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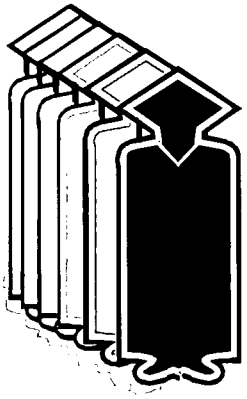
ABSTRACT

This document contains a description of the Georgia High School Graduation Test in Science. The test item specifications, reflecting the Georgia State Quality Core Curriculum, are used by writers and reviewers who are responsible for the development of test items. Much of the content in the description is based on earlier test versions developed between 1994 and 1996. In its present form, the description includes the test content and the types of questions students will be expected to answer. Practical advice for test taking is also included. The test content description includes information for these areas: (1) Process/Research Skills (30% to 32% of the test); (2) Physical Science (33% to 35% of the test); and Biology (33%-35% of the test). (SLD)

TM

Georgia High School Graduation Tests



Test Content Description
for

Science

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Revised October 1999

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OVERVIEW

SELECTION OF CONTENT FOR GEORGIA HIGH SCHOOL GRADUATION TESTS

In November 1997, the State Board of Education approved the revised Quality Core Curriculum (QCC) for use in public schools throughout Georgia. This QCC serves not only as the basis for instruction in Georgia schools but for development of the Georgia High School Graduation Tests as well.

Much of the content of these *Test Content Descriptions* is based on earlier versions developed between 1994 and 1996. Those earlier versions were based on statewide surveys of Georgia high schools and numerous meetings with Georgia educators to determine which content could defensibly be included in the Georgia High School Graduation Tests. Since the publication of the earlier version of the QCC, test developers have analyzed the changes made to the original QCC document, met again with groups of Georgia teachers, and prepared the lists of QCC standards found in these *Test Content Descriptions*.

In their present form, these *Test Content Descriptions* should adequately describe not only the content that is assessed in the graduation tests but the types of questions students will be asked to answer as well. Many of the item types may be unfamiliar to students who have not had much experience with questions that require them to apply what they have learned to new situations or to solve complex problems involving simple concepts. By publishing these *Test Content Descriptions*, it is the sincere desire of the Georgia Department of Education to offer encouragement to those who are preparing our students to be thinkers and problem solvers in all they do.

These *Test Content Descriptions* contain many sample test items and descriptions of how the items are developed. A careful study of these descriptions can be very helpful in preparing students for the tests. Teachers are encouraged to use these test items or others which they prepare themselves to match these descriptions to give students practice in responding to the types of items they are likely to encounter on the Georgia High School Graduation Tests. Furthermore, teachers are encouraged to use the new accompanying student guide for preparing for tests.

In preparing students to take the Georgia High School Graduation Tests, it would also be helpful to consider the practical advice concerning test taking on the following page. We have offered this material before, but it bears repeating.

Instructions on Preparing for Tests

1. **Read everything carefully.** Many of the science items involve descriptions, tables, charts, graphs, and other stimulus materials. All items require careful reading of the question and four answer choices. Stimulus materials will always include directions that tell students which items are based on them. Prior to reading the passage or other stimulus material, students may find it helpful to skim the questions following it to get a better idea of the purpose of their reading.

2. **Remember that there are no trick questions**. While it is important to read each item carefully, no trick questions are included on the test. Students should not spend too much time trying to figure out what the question is actually asking. If the student has read the entire question (including all accompanying stimulus material), the real meaning and the apparent meaning should be the same. Negatively worded questions and convoluted combinations of answers (e.g., II and III only, A and B, A but not B, etc.) have not been included on the test unless absolutely necessary for clarification. Some questions require a complete reading of the entire text in order to get the correct answer.

3. **Consider every answer choice**. Students must sometimes go beyond what is stated and draw valid inferences. They must then choose from four alternatives the answer that best addresses the question. Some of the alternatives (distractors) will be attractive because they can be obtained by incomplete or incorrect working of the problem. Such distractors are included precisely to distinguish between students who can recognize the problem to be solved and those who cannot.

4. **Guess intelligently**. There is no correction for guessing on this test; that is, students are not penalized for guessing. Students who cannot deduce the correct answer are encouraged to guess. Guessing is made easier if the student can eliminate one or more distractors as clearly incorrect. Be warned, however, that many of the distractors are made very attractive because they are based on common mistakes students make.

5. **Spend test time wisely**. Many tests are arranged so that the easiest items are first and the hardest are last. The Georgia High School Graduation Tests are **not** usually arranged that way. Instead, they are arranged as nearly as possible by strand and standard. Therefore, it is possible to run into several difficult items in a row, only to find much easier items later. If a portion of the test appears to be quite difficult, the student should not despair and assume that the rest of the test only gets harder. It would be better to move on, answer as many questions as possible, and then come back to the more difficult ones.

6. **Check your work**. There are several opportunities for careless errors to enter into a student□s response. The first is in the initial reading of the question (see # 1 above). The second is in the selection of a response. Students should evaluate each alternative critically to make sure it actually addresses the question (see # 3 above). The third opportunity is in the transfer of the correct answer to the answer document. Students should ask themselves two questions: "Am I on the right item number in the right section of the test?" and "Is this the answer I mean to mark?"

SCIENCE

INTRODUCTION

This document has been designed to acquaint Georgia teachers, curriculum directors, and other educators with the content of the Georgia High School Graduation Tests in science. It is based on the revised Quality Core Curriculum (QCC) approved by the State Board of Education in November 1997.

This document is a collection of test content descriptions for the science component of the Georgia High School Graduation Tests. It is used by the test item writers and reviewers in test construction. Georgia teachers and other educators may also find it useful in preparing in-class tests.

Content Standards and Skills

The standard exactly as it appears in the November 1997 version of the QCC is given here. In some instances, two or more standards will appear together. This pairing occurs when the standards are very similar and a single test content description has been developed to assess the cluster of standards, rather than each individual standard in that cluster.

Strand 1 standards focus on Process/Research Skills;
Strand 2 standards focus on Physical Science; and
Strand 3 standards focus on Biology.

Item Types

Science content items will fall into one of the general categories presented in the chart below.

ITEM TYPES
Process/Research Skills, Physical Science, Biology

Item Type	Stimulus Characteristics	Cognitive Level	Correct Response Characteristics
1	Direct question requiring factual recall	low	Demonstrates knowledge of facts and ideas
2	Direct question requiring interpretation	medium	Demonstrates understanding of principles, theories, and ideas; demonstrates some application or problem solving skills
3	Relationships: Interrelations, Cause/Effect, Comparison/Contrast, Consistency	medium	Demonstrates understanding of principles, theories, processes, patterns, trends, systems, and relationships; demonstrates some application or problem-solving skills
4	Application	high	Demonstrates an ability to apply principles, theories, and ideas to scientific and everyday situations
5	Prediction	high	Demonstrates an ability to analyze patterns and draw conclusions
6	Analysis	high	Demonstrates an ability to analyze and evaluate information, procedures, theories, and designs; may demonstrate ability to correct errors or flaws

Cognitive Levels

Cognitive levels are based on learning expectations, not item difficulty. Items may be written at the following levels:

Low: requires recognition only and typically deals with terminology, identification, or other low-level activities

Medium: requires some degree of interpretation of a problem or situation in which a scientific principle is applied

High: requires a significant degree of interpretation, problem solving, and analysis (e.g., devising a solution to a problem by applying a scientific principle)

Sample Items

Following are sample items representing each of the six Item Types. These questions also vary in their cognitive levels.

Type 1. What are recorded observations in an experiment called?

(A) apparatus
(B) data
(C) hypotheses
(D) variables

Explanation:
This factual recall question is at the **low** cognitive level. It focuses on knowledge of basic research terms and laboratory equipment. Note that while the correct answer is data (B), the distractors (A, C, and D) are all basic terminology a student will encounter in the design and execution of an experiment. This question falls under the strand **Process/ Research Skills**.

Type 2. Today, Marjorie's lab work involves working with bases. Which types of safety equipment is Marjorie **most likely** to need?

(A) gloves and safety glasses
(B) safety glasses and litmus paper
(C) a fire extinguisher and a blanket
(D) litmus paper and an apron

Explanation:
This item assesses the use of standard safety practices and is at the **medium** cognitive level because it goes beyond recall, asking the student to apply knowledge of various forms of safety equipment to a specific situation. To answer correctly, the student should recognize that gloves and safety glasses (A) are always required when working with bases. The distractors (B,C, and D) all focus on other types of laboratory equipment that may be present in the lab, but are not types of safety equipment Marjorie will most likely need. This question falls under the strand **Process/Research Skills**.

Type 3. Refer to the portion of the periodic table below to answer the question that follows.

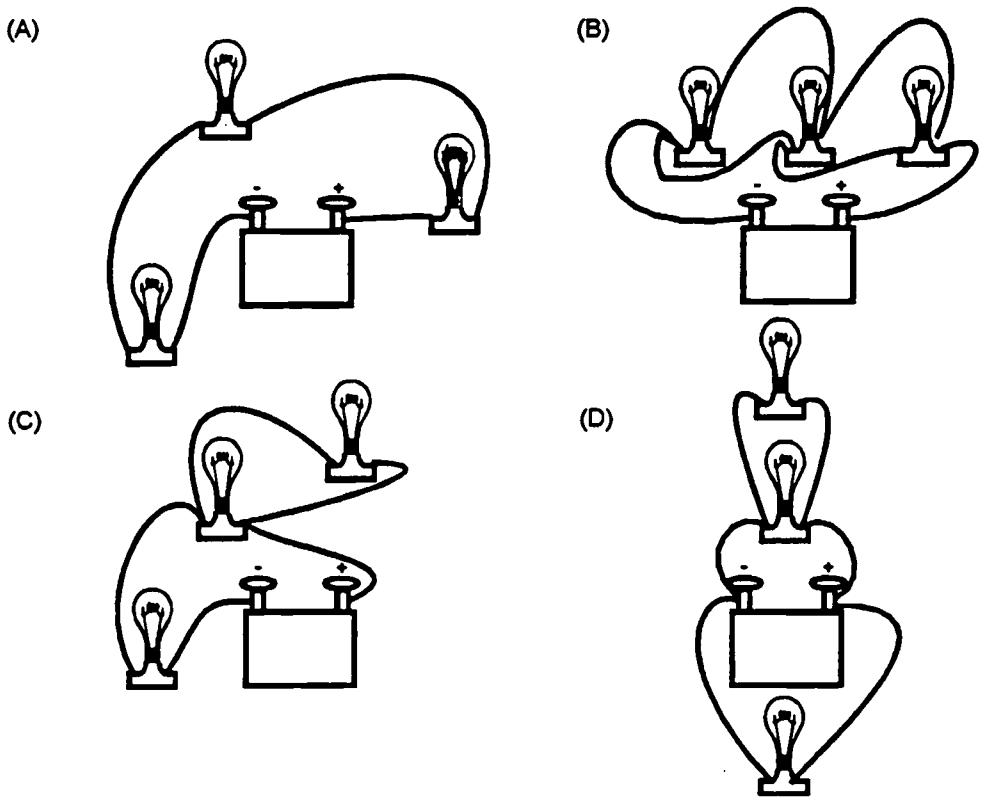
6 Carbon **C** 12.011 2,4
14 Silicon **Si** 28.086 2,8,4
32 Germanium **Ge** 72.59 2,8,18,4
50 Tin **Sn** 118.69 2,8,18,18,4
82 Lead **Pb** 207.19 -18,32,18,4

What do all of the elements listed above have in common?

(A) They are metals.
(B) They are in the same period.
(C) They have the same number of electrons.
(D) They have four electrons in their outer shells.

Explanation:
This question is written at the **medium** cognitive level. It requires the student to understand the relationships and patterns presented in the periodic table of the elements. In order to get the correct answer (D), the student must understand the periodic table and the pattern presented. Choice C is incorrect because it is based on a misinterpretation of the information given. Note that A and B, though incorrect here, are conclusions that are based on relationships exhibited in the periodic table. This question falls under the strand **Physical Science**.

Type 4. Use the illustration below to answer this question.



Which setup above shows 3 light bulbs arranged in series?

(A) A
(B) B
(C) C
(D) D

Explanation:
This item presents pictures of four different circuits. The knowledgeable student will know that the series circuit is shown in option A. The distractors are all different kinds of circuits that an unknowledgeable student may choose. This item has a **high** cognitive level because it requires the student to apply knowledge of electricity and circuits to determine the series circuit. This question falls under the strand **Physical Science**.

Type 5. Flowers known as four o'clocks may be red, white, or pink. The genes show incomplete dominance. If a red and white gene are inherited, the flower is pink. If two red genes are inherited, it will be red. If two white genes are inherited, it will be white. What happens if you cross two pink plants?

(A) All of the offspring will be pink.
(B) Half of the offspring will be red and the other half will be white.
(C) One-third of the offspring will be pink, one-third will be red, and one third will be white.
(D) Half the offspring will be pink, one quarter will be red, and the other quarter will be white.

Explanation:
This item is a typical problem in genetics. Here, the student must calculate or otherwise determine that pink (red/white, or RW) crossed with RW will produce RR, RW, and WW offspring and that the proportion of RW to RR to WW will be about 2:1:1. Thus, about half the offspring will be pink, one-fourth red, and one-fourth white (D). Distractors A, B, and C reflect incomplete or incorrect application of the principles of genetics. This question has a **high** cognitive level because it requires the student to apply the properties of genetics and to make a correct prediction based on these principles. This question falls under the strand **Biology**.

Type 6. Juanita would like to know whether a sample of a solid will float in water. In which type of table could she find this information?

(A) densities
(B) solubilities
(C) periodic table
(D) chemical properties

Explanation:
This question deals with whether or not a particular substance will float in water. Since floating is a function of the density of the substance, relative to the density of water, a density table (A) would be most useful. Solubility (B) sounds reasonable because water and another substance are involved, but soluble substances may or may not float. The periodic table (C) gives atomic weights, but atomic weight alone does not determine ability to float. The other choice is plausible because, for example, students might believe that the chemical properties of a substance (D) might have some bearing on ability to float. This question has a **high** cognitive level because it requires a significant amount of analysis. The student must know how density of an object affects its ability to float and must know that the information gathered from the distractors does not give the appropriate information needed to determine if an object will float. This question falls under the strand **Process/Research Skills**.

SUMMARY OF SCIENCE TEST CONTENT

The following are standards from the Quality Core Curriculum in science.

Strand 1: Process/Research Skills (30-32% of the test)

Standards

1.	S.9-12.1	Uses science process skills in laboratory or field investigations, including observations, classification, communication, metric measurement, prediction, inference, collecting, and analyzing data.
2.	S.9-12.2	Uses traditional reference materials to explore background and historical information regarding a scientific topic.
3.	S.9-12.3	Learns and uses on a regular basis standard safety practices for field investigations.
12.	S.9-12.14	Measures and compares relationships among speed, velocity, and acceleration.
13.	S.9-12.16	Relates frequency and energy of the electromagnetic spectrum. Explains how waves carry energy and can interact with matter.

Strand 2: Physical Science (33-35% of the test)

Standards

4.	S.9-12.4	Compares and contrasts matter and its characteristics related to its state (solids, liquids, and gases).
5.	S.9-12.5	Describes the fundamental parts of the atom.
6.	S.9-12.6	Identifies chemical or physical changes conceptually in a laboratory setting.
7.	S.9-12.7	Describes the basic structure of the atom as protons, neutrons, and electrons in specific arrangements.
8.	S.9-12.4/7/8, C.9-12.5	Compares and contrasts matter and its characteristics related to its state (solids, liquids, and gases). Describes the basic structure of the atom as protons, neutrons, and electrons in specific arrangements. Identifies the symbol, atomic number, and mass of each of the first 20 elements of the periodic table. Describes the fundamental parts of the atom.
9.	S.9-12.12	Analyzes different types of energy in terms of sources, limits and uses, and environmental impact.
10.	S.9-12.13/15	Identifies gravity as a force that is dependent upon mass and the distance between objects. Measures and/or calculates work and power using several examples from the learner's environment.

11.	S.9-12.13	Identifies gravity as a force that is dependent upon mass and the distance between objects.
14.	S.9-12.17	Generates an imbalance of electrical charge and experiments with attraction and repulsion of objects. Shows how electricity and magnetism are related.

Strand 3: Biology (33-35% of the test)

Standards

15.	S.9-12.3	Explains the significance of biology (e.g., impact on a daily basis).
16.	S.9-12.4	Explains the cellular basis of life.
17.	S.9-12.5	Explains homeostasis and describes the transport of materials through cell membranes.
18.	S.9-12.6	Recognizes that life has a chemical basis.
19.	S.9-12.7	Explains the processes of photosynthesis and respiration.
20.	S.9-12.8	Explains the structure of DNA and RNA and their role in protein synthesis. Describes the double-helix model.
21.	S.9-12.9	Describes the process of cell division, mitosis, and meiosis in sperm and egg formation.
22.	S.9-12.10	Explains and uses the basic Mandelian genetic principles.
23.	S.9-12.11	Describes patterns of inheritance and genetic engineering.
24.	S.9-12.13	Classifies organisms into a hierarchy of groups and subgroups based on their similarities.
25.	S.9-12.15	Describes characteristics and examples of monerans.
26.	S.9-12.16	Describes characteristics and examples of protists.
27.	S.9-12.17	Describes characteristics and examples of fungi.
28.	S.9-12.18	Describes the similarities and differences of spore-producing plants.
29.	S.9-12.19	Describes the similarities and differences of seed-producing plants.
30.	S.9-12.20	Describes the anatomy and physiology of each phylum of invertebrates.
31.	S.9-12.21	Describes the anatomy and physiology of classes of vertebrates.
32.	S.9-12.22/23	Analyzes the overall organization of the human body.
33.	S.9-12.25	Explains the structure of an ecosystem.
34.	S.9-12.26	Lists and describes the major biomes of the world.
35.	S.9-12.27	Assesses the impact of man's activities on the environment and explores ways to help solve ecological problems.

Test Content Descriptions

Science QCC Standard: Process/Research Skills (S. 9-12.1)

Uses science process skills in laboratory or field investigations, including observations, classification, communication, metric measurement, prediction, inference, collecting and analyzing data.

TEST CONTENT DESCRIPTION

For assessment purposes, students will be expected to recognize, interpret, and use the terminology of the scientific method, evaluate experimental designs and data, and decide how best to present results of an experiment or investigation. Students will be expected to recognize basic terminology (e.g., hypothesis, control, experimental variable), various types of graphs and other data display techniques, and sources of invalidity in experiments.

This standard is associated with four enabling objectives. These enabling objectives define the full range of the content to be assessed.

PS1.1./C1.1	Designs and conducts a scientific experiment that identifies the problem, distinguishes manipulated, responding, and controlled variables, collects, analyzes, and communicates data, and makes valid inferences and conclusions.
PS1.2/C1.2	Evaluates procedures, data, and conclusions to determine scientific validity of research.
B1.1	Demonstrates proficiency in the use of science process skills in laboratory and/or field activities involving observation, classification, communication, metric measurement, prediction, inference, identifying variables, formulating hypotheses, controlling variables, making operational definitions, designing investigations, experimenting, collecting qualitative and/or quantitative data, constructing a data table, graphing, analyzing, and interpreting data and/or drawing conclusions.
B1.2	Produces written reports of laboratory and/or field activities in accepted formats and uses precise language for presentations of procedure, tables of data, graphs, analytical methods, results, and analyses of error.

Sample Items	★ Key	Cognitive Level

Low

1. For any laboratory experiment, what should be the first step?

   A. Form a hypothesis.
   ★ B. State the problem.
   C. Perform the experiment.
   D. Write the conclusion.

Read the passage and answer the question.

A tropical fish hobbyist wants to see whether a new, more expensive fish food causes fish to grow faster. She sets up an experiment using four groups of ten fish each. The fish in group A receive a diet of the new fish food. Fish in group B receive the old fish food. Fish in Group C receive a mixture containing two parts new food and one part old food. Fish in Group D receive a mixture containing three parts new food and one part old food. The length of each fish is measured weekly.

Medium

2. What is the control group in this experiment?

   A. Group A
   ★ B. Group B
   C. Group C
   D. Group D

Read the passage and answer the question.

Patrice wanted to test the effect of temperature on plant growth. She filled three identical pots with the same kind of soil and identical seeds. She placed one pot in a sunny room, one in a cool basement, and one in a refrigerator. She gave each plant the same amount of water each day. After four weeks the plant in the warm room was taller than the other two plants. Patrice concluded that plants grow best in warm temperatures. Her conclusion was unwarranted because she failed to control one of the variables.

High

3. Which variable should have also been controlled?

   A. type of soil
   B. type of seed
   ★ C. amount of light
   D. amount of water

Sample Items **★ Key** **Cognitive Level**

High

4. You have been collecting data to determine average monthly rainfall for a particular year. You have 25 random samples recorded in milliliters for each month. You want to show rainfall trends over the year. What would be the **best** way to represent your data to illustrate each month's average rainfall?

A. on a calendar, with the samples written on the days they were taken
★ B. on a bar graph, with each bar representing the average of 25 samples for a particular month
C. in a brief but descriptive paragraph that includes your methods and general findings
D. on a data table, with the months labeled along the top and 25 samples written below each, averaged at the last row

Read the passage and study the data table, then answer the two questions that follow.

As much of a crystalline substance as could dissolve was mixed with a liter of distilled water in a tall graduated cylinder. A seed crystal of that substance was then hung in the solution. Each day the crystal length, strength of solution, temperature, and volume of liquid are measured and the following data are collected.

DATA TABLE OF OBSERVATIONS

	Length of Crystal (cm)	Concentration of Solution (%)	Temperature of Solution (°C)	Volume of Solution (mL)
Day 1	1	25	21	1000
Day 2	3.2	25	20	900
Day 3	5.4	25	21	800
Day 4	7.6	25	21	700
Day 5	10.0	25	20	600

Low

5. Which of the two properties in this experiment seem to be related?

A. volume of solution and temperature of solution
B. volume of solution and concentration of solution
C. length of crystal and temperature of solution
★ D. length of crystal and volume of solution

Sample Items	★ Key	Cognitive Level
		High

6. Why does the volume of solution decrease each day?

A. The temperature varies.
★ B. Evaporation and crystallization occur.
C. Evaporation causes nearly 100 mL of solution to be removed each day.
D. The crystal suspended in the solution is more dense. As it grows, the apparent volume of solution decreases.

Science QCC Standard: Process/Research Skills (S. 9-12.2)

Uses traditional reference materials to explore background and historical information regarding a scientific concept.

TEST CONTENT DESCRIPTION

For assessment purposes, students will focus on the correct identification of science resource materials and matching of resource to information needed.

This standard is associated with one enabling objective. This enabling objective defines the full range of content to be assessed.

B2.1 Uses media resources such as print, audiovisual, and online services to find information.

Science QCC Standard: Process/Research Skills (S. 9-12.2)

Sample Items	★ Key	Cognitive Level

Low

1. A student wishes to find a diagram of Earth's interior in his science textbook. Which part of a science textbook is likely to be **most** useful?

   A. appendix
   B. bibliography
   C. glossary
   ★ D. index

Low

2. In which part of a science textbook are definitions of science terms **most likely** to be found?

   A. index
   ★ B. glossary
   C. appendix
   D. table of contents

Science QCC Standard: Process/Research Skills (S. 9-12.3)

Learns and uses on a regular basis standard safety practices for field investigations.

TEST CONTENT DESCRIPTION

For assessment purposes, the emphasis will be on the recognition of safety terms and procedures and the correct identification of precautions to take in specific settings.

This standard is associated with one enabling objective. This enabling objective defines the full range of content to be assessed.

PS3.1/B1.3/CI3.1 Learns and uses safety procedures specific to an investigation or research activity.

Science QCC Standard: Process/Research Skills (S. 9-12.3)

Sample Items	★ Key	Cognitive Level

Low

1. What is the proper procedure for determining whether an unknown liquid has a characteristic odor?

   A. Place a container of the liquid under your nose, remove the cover from the liquid, and sniff it.
   B. Pour a sample of the liquid into water, place the beaker of water under your nose, and then sniff it.
   ★ C. Hold the container away from your body, remove the cover, allow some fumes to escape, and wave the fumes toward your face with your free hand.
   D. Insert a piece of glass tubing into the liquid, allow a small amount of the liquid to rise in the tube through capillary action, hold the tube near your nose, and sniff it.

Medium

2. Today, Marjorie□s lab work involves working with bases. Which types of safety equipment is Marjorie **most likely** to need?

   ★ A. gloves and safety glasses
   B. safety glasses and litmus paper
   C. fire extinguisher and blanket
   D. litmus paper and an apron

Compares and contrasts matter and its characteristics related to its state (solids, liquids, and gases).

TEST CONTENT DESCRIPTION

For assessment purposes, the student will recognize the nature of matter by distinguishing among atoms, molecules, and ions.

This standard is associated with five enabling objectives. Together, they define the full range of content to be assessed.

PS4.1	Identifies and classifies examples of matter in the learner□s environment as molecules, atoms, or ions.
PS4.2	Compares and contrasts the terms atoms, molecules, and ions and provides examples of each.
PS4.3	Identifies matter in its various forms including pure substances, heterogeneous and homogeneous mixtures, and solutions.
PS4.4	Describes solutions in terms of solvent, solute, and relative solubility.
PS4.5	Identifies the characteristics of water that make it the universal solvent.

Sample Items	★ Key	Cognitive Level

Low

1. Which chemical change takes place when vinegar is added to baking soda?

   ★ A. A gas is released.
   B. A blue powder forms.
   C. The combination will burn.
   D. The color of the solution will change.

Medium

2. Instant coffee crystals are prepared for breakfast by stirring them into boiling water. Water is the

   A. solute.
   ★ B. solvent.
   C. compounding agent.
   D. heterogeneous agent.

Medium

3. What chemical change takes place when you turn the thermostat up on a furnace?

   A. The temperature in the room increases.
   B. Air moves throughout the room.
   ★ C. Fuel burns in the furnace.
   D. Heat in the room rises.

Science QCC Standard: Physical Science (S. 9-12.5)

Describes the fundamental parts of the atom.

TEST CONTENT DESCRIPTION

Given portions of the periodic table, the student will correctly identify and apply the concepts of atomic number, atomic mass, period, and group or family.

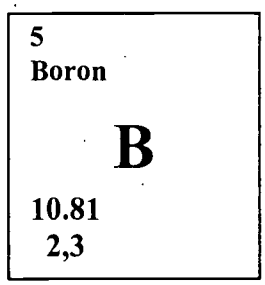
This standard is associated with three enabling objectives which define the full range of the content to be assessed. The periodic table should be used in assessment whenever possible.

C5.1	Uses the periodic table to identify atomic number and mass.
C5.2	Relates relative position of elements on the periodic chart to period and group reactivity trends.
C5.3	Describes the relationships of ionization energy and electron affinity to atomic radius and describes the relationship of valence electrons to reactivity trends in the periodic table.

Sample Items **★ Key** **Cognitive Level**

Low

Refer to the portion of the periodic table below to answer the question that follows.



1. The number 5 refers to the element's

   A. atomic mass.
   ★ B. atomic number.
   C. number of neutrons.
   D. number of electron shells.

Refer to the portion of the periodic table below to answer the question that follows.

3	4	5	6	7	8	9	10
Lithium	Beryllium	Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon
Li	**Be**	**B**	**C**	**N**	**O**	**F**	**Ne**
6.939	9.01218	10.81	12.011	14.0067	15.9994	18.9984	20.183
2,1	2,2	2,3	2,4	2,6	2,6	2,7	2,8

Medium

2. Which element in this period would be **least likely** to react with other elements?

   A. Boron
   B. Carbon
   ★ C. Neon
   D. Oxygen

Sample Items **★ Key** **Cognitive Level**

Medium

Refer to the portion of the periodic table below to answer the question that follows.

6 Carbon **C** 12.011 2,4
14 Silicon **Si** 28.086 2,8,4
32 Germanium **Ge** 72.59 2,8,18,4
50 Tin **Sn** 118.69 2,8,18,18,4
82 Lead **Pb** 207.19 -18,32,18,4

3. What do all of the elements listed above have in common?

A. They are metals.
B. They are in the same period.
C. They have the same number of electrons.
★ D. They have four electrons in their outer shells.

Science QCC Standard: Physical Science (S. 9-12.6)

Identifies chemical or physical changes conceptually in a laboratory setting.

TEST CONTENT DESCRIPTION

For assessment purposes, students are required to distinguish between physical and chemical changes in matter, such as change in phase (solid to liquid) versus change in molecular structure.

This standard is associated with one enabling objective which defines the full range of content to be assessed.

PS6.1	Differentiates chemical from physical changes in the following laboratory investigations: combustion, fermentation, melting, dissolving, metabolism, boiling, and electrolysis.

Sample Items	★ Key	Cognitive Level

Low

1. Melting can be defined as a

   A. chemical change.
   ★ B. phase change of solid to liquid.
   C. substance undergoing sublimation.
   D. change from solid to gas only in the presence of a high temperature.

Low

2. In a beaker, sugar is dissolved in water, and then the water is heated and evaporates. The sugar is recovered, and heat is again applied. Vapor is released, and the material in the beaker changes from white to black. What must you know to determine if a chemical change occurred?

   A. the boiling point of water
   B. the boiling point of sugar
   C. temperature at which sugar evaporates
   ★ D. whether or not the black substance is sugar

Medium

3. Which represents a chemical change in matter?

   A. carbon dioxide undergoing sublimation
   B. water dissolving salt to form a solution
   C. water undergoing evaporation
   ★ D. metal post beginning to rust

Science QCC Standard: Physical Science (S. 9-12.7)

Describes the basic structure of the atom as protons, neutrons, and electrons in specific arrangements.

TEST CONTENT DESCRIPTION

For assessment purposes, the student will be asked to identify subatomic particles, tell how they interrelate, and relate atomic energy to everyday life.

This standard is associated with three enabling objectives which define the full range of content to be assessed.

PS7.1	Identifies relative location, size, and charge of subatomic particles.
PS7.2	Relates the relative number of protons and electrons to chemical charge and reactivity.
PS7.3	Defines radioactivity and describes the properties of radioactive elements and isotopes. Relates their importance to everyday life as in medicine, pollution, industry, and electrical power.

Sample Items	★ Key	Cognitive Level

Low

1. An electron cloud is defined as

   ★ A. a space around the nucleus where electrons are found.
   B. the first two energy levels of electrons in an atom where electron density is greatest.
   C. a more specific term for the entire atom, since all chemical properties are determined by the electrons.
   D. an atmospheric cloud in which electrons have been stripped from atoms and molecules and are free in the cloud.

Low

2. Which characteristic is associated with alpha radiation?

   A. the ability to produce X-rays
   B. the ability to gain or lose an electron
   C. the capability of penetrating 5 inches of lead shielding
   ★ D. the reduction of the atomic number of the parent nuclide by 2

Medium

3. Radioactive materials (such as uranium and plutonium) have been linked to cancer and genetic defects, both of which are caused by changes within the cell. How does radioactivity affect living cells?

   A. Radio-length waves emitted from radioactive elements constantly bombard the cell, causing changes.
   B. Uranium and plutonium replace normal elements in certain proteins, either causing birth defects or initiating cancer.
   ★ C. Alpha, beta, or gamma radiation can change the molecular composition of a chromosome or other cell structure, thus changing the cell.
   D. Although radioactivity has been suggested as a causal factor, it is known that all atoms of higher atomic mass are incompatible with life forms and cause cellular changes.

High

4. The atomic number of iron is 26, and the atomic mass is 55.847. What does this mean in terms of protons, electrons, and neutrons?

   A. There are 26 each of protons and neutrons, and the rest of the mass is the result of electrons.
   ★ B. There are 26 protons and 26 electrons. Some atoms of iron have 29 neutrons; the .847 shows that there is more than one isotope of iron.
   C. There are 26 protons and 29 neutrons. Each particle has an atomic mass of 1. The 0.847 is the result of the negligible weight of 26 electrons.
   D. There are 26 protons and 26 neutrons. Since neutrons have slightly more mass than protons, the mass is greater than 52.

Compares and contrasts matter and its characteristics related to its state (solids, liquids, and gases).

Describes the basic structure of the atom as protons, neutrons, and electrons in specific arrangements.

Identifies the symbol, atomic number, and mass of each of the first 20 elements in the periodic table.

Describes the fundamental parts of the atom.

TEST CONTENT DESCRIPTION

For assessment purposes, the student will identify the parts of the atom, recognize the differences among atoms, molecules, and ions, and will relate atomic theory to chemical changes.

Content for this standard comes from the Physical Science strand. For assessment purposes, those chemistry topics accessible to Physical Science students will be included. The periodic table should be used whenever possible.

This standard is associated with six enabling objectives which define the full range of content to be assessed.

PS4.1	Identifies and classifies examples of matter in the learner□s environment as molecules, atoms, or ions.
PS4.2	Compares and contrasts the terms atoms, molecules, and ions and provides examples of each.
PS7.1	Identifies relative location, size, and charge of subatomic particles.
PS7.2	Relates the relative number of protons and electrons to chemical charge and reactivity.
PS8.1	Compares trends of chemical properties of periods and groups in the periodic chart.
C5.1	Uses the periodic table to identify atomic number and mass.

Sample Items	★ Key	Cognitive Level

Low

1. Which is the smallest particle of sugar that still has all the properties of sugar?

   A. atom
   B. ion
   C. isotope
★ D. molecule

Low

2. Which is a property of a proton?

   A. no electrical charge
★ B. atomic mass equal to 1
   C. same mass as an electron
   D. same charge as an electron

Medium

3. The half-life of carbon-14 is 5,730 years. How much carbon-14 would remain after 11,460 years, if any?

   A. none
   B. one-eighth
★ C. one-fourth
   D. one-half

Analyzes different types of energy in terms of sources, limits and uses, and environmental impact.

TEST CONTENT DESCRIPTION

For assessment purposes, this objective deals with types of energy and energy sources. Everyday examples of devices that convert energy from one form to another will be included as practical applications.

This standard is associated with four enabling objectives which define the full range of content to be assessed.

PS12.1	Describes some sources and uses of energy such as chemical, thermonuclear, photoelectric, electromagnetic, etc.
PS12.2	Describes the law of conservation of energy.
PS12.3	Compares the effectiveness of various methods of energy conversion.
PS12.4	Identifies and analyzes the nature of heat transfer in the learner□s environment and describes and classifies heat transfer as conduction, convection, and radiation.

Sample Items	★ Key	Cognitive Level

Low

1. Which would be the **best** example of kinetic energy?

   A. batteries on a shelf
   B. batteries in a flashlight that is turned off
   ★ C. batteries in a flashlight that is turned on
   D. batteries in a flashlight that has been left on too long

Low

2. Which of the following **best** defines convection?

   ★ A. Heat is transferred by the movement of a fluid.
   B. A liquid acquires enough heat to change to a gas.
   C. Temperature changes are measured only in Kelvin degrees.
   D. Thermal energy is transferred by the direct contact of one molecule to another.

High

3. Bob picked up two eggs from the table. One egg slipped out of his hand as he picked it up and hit the table, but did not break. The egg then rolled off the table and fell on the floor, where it broke. Which principle of physical science **best** explains why the egg broke on the floor but not on the table?

   A. The floor was harder than the table.
   B. The first fall cracked the egg so that it would break the next time it hit something.
   C. As the egg fell to the floor, it encountered friction with the air which made it easier to break.
   ★ D. The egg was going faster when it hit the floor than when it hit the table; therefore it hit the floor with greater force.

Science QCC Standard: Physical Science (S. 9-12.13/15)

Identifies gravity as a force that is dependent upon mass and the distance between objects.

Measures and/or calculates work and power using several examples from the learner's environment.

TEST CONTENT DESCRIPTION

For assessment purposes, students will focus on the calculation of work and gravitational forces. While some items will require recognition and recall, most will involve simple calculations demonstrating application of principles of gravitation and work to typical situations. Formula sheets will be provided; however, the student will have to determine which is the proper formula to apply.

These standards are associated with three enabling objectives which define the full range of content to be assessed.

PS13.1	Distinguishes among mechanical, atomic, gravitational, and electromagnetic forces.
PS14.2	Describes experimentally the effect of unbalanced forces in overcoming inertia, including the effect of sliding, static, and rolling friction.
PS15.3	Identifies compound machines as combinations of simple machines and describes how the work is done.

Sample Items **★ Key** **Cognitive Level**

Low

1. Choose the statement or situation which **best** demonstrates the relationship between power and force.

   A. Force is power divided by time.
   B. Greater power implies greater force, but greater force does not imply greater power.
   C. Since power involves greater speed and greater force, it means a higher work output than force alone.
★ D. Since power is work divided by time, and work is force times distance, power involves the rate at which a change in motion is accomplished.

Low

2. An inclined plane is described as a sloping surface which helps make work easier. Which other machines work on the same principle?

   A. lever, pulley
   B. lever, wheel, and axle
★ C. screw, wedge
   D. wedge, wheel, and axle

High

3. Apply the concept that a newton (N) is the force needed to accelerate one kilogram of mass by one meter per second. In soccer practice, what would you use newtons to measure?

   A. the air pressure needed inside the ball to accomplish perfect shots at the goal
★ B. how hard a person kicks the ball
   C. how far the ball goes after it is kicked
   D. the proper length of the field to ensure a fair game

High

4. Use the formula, Power = Work/Time, to determine the amount of power needed for the following problem.

   A person weighing 800 newtons walks up three flights of steps. Each flight is 10 meters high. It takes 60 seconds to reach the top. How much power is required?

   A. 8000 newton-meters/sec
★ B. 400 newton-meters/sec
   C. 133.3 newton-meters/sec
   D. 0 newton-meters/sec

Science QCC Standard: Physical Science (S. 9-12.13)

Identifies gravity as a force that is dependent upon mass and the distance between objects.

TEST CONTENT DESCRIPTION

For assessment purposes, students will deal with the laws governing the attraction between bodies in space. Principles include gravity, weight, and mass. Special attention is given to the contributions of Galileo and Newton. Calculations are not required.

This standard is associated with one enabling objective which defines the full range of content to be assessed.

PS13.2	Identifies and measures everyday forces such as gravity, rolling and sliding frictions, and other mechanical forces using common laboratory devices.

Sample Items	★ Key	Cognitive Level

Medium

1. A spaceship crew has been given the task of gathering "space trash." They are to collect the material and bring it back to earth in the shuttle. Some materials are quite large and some quite small. Apply what you know of weight and mass to this situation to determine which statement is true.

   A. The larger pieces will be harder to move, strictly because of their weight.
   B. The smaller pieces will be easily gathered since little or no force will be required to move them to the shuttle.
   C. Since weight is not involved, the crew will be able to move all the material using the same amount of force.
   ★ D. The force required to move the material will depend solely on its mass.

High

2. At one time, there were only seven known planets in our solar system. However, the orbit of the seventh planet did not follow a logical path. Something was affecting the orbit. Using this aberration, a scientist knew where to look in the sky for another mass and Neptune was discovered. Which laws or theory helped in this discovery?

   A. Matter is anything that has mass and takes up space.
   B. For every action, there is an equal and opposite reaction.
   ★ C. Gravitational force increases with increased mass and decreases as distance between masses becomes greater.
   D. A mass moving at a constant velocity tends to keep moving at that velocity unless acted on by an outside force.

Science QCC Standard: Process/Research Skills (S. 9-12.14)

Measures and compares relationships among speed, velocity, and acceleration.

TEST CONTENT DESCRIPTION

For assessment purposes, students will evaluate changed variables and/or calculate resultant speed, velocity, friction, and acceleration.

This standard is associated with one enabling objective which defines the full range of content to be assessed.

PS14.1 Describes experimentally the effect of unbalanced forces in overcoming inertia, including the effects of sliding, static, and rolling friction.

Science QCC Standard: Process/Research Skills (S. 9-12.14)

Sample Items	★ Key	Cognitive Level

Low

1. The statement, "The car was traveling at 55 mph due west," **best** describes

   A. acceleration.
   B. motion.
   C. speed.
★ D. velocity.

Medium

2. A car is moving southwest at a velocity of 20 meters/sec. Five seconds later, still traveling in the same direction, the car has a velocity of 25 meters/sec.

   Calculate the acceleration using the formula: $a = \frac{\Delta v}{t}$

★ A. 1 meter/sec/sec
   B. 5 meters/sec/sec
   C. 8 meters/sec/sec
   D. 100 meters/sec/sec

High

3. Use your knowledge of linear motion to predict what will happen in the following situation.

   Two model trains are traveling in opposite directions on the same track. Train A has a mass twice that of train B and is traveling twice as fast. Train A and train B hit head-on. They bounce backward, and neither is damaged.

   A. Train A bounces backward twice as far as train B.
   B. Train A and B both bounce back the same distance.
★ C. Train B bounces backward much farther than train A.
   D. There is insufficient information to make a prediction.

Relates frequency and energy of the electromagnetic spectrum. Explains how waves carry energy and can interact with matter.

TEST CONTENT DESCRIPTION

For assessment purposes, students will order the components of the electromagnetic spectrum by frequency or potential energy emission.

This standard is associated with five enabling objectives, listed below. These enabling objectives define the full range of the content to be assessed.

PS16.1	Uses wave and particle theory to describe transmission, absorption, reflection, and refraction of light in the visible spectrum.
PS16.2	Experimentally demonstrates how light interacts with lenses, mirrors, prisms, lasers, and optical fibers.
PS16.3	Relates color to frequency of light.
PS16.4	Relates frequencies of the electromagnetic spectrum outside the visible range to technological advances (e.g., microwave, radiowave).
PS16.5	Describes and varies properties of sound by changing temperatures or medium.

Sample Items	★ Key	Cognitive Level

Low

1. What does the law of reflection state?

   A. For every incident ray, there are many reflections.
   ★ B. The angle of reflection is equal to the angle of incidence.
   C. The angle of reflection is affected by the wavelength of light reflected.
   D. The angle of reflection depends on the nature of the reflective surface.

Low

2. Technically, noise is defined as

   A. any loud sound.
   ★ B. irregular vibrations at irregular intervals.
   C. a compressional wavelength with a large amplitude.
   D. any sound that falls between the range of 100 to 1,000 decibels.

Medium

3. The local convenience store has a mirror mounted near the ceiling in a corner opposite the check-out counter. This mirror allows the clerk to watch people throughout the store. What kind of mirror is this **most likely** to be?

   A. concave
   ★ B. convex
   C. flat
   D. two-way

Medium

4. A science project dealt with solar energy (sunlight). Equipment included a solar cell, colored transparent squares (filters) to cover the solar cell, and a propeller wired to the cell. When the cell was exposed to light, the propeller turned at a constant rate. When a blue filter was placed over the cell, the propeller slowed down. The blue filter was removed, and a red one was installed. The propeller slowed even more. The speed increased again when all filters were removed. What can be inferred from this information?

   ★ A. Different colors of visible light have different energies.
   B. Solar cells are unable to produce a steady supply of energy.
   C. Variance in the light source intensity accounted for changes in the speed.
   D. No hypothesis can be drawn, since the wavelengths of visible light are so similar.

Generates an imbalance of electrical charge and experiments with attraction and repulsion of objects. Shows how electricity and magnetism are interrelated.

TEST CONTENT DESCRIPTION

For assessment purposes, students will demonstrate how electricity and magnetism are interrelated.

This standard is associated with six enabling objectives. These enabling objectives define the full range of content to be assessed.

PS17.2	Demonstrates production of electrical charge in a chemical reaction (e.g., simple cell).
PS17.3	Evaluates different methods of generating electricity such as electric induction or a simple, piezoelectric, thermoelectric, or photoelectric cell.
PS17.4	Builds series and parallel circuits to perform specific tasks.
PS17.5	Measures and/or calculates current, voltage, and resistance at various points in series or parallel circuits.
PS17.6	Illustrates the interactions of electricity and magnetism by using electricity to create a magnetic field and magnetic induction to create an electric field.
PS17.7	Describes the interplay of electric and magnetic forces as the basis for electric motors, generators, radio, television, computers, and other modern technologies.

Science QCC Standard: Physical Science (S. 9-12.17)

Sample Items	★ Key	Cognitive Level

Low

1. A good way to generate static electricity is to

   ★ A. rub a glass rod with fur.
   B. rub a wire on a magnet.
   C. turn a magnet in a coil of wire.
   D. rub two pieces of wool together.

Low

2. In electric circuits, what is the relationship between wattage and energy?

   A. The higher the wattage, the less energy required.
   B. The lower the wattage, the less energy needed to cause a fire.
   C. The lower the wattage, the higher the initial energy required.
   ★ D. The higher the wattage, the greater the energy delivered per second.

Medium

3. Fred's car would not start, and Alicia offered to help him by using her jumper cables. Alicia started her engine and connected the cables to her battery. The other end of the cables touched Fred's car and made sparks. Why did this happen?

   A. Alicia had not correctly connected the cables to her battery.
   ★ B. Alicia completed an electrical circuit from her battery, to Fred's car, and back again.
   C. Fred forgot to wait until both ends of the cables were connected before starting his car.
   D. Alicia's jumper cables probably had a break in the insulation, which will cause a short circuit.

Medium

4. Your task is to generate electricity by a chemical reaction. Which of the following supplies could you use?

   A. magnet, copper wire, HCl, test tube
   ★ B. beaker, HCl, zinc and copper strips
   C. silk material, rubber rod, electroscope
   D. sulfuric acid, graphite, silicon, graduated cylinder

Sample Items	★ Key	Cognitive Level

Medium

5. High tension wires that carry electricity across the countryside are left bare because the amount of insulation required for 230,000 volts is not practical. Porcelain guides are used on high tension wires where they come near the steel support towers. What is a likely explanation for this fact?

   A. The porcelain provides leverage for electricians when repairs are necessary.
   ★ B. The porcelain insulates the wire from the steel tower.
   C. The porcelain prevents rubbing of the wires against the steel, which can cause interference in the electric current.
   D. That porcelain conducts a small current of electricity, which feeds a monitor that controls the flow of electricity through the wire.

High

6. How could some of these materials be used to generate electricity?

hydrochloric acid
lead strip
silicon
zinc strip
magnets
copper wire
graphite

   ★ A. Make a loop in the copper wire and turn it between the two magnets.
   B. Make a loop in the copper wire and insert one end into a beaker of hydrochloric acid and the other in silicon.
   C. Attach a copper wire to a zinc strip and insert the copper end into a beaker of hydrochloric acid and the zinc end into graphite.
   D. Wrap one end of the copper wire in silicon and place the other end in hydrochloric acid.

Explains the significance of biology (e.g., impact on daily life).

TEST CONTENT DESCRIPTION

The student will recognize common impacts of biology on daily life, will identify various fields of biology, and will relate biological principles to applications in everyday life.

This standard is associated with three enabling objectives. These enabling objectives define the full range of the content to be assessed.

B3.0	Explains the significance of biology (e.g., impact on daily life).
B3.1	Defines biology and major divisions (e.g., botany, genetics).
B3.2	Explains the use of biology in daily life.

Sample Items	★ Key	Cognitive Level

Low

1. Which aspect of modern life has been **most greatly** affected by biologists?

   A. transportation systems
   B. communications
   ★ C. food supply
   D. education

Low

2. Which branch of biology focuses on the study of heredity?

   A. ecology
   ★ B. genetics
   C. microbiology
   D. zoology

Low

3. The water you drink each day probably comes from a municipal water supplier that employs a biologist. What is the biologist **most likely** to do that would affect the quality of the water you drink?

   ★ A. Conduct tests to make sure there are no harmful bacteria in the water.
   B. Design systems to make sure you have enough water pressure.
   C. Inspect water pipes to make sure there are no cracks or leaks.
   D. Collect water samples from various places to make sure the pH is the same throughout the system.

Science QCC Standard: Biology (S. 9-12.4)

Explains the cellular basis of life.

TEST CONTENT DESCRIPTION

For assessment purposes, students will correctly identify cells specialized parts for the transport of materials, energy capture and release, protein construction, waste disposal, information feedback, and motility, and associate each specialized part with its function.

This standard is associated with five enabling objectives. These enabling objectives define the full range of the content to be assessed.

B4.1	Distinguishes between living and nonliving things (e.g., characteristics of living things).
B4.2	States the cell theory.
B4.3	Differentiates between prokaryotes and eukaryotes.
B4.4	Identifies common cell organelles and describes the function of each (e.g., in diagrams and microscopic examinations).
B4.5	Distinguishes between unicellular and multicellular organisms.

Sample Items	★ Key	Cognitive Level

Low

1. Which of the following processes involves the chloroplast?

   A. cell division
   ★ B. conversion of light energy to chemical energy
   C. formation of reproductive cells
   D. stringing together amino acids

Low

2. What is the basic unit of structure and function of living things?

   ★ A. cell
   B. organ
   C. molecule
   D. organelle

Medium

3. Which organelle helps to maintain homeostasis within a multicellular organism through the exchange of materials with other nearby cells?

   ★ A. cell membrane
   B. mitochondrion
   C. nucleus
   D. vacuole

Medium

4. In what general way is the fact that an amoeba divides into two related to the healing of skin?

   ★ A. Cells originate from cells of like kind.
   B. All cells divide into two or more cells.
   C. Skin cells produce amoebas when healing.
   D. Amoebas may be found in a cut on the skin.

Explains homeostasis and describes the transport of materials through cell membranes.

TEST CONTENT DESCRIPTION

For assessment purposes, students will compare diffusion and osmosis. Students will determine the effects of different solutions on cells.

This standard is associated with four enabling objectives that define the full range of the content to be assessed.

B5.1	Explains the role of homeostasis in maintaining life.
B5.2	Cites examples of homeostatic mechanisms in unicellular and multicellular organisms.
B5.3	Describes processes whereby substances enter and leave the cell (passive and active transport mechanisms).
B5.4	Compares the reaction of plant and animal cells in solutions of different solute concentrations, (e.g., isotonic, hypotonic, and hypertonic solutions).

Sample Items	★ Key	Cognitive Level

Low

1. Which statement **best** describes active transport?

   A. Molecules move very quickly across a membrane.
   ★ B. Energy is expended to move molecules across a membrane.
   C. More molecules move across a membrane than in diffusion.
   D. Water molecules stream across a membrane into a concentrated situation.

Low

2. An animal cell is placed in a solution of distilled water. If left overnight, this cell will

   A. shrivel and die.
   ★ B. swell and burst.
   C. undergo plasmolysis.
   D. remain the same, since it has a cell wall to protect it.

Low

3. Homeostasis can **best** be defined as the

   A. mature period of an organism's life cycle when little change occurs.
   ★ B. maintenance of a relatively stable internal environment.
   C. maintenance of a constant external environment.
   D. period of no change in evolutionary history.

Low

4. Which is the **best** example of a multicellular organism maintaining internal homeostasis?

   A. a dog salivating at the sound of a bell
   B. a moth flashing eye spots on its wings
   C. a wolf remaining with a pack of wolves
   ★ D. a kangaroo rat producing concentrated urine

Science QCC Standard: Biology (S. 9-12.6)

Recognizes that life has a chemical basis.

TEST CONTENT DESCRIPTION

Student assessment will focus on elements found in living cells, the role of water, types of organic compounds, enzymes, carbohydrates, lipids, and proteins.

This standard is associated with four enabling objectives, listed below. These enabling objectives define the full range of content to be assessed.

B6.1	Demonstrates an understanding of basic chemical principles, (e.g., phases of matter, atomic structure, bonding, acids, bases).
B6.2	Identifies the elements of the earth□s atmosphere and crust that comprise living cells.
B6.3	Explains the special role of water in living systems.
B6.4	Describes the four basic types of organic compounds (carbohydrates, lipids, proteins, and nucleic acids) and their functions in the cell.

Sample Items	★ Key	Cognitive Level

Low

1. What is always found in organic compounds?

   A. calcium
   ★ B. carbon
   C. glucose
   D. sulfur

Medium

2. Both plants and animals need water to live. What common purpose does water serve for plants and animals?

   A. Both use water for cooling.
   B. Both get their energy from water.
   ★ C. Both use water to transport nutrients.
   D. Both extract hydrogen and oxygen from water.

High

3. As a researcher, you have been hired to confirm that a new food which claims to be low in calories is in fact low in calories. If you can only run one test to support this claim, you should test for the presence of

   A. carbohydrates.
   ★ B. lipids.
   C. nucleic acids.
   D. proteins.

Explains the processes of photosynthesis and respiration.

TEST CONTENT DESCRIPTION

For assessment purposes, students will define photosynthesis and respiration and identify them in various contexts. Students will also be asked to apply these concepts to practical problems.

This standard is associated with three enabling objectives which define the full range of content to be assessed.

B7.1	Diagrams and explains ATP-ADP cycle.
B7.2	Lists the reactants, products, and other requirements of photosynthesis.
B7.3	Lists the reactants, products, and other requirements of respiration.

Sample Items **★ Key** **Cognitive Level**

Low

1. Which process converts energy-storing molecules to energy for cellular activities?

★ A. respiration
B. photosynthesis
C. transcription
D. recombination

High

2. Which of the following statements **best** explains why all living things need food in order to live?

A. Body mass must be maintained, and food supplies the needed body mass.
★ B. Cells, tissues, and organs require energy to carry out their tasks, and food provides the needed energy.
C. A balanced diet is necessary to maintain strong bones and healthy teeth.
D. Food contains essential vitamins and minerals bodies need in order to synthesize other nutrients.

High

3. As a researcher, you have been hired to measure the growth rate of a new plant. The plant is extremely small and never grows more than a few centimeters a year; thus, a visual measure of growth is out of the question. Having only one specimen, which experiment would you conduct?

A. Plant the specimen, then dig it up at the end of 7 days and weigh it.
★ B. Plant the specimen in a sealed chamber and measure the amount of oxygen produced by the plant.
C. Plant the specimen in a sealed chamber and measure the amount of carbon dioxide produced by the plant.
D. Plant the specimen outside and compare its growth to that of other types of plants.

Explains the structure of DNA and RNA and their role in protein synthesis. Describes the double-helix model.

TEST CONTENT DESCRIPTION

Student assessment will focus on genetic expression at a chemical level using the double-helix model. The relationships among DNA, RNA, protein synthesis, and enzyme action are included.

This standard is associated with three enabling objectives which define the full range of content to be assessed.

B8.0	Explains the structure of DNA and RNA.
B8.1	Describes the double-helix model.
B8.2	Summarizes the processes of replication, transcription, and translations.

Sample Items	★ Key	Cognitive Level

Low

1. What are the basic building blocks of DNA and RNA?

   A. lipids
   B. organic salts
   ★ C. nucleic acids
   D. carbohydrates

High

2. Two geneticists found that they could cause mutations in a type of mold. When they examined the mutated cells, they found that specific genes had changed. In cells in which one gene had changed, they found that a particular enzyme was not properly made. In cells in which another gene had changed, they found that a different enzyme was not properly made. What would the geneticists conclude from their findings?

   ★ A. Each gene is responsible for the structure of a specific enzyme.
   B. Each enzyme is responsible for the structure of a specific gene.
   C. Genes and enzymes are able to mutate at the same time.
   D. Enzyme treatment can be effective in the battle against genetic mutations.

Describes the process of cell division, mitosis, and meiosis in sperm and egg formation.

TEST CONTENT DESCRIPTION

Students will distinguish between living and non-living, identify the cell as the basic unit of structure, define associated terms, and compare unicellular and multicellular organisms.

This standard is associated with three enabling objectives which define the full range of content to be assessed.

B9.1	Identifies the phases of mitosis.
B9.3	States the significance of mitosis to unicellular and multicellular organisms.
B9.4	Compares meiosis in sperm and egg formation, (e.g., cell number, cell size, chromosome number).

Sample Items	★ Key	Cognitive Level

Low

1. The basic unit of structure and function in living things is the

   ★ A. cell.
   B. organ.
   C. molecule.
   D. organelle.

Medium

2. If an intestinal cell in a butterfly contains 24 chromosomes, a butterfly egg cell would contain

   A. 3 chromosomes.
   B. 6 chromosomes.
   ★ C. 12 chromosomes.
   D. 24 chromosomes.

High

3. It is not easy to observe individual chromosomes during the interphase because

   A. the DNA has not been duplicated yet.
   ★ B. they have uncoiled to form long, thin strands.
   C. they leave the nucleus and are scattered throughout the cell.
   D. homologous chromosomes do not pair up until division starts.

Explains and uses the basic Mendelian genetic principles.

TEST CONTENT DESCRIPTION

Student assessment will focus on genetic terms and use Punnett Squares to demonstrate genetic crosses.

This standard is associated with two enabling objectives which define the full range of content to be assessed.

B10.1	Defines important genetic terms.
B10.2	Given parental genotypes, predicts the phenotypic and genotypic probabilities of subsequent generations.

Sample Items	★ Key	Cognitive Level
1. An offspring from parents with different characteristics is described as		Low
★ A. hybrid. B. purebred. C. mutant. D. homozygous.		

Use the graphic below to answer the following question.

	R	r
R	RR	Rr
r	Rr	rr

High

2. In this monohybrid cross of two roses, R represents the red gene and r represents the white gene. What percent of the phenotype of the offspring is red?

A. 25%
B. 50%
★ C. 75%
D. 100%

Describes patterns of inheritance and genetic engineering.

TEST CONTENT DESCRIPTION

Student assessment will focus on practical applications of genetics to agriculture and medicine. Topics include sex-determination, environmental factors in mutation, and the genotype-phenotype relationship.

This standard is associated with three enabling objectives which define the full range of content to be assessed.

B11.1	Relates normal patterns of genetic inheritance to genetic variation (e.g., crossing over).
B11.2	Relates abnormal patterns of genetic inheritance to genetic disorders and disease (e.g., nondisjunction).
B11.3	Lists significant contributions of genetic engineering to agricultural and medical practices.

Sample Items	★ Key	Cognitive Level

Low

1. A recessive allele is one whose effects on the phenotype (visible characteristics) are

★ A. masked in a heterozygous organism by a dominant allele.
B. masked in a homozygous organism by other genes.
C. mixed with those of the dominant allele to produce a hybrid.
D. only observable in a hybrid organism.

High

2. In a particular type of pea, round seeds (R) are a dominant trait, while wrinkled seeds (r) are a recessive trait. Two parent plants, one that is Rr and one that is rr, produce 800 offspring. Approximately how many of the offspring should have wrinkled seeds?

A. 200
★ B. 400
C. 600
D. 800

High

3. Flowers known as four o□clocks may be red, white, or pink. The genes show incomplete dominance. If a red gene and a white gene are inherited, the flower is pink. If two red genes are inherited, it will be red. If two white genes are inherited, it will be white. What happens if you cross two pink plants?

A. All of the offspring will be pink.
★ B. Half the offspring will be pink, one quarter will be red, and the other quarter will be white.
C. Half of the offspring will be red, and the other half will be white.
D. There is not enough information given to determine the results.

Classifies organisms into a hierarchy of groups and subgroups based on their similarities.

TEST CONTENT DESCRIPTION

Student assessment will focus on using the required accepted model to identify common organisms and characteristics of the five kingdoms.

This standard is associated with four enabling objectives which define the full range of content to be assessed.

B13.1	Recognizes and uses the Linnaean system of nomenclature as an accepted system of classification.
B13.2	Uses a dichotomous key to classify a variety of living things based on structural similarities and differences in a laboratory setting.
B13.3	Describes characteristics of organisms and identifies examples of at least five different kingdoms.
B13.4	Identifies common examples of organisms in each of the kingdoms.

Sample Items	★ Key	Cognitive Level

Low

1. Which of the following is the broadest classification category listed?

   A. class
   B. genus
   C. order
   ★ D. phylum

Low

2. Every organism is called by a two-word Latin name representing its

   A. class and order.
   B. order and family.
   ★ C. genus and species.
   D. kingdom and phylum.

Medium

3. The levels of classification in order from largest to smallest are

   A. genus, species, order, class, family, kingdom, and phylum.
   B. kingdom, phylum, genus, species, order, family, and class.
   ★ C. kingdom, phylum, class, order, family, genus, and species.
   D. phylum, class, family, species, kingdom, genus, and order.

Science QCC Standard: Biology (S. 9-12.15)

Describes characteristics and examples of monerans.

TEST CONTENT DESCRIPTION

Student assessment will focus on describing the roles of different monerans, particularly bacteria. Viruses are included, as well as the control of these organisms.

This standard is associated with four enabling objectives which define the full range of content to be assessed.

B15.1	Describes the cellular structure and the conditions necessary for growth and reproduction.
B15.2	Describes common diseases caused by bacteria and their treatments (e.g., streptococcal infections, pneumonia).
B15.3	Describes methods of bacterial control in food preparation, handling, and storage.
B15.4	Lists beneficial effects of monerans.

Sample Items	★ Key	Cognitive Level

Low

1. A parasitic, unicellular organism is found to have no organized nucleus. Choose the kingdom below in which this organism is classified.

★ A. Monera
B. Plantae
C. Protista
D. Protozoa

Medium

2. Ancient bacteria, found in fossils, were very important in the history of life because they

A. are the oldest known bacteria.
B. were the first multicellular organisms.
★ C. deposited oxygen into the atmosphere.
D. extracted heat from the atmosphere, cooling the earth.

Medium

3. Nitrogen-fixing bacteria are found in soybeans and many peas and beans. What should farmers do when they find these bacteria in their crops?

A. Use an antibacteria spray to destroy them.
B. Introduce predators that will eat the bacteria.
C. Destroy the crops because there is no cure for the bacteria.
★ D. Let the bacteria do their job of providing nourishment for the crops.

High

4. A certain bacterium is responsible for gas gangrene infection, which causes death or loss of limb. Physicians have learned that prevention of this infection can be achieved by thoroughly cleaning a severe puncture wound and then bandaging it loosely. Which **most likely** inhibits the growth of this bacterium?

A. excessive moisture
★ B. the presence of oxygen
C. exposure to ultraviolet radiation
D. a temperature of 98.6 degrees Fahrenheit

Science QCC Standard: Biology (S. 9-12.16)

Describes characteristics and examples of protists.

TEST CONTENT DESCRIPTION

Student assessment will focus on unicellular protozoa and algae and the roles these organisms play worldwide.

This standard is associated with three enabling objectives which define the full range of content to be assessed.

B16.1	Compares the phyla of protozoa.
B16.2	Compares alga phyla and identifies examples of each.
B16.3	Describes the beneficial and harmful effects of protozoa and algae.

Science QCC Standard: Biology (S. 9-12.16)

Sample Items	★ Key	Cognitive Level

Low

1. Which of the following are grouped into a phylum according to the way they move?

   A. algae
   B. parasites
   ★ C. protozoans
   D. fungus-like protists

Medium

2. The kingdom Protista is more diverse than other kingdoms of small membraned organisms because

   ★ A. Protista inhabit a wider array of natural habitats.
   B. evolution has been going on longer for Protista.
   C. symbiosis distinguishes Protista from bacteria.
   D. they are single units derived from individual groups of Protista.

Medium

3. Malaria is a disease caused by a sporozoan which releases poisonous substances in an infected host and destroys

   A. the parasite.
   B. the mosquito.
   ★ C. red blood cells.
   D. the thyroid gland.

Science QCC Standard: Biology (S. 9-12.17)

Describe characteristics and examples of fungi.

TEST CONTENT DESCRIPTION

Student assessment will focus on fungi and how they affect human beings.

This standard is associated with two enabling objectives which define the full range of content to be assessed.

B17.1	Compares and identifies fungi phyla.
B17.2	Explains the beneficial and harmful effects of fungi.

Sample Items	★ Key	Cognitive Level

Low

1. When we say that fungal spores have less metabolic activity than vegetative cells, we mean they are

   A. asexual structures.
   B. sexual structures.
   C. dead.
   ★ D. dormant.

Medium

2. Which is true for all fungi?

   A. They form sexual spores.
   B. They contain chitin.
   C. They form asexual spores.
   ★ D. They are heterotrophic.

Medium

3. When transplanting a wild plant to garden soil, it is very important to include some of the soil from the original habitat. This is **most likely** because soil from the original habitat would contain

   A. beneficial viruses for the plant.
   B. the proper pH for this particular plant.
   ★ C. symbiotic fungi, to assist in nutrient absorption.
   D. the seeds of the plant, in case the mature one dies.

Science QCC Standard: Biology (S. 9-12.18)

Describes the similarities and differences of spore-producing plants.

TEST CONTENT DESCRIPTION

Student assessment will focus on the differences of spore-producing mosses and ferns and their needed living conditions.

This standard is associated with three enabling objectives which define the full range of content to be assessed.

B18.1	Identifies the structure for nonvascular and vascular spore-producing plants.
B18.2	Describes the conditions necessary for growth and reproduction.
B18.3	Explains the life cycles of mosses and ferns.

Sample Items	★ Key	Cognitive Level

Medium

1. Which of the following examples of the Plantae Kingdom has the **least** developed sporophyte?

   A. ferns
   ★ B. mosses
   C. pine trees
   D. flowering plants

Medium

2. Why are seeds an important evolutionary improvement over spores?

   A. Seeds contain little water.
   ★ B. Seeds enhance dispersal and thus migration of genotypes.
   C. Seeds such as beans, corn, and rice are important food sources.
   D. Seeds are lighter for wind to carry away.

Low

3. In the moss life cycle, which structure of the plant develops a capsule on top of a stalk?

   A. thallus
   B. protonema
   ★ C. sporophyte
   D. gametophyte

Describes the similarities and differences of seed-producing plants.

TEST CONTENT DESCRIPTION

Student assessment will focus on the characteristics and functions of seed plants. The student will identify seed plants (gymnosperms and angiosperms), relate structure to function (food production, gas exchange, transport, etc.) and describe the significance of certain seed plants not only to humans but also to ecological systems.

This standard is associated with four enabling objectives which define the full range of content to be assessed.

B19.1	Lists and describes distinguishing characteristics of gymnosperms and angiosperms.
B19.2	Describes the structure and function of roots, stems, leaves, and flowers.
B19.3	Explains the process of sexual and asexual plant reproduction (e.g., pollination, fertilization, germination).
B19.4	Describes the importance of seed plants for food, medicine, and other products.

Sample Items	★ Key	Cognitive Level

Medium

1. Among angiosperms, dicots are distinguished by their

   A. absence of xylem and phloem.
   ★ B. net-like veins in their leaves.
   C. single embryonic leaf.
   D. scattered vascular bundles in the stem.

Medium

2. The sequence of stem layers from inside out is

   A. cambium-xylem-phloem-cortex.
   B. phloem-cortex-cambium-xylem.
   ★ C. phloem-xylem-cambium-cortex.
   D. xylem-cambium-cortex-phloem.

Medium

3. When pollen is transferred from the anther to the stigma of a flower, what has occurred?

   A. germination
   B. pollen formation
   ★ C. self-pollination
   D. cross-pollination

Describes the anatomy and physiology of each phylum of invertebrