presentation lacks focus and organization. • Medium hinders communication.
Relevance to Society: How well do you show how science affects people's lives? • Person and society • Context • Consequences and alternatives • Connections	• Relevant applications to personal and societal issues are identified and insightfully described. • Background information provides clear context for interpretation. • Consequences and alternatives are identified and discussed. • Multiple relevant connections are made to other content (e.g., social studies, arts, music, literature).	• Applications to personal and societal issues are identified. • Background information provides context for interpretation. • Consequences and alternatives are identified. • Connections are made to other content areas.	• Applications to personal and societal issues are suggested or implied. • Background information provides some context for interpretation. • Consequences and/or alternatives are implied. • Some limited connection is made to other content areas.	• Applications are unclear or absent. • Background information provides minimal context for interpretation. • Consequences and alternatives are unclear or absent. • Connections are not made to other content areas.

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Item Discussion

Item discussion on the following pages pertains to **EIGHTH GRADE** SCIENCE TYPE 3 MODEL COMPETENCY ASSESSMENTS. **Item Descriptions** provide an overview of items and pertinent content. Parameters for holistic evaluation of student work are suggested in the *Science Portfolio Scoring Guide*.

Science Portfolio Framework

(Used with permission from the *CCSSO SCASS* Science Portfolio materials.)

RATIONALE. A science portfolio assessment strategy supports improved proficiency performance. A portfolio supports science program implementation, framing teachers' on-going guidance and suggestions to keep students' work manageable, productive, and relevant to the objectives for student learning. A portfolio interfaces with previous assessment development*. A portfolio allows holistic assessment of students' doing and knowing science. (*Note: Examples of potential science portfolio work included in the **EIGHTH GRADE** TYPE 3 MODEL ASSESSMENTS are marked with a folder icon, 🗁, in the accompanying *Content Summary Charts*.)

ASSUMPTIONS. Potential science portfolio entries will result from a combination of teacher initiated questions and student initiated questions. Students will learn and extend self-evaluation skills. The student's **final science portfolio** contains his or her choices of the best four products, with revisions, to represent his or her science learning. These products are selected from among all the learning activities and demonstrations he or she completes over a set time period (i.e., quarter, semester, year). Products are selected as **portfolio entries** and placed in one of the four categories of science work described below.

- 🗁 **Investigation** Experimental research: Requires students to design, carry-out, and report results of an observational and/or experimental process.
- 🗁 **Research** Non-experimental research: Requires students to access, analyze, synthesize, evaluate, and use the kind of information the average citizen might use to investigate and solve a problem of personal or societal significance. Students also identify alternatives, trade-offs, and make a decision regarding an issue.
- 🗁 **Application** Inventive or expressive in nature: Requires students to choose a manner of demonstrating what they *can do*, what they *can apply*, and how thoroughly they *can justify* their thinking. An inventive application allows students to show how scientific information can be used to solve real-world problems. An expressive application allows students to communicate scientific information in a medium of his or her choice. His or her work includes a written or verbal description of the scientific basis for the entry.
- 🗁 **Open Choice** Students may use this entry to provide further evidence of his or her science learning. This entry may be another piece of the previously described categories of science work.

Each entry is accompanied by the student's **entry summary** (self-evaluation). Students discuss how well the entry reflects the *Science Portfolio Scoring Guide's* **four parameters**

- Depth of Understanding
- Communication
- Evidence of Inquiry
- Relevance to Society

- 🗁 **Portfolio Summary** The *fifth entry* of the students' final science portfolio: The student writes his or her **portfolio summary** to illustrate how the final portfolio entries reflect one or more of the above **four parameters.**

Teachers, parents, and administrators can use the Portfolio Summary as a road map of the how students' final portfolios demonstrate progress toward the objectives of instruction. The act of scoring students' final science portfolios may be mediated by teachers (and others) holistically comparing students' final portfolios to the suggested parameters in the *Science Portfolio Scoring Guide*. In this process take into consideration that each student entry need not reflect all parameters or all indicators for all parameters in the *Science Portfolio Scoring Guide* (i.e., the *Guide* is not intended for use as a checklist).

EXAMPLE STUDENT PORTFOLIO: Acid Rain and its Effects*

- **Example Portfolio Summary Outline**

Students discuss examples from his or her portfolio entries that demonstrate their understandings of those processes in which some properties and behaviors of things change while other properties and behaviors remain constant. In this discussion, students present evidence from across his or her **four entries** to illustrate one or more of the **four parameters** (see *Science Portfolio Scoring Guide*). In the process students answer the following questions

- How well do I know science? ...(Depth of Understanding)
- What can I do in science? ...(Evidence of Inquiry)
- How well do I communicate what I know and can do in science? ...(Communication)
- How well do I show how science affects people's lives. ...(Relevance to Society)

- **Examples of Student Entries** (*Examples result from a combination of student and teacher generated questions*):

  Investigation Entry Students design and conduct investigation, make observations, use tools, collect data, and use evidence to support conclusions about the effects of acid rain (e.g., *The Effects of Acid Rain on Monuments, Plants, and Buildings*).

  Research Entry Students gather data about acid rain, devise and use models to describe and make predictions about weather patterns and evaluate impact of acid rain effect (e.g., Another Town's Acid Rain: *Sources, Strategies, and Regulations*).

  Application Entry Students make use of creative and inventive communication tools to illustrate how to reduce the effects of acid rain (e.g., *Preserve the Monument on Town Square*).

  Open Entry Students discuss a problem of personal interest illustrating relevant science knowledge (e.g., *Findings from an Internet search on the causes and effects of air pollution on cultural artifacts around the world*).

*In this example student portfolio, the unifying concepts of models, systems and interactions glue together the objectives of classroom instruction and learning activities. These unifying concepts are not the topics of instruction. Separate topics that are taught in classrooms can be tied together with these unifying concepts.

START-UP SUGGESTIONS

DEFINE THE GOALS AND OBJECTIVES THAT YOU WANT THE PORTFOLIO TO DEMONSTRATE. Think about existing opportunities for students to become familiar with the targets of their science learning.

DECIDE ON THE LOGISTICS AND RESPONSIBILITY OF THE PORTFOLIO. Time and space needs for completion and storage of portfolios should be addressed. Also, think about existing opportunities for potential science portfolio entries to come from a combination of teacher initiated questions and student initiated questions. Teachers continue to offer on-going guidance and suggestions to make student's work manageable, productive, and relevant to the objectives for student learning.

BE SURE TO COMMUNICATE YOUR EXPECTATIONS CLEARLY TO STUDENTS, PARENTS, AND ADMINISTRATORS. Think about existing opportunities for sharing the parameters in the Science Portfolio Scoring Guide relevant to the science program objectives for student learning.

THINK BIG; START SMALL. EXPERIMENT UNTIL YOU FIND A FORMAT AND PACE THAT IS COMFORTABLE FOR EVERYONE. Think about existing opportunities for students to start, receive feedback, revise his or her work, and practice self-evaluation skills.

Item: Water Pollution

Item Description:

The item asks the students to write a letter to the city council. The purpose of the letter is to state if they support or reject a proposal to restock the river with trout, and they should back up their statement with information from the data table and the scenario at the beginning of the module.

A good response will show that the student can interpret the data in the table and draw the conclusion that trout need at least 6 ppm of dissolved oxygen and a temperature of 20° C or less. The low pH level in 1994, although it may be a contributing factor to the loss of trout in the river, cannot alone be the cause of the loss of trout.

Based on the scenario the student should recognize that in order for trout to have a suitable environment more needs to be done. The number of trees along the river should be increased, the number of new homes and industry should be limited, and/or tighter pollution controls are needed.

Criterion	Rubric Summary
1.	Supports or rejects proposal.
2.	Dissolved oxygen and temperature are important factors
3.	Dissolved oxygen level necessary. OR Temperature necessary for trout to survive.
4.	Scenario based statement.

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Item: Diversity of Life

Item Description:

This item assesses the student's understanding of the characteristic adaptations to land habitats of immobile organisms.

A good response will show that the student is familiar with the terminology used in Table 1 and understands the significance of each characteristic listed in the left-hand column.

Whichever organism is chosen, the response should include a description of the merits of that organism's way of getting food and water, its reproductive strategy and any differentiating adaptations of the organism.

While the length of time an organism has existed on Earth is a salient point, it is <u>not</u> an explanation of a necessary adaptation.

To sum up, the necessary adaptations described, should deal with how the organism collects and stores nutrients, especially water, or propagates itself, or survives climatic extremes.

Criterion	Rubric Summary
1.	Names one of the organisms collected on land.
2.	Cites at least one feature of the organism that is necessary to ensure its survival on land AND explains why it is necessary.
3.	Describes two features of the organism that are necessary to its survival on land, and explains why each is necessary.
4.	Cites a feature of the organism that distinguishes it from the others and is a survival advantage, and clearly explains that advantage. This feature may be one of the two used to fulfill criterion 3, but nay not be "multicellularity" or "having a cell wall," since those are common to all the land organisms.

Item: Plate Tectonics - Movement Within the Earth

Item Description

The purpose of this event is to allow students to demonstrate their understanding of the concept and dynamics of tectonic plates. Students are asked model and describe in way appropriate to help younger children to understand changes in the earth's surface over long and short periods of time, resulting from earth movements and forces.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide*.

Scoring Parameters

- Student identifies and accurately organize pertinent data about plate tectonics Discusses/illustrates how the earth's surface has changed over time relating plates, plate boundaries and the internal structure of the Earth as it relates the plate tectonics.

- Student references multiple sources of relevant information and shows evidence of formulating logical conclusions about climate change/biome shifts as a result of plate tectonics, relating relative motion at the boundary to land forms.

- Student demonstrates ability to evaluate plate data for it's informational value and incorporates the information in a book format with a definite story line AND illustrations that are appropriate for elementary children.. Details are precise, clear, focused, and organized.

- Student discusses the impact of plate tectonics on human beings and discusses the ease/difficulty with which predictions can be made about short term and long term impacts.

Item: Acid Rain and Its Effects

Item Description

Acid rain is a problem in the U.S. and around the world. Acid rain is also responsible for the death of some plants and animals. Students discuss functional understandings of the unifying concepts of models, systems and interactions (e.g., observing and analyzing characteristics, behaviors, and relationships of organizations of objects and organisms; identifying parts and whole with form and function, feedback and equilibrium, cause and effect, and predictable relationships; comparing mass and energy relationship for open and closed systems).

This event assesses the student's understanding of acids and bases, the role of acid-base indicators as a function of pH, and if they can apply this understanding to test the rain in your area to see if it is acidic.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide.*

Scoring Parameters

- Student demonstrates understanding of acids and bases, the role of acid-base indicators as a function of pH, exceptional understanding of the effects of acid rain, and the uses evidence to support explanations and recommendations.

- Students design and conduct investigation, make observations, use tools, collect data, and performs pertinent analysis to generate evidence to determine if the precipitation is acidic and to support conclusions about the effects of acid rain.

- Multiple sources are used and referenced to support student discussion of where acid rain comes from. Student shows an understanding of their description of acid rain (i.e., information copied word for word from an encyclopedia without any further discussion does not meet this criterion parameter). Students devise and use models to describe and make predictions about weather patterns and evaluate impact of acid rain effect.

- Students make use of creative and inventive communication tools to provide a plan to reduce the amount of acid rain, prevent acid rain from developing, or diminish its effects.

Item: Electric Switch

Item Description:

The following event deals with switches and how they can be modified for persons who do not have the use of their hands. In the first question students are asked to design (draw), and describe a simple circuit and switch. Then, in the second question students are asked to design and describe a modified switch. Answers to each may be found in either question.

Before students work with switches, they first demonstrate a basic understanding of what a simple circuit is and how to construct one. This is why the first Parameter (1) looks at whether or not students can at least draw a circuit with a battery and a light bulb. To be considered complete, a continuous path must lead from one end of the battery to the bulb holder and back to the other end of the battery. Switches are optional here. Simple illustrations for a circuit and switch that would effectively work to power and control a light. Some students may provide a short circuiting switch which is basically a wire that when hooked up, bypasses the light and turns it off.

How students design a switch, for someone who does not have the use of their hands, is the main focus in this event. Parameter 2 looks at the design itself. Here, students must label the switch as such or at least label the main parts of it to show a clear switch design. The student's design can be limited to the materials provided.

Finally, Parameter 4 looks at the student's description of how their switch works and how the circuit can be modified for energy efficient operation The student must address the use of some other body part like the elbow, foot, or mouth and how the part operates the switch.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide*.

Scoring Parameters

- The student demonstrates that he or she correctly understands what it takes to complete the circuit (e.g., concepts as polarity, flow, short circuit) and uses good science to explain the operation of his or her re-designed circuits (i.e., a switch operated hands-free, a circuit that saves energy).
- Drawings are complete, student discussion shows that the experiment was done. The questions are answered and are consistent with the results. Safety for self and others is demonstrated.
- Student answers questions correctly relative to making a complete circuit. Answers and diagram(s) are consistent with the experimental findings, clear, focused, and organized.
- Student gives successful descriptions for operation of a hands-free switch and illustrates different conditions for an energy efficient circuit design.

Item: Automobile Safety

Item Description:

This open-ended scenario assesses a student's ability to extended their knowledge and skills associated with concepts and principles of moving objects to automobile safety. Successful completion of this task will require students to synthesize pertinent scientific principles with researched information on related technical, economic, social and feasibility issues.

Evaluation of the students products, data, analyses, discussion and conclusions is scored holistically with reference to the parameters in the *Science Portfolio Scoring Guide*.

Scoring Parameters

- Student identifies and accurately organizes pertinent data collected from research and experimentation about concepts and principles of moving objects (e.g., effects of speed, mass, and stopping time/distance on collision forces). The students discusses the impact of this information on automobile safety.

- Student references multiple sources of relevant information and shows evidence of formulating logical conclusions about the safe automobile design. An experiment must be included. Safety for self and others is demonstrated.

- Student demonstrates ability to evaluate data and prepare a drawing and written explanation of the design. Details are precise, clear, focused, and organized. (A bibliography is desirable, unless the student uses no outside sources and clearly indicates the fact.)

- Student makes use of information about safety features currently in use and proposals for guidelines; either economics, feasibility, or social impact must be touched upon.

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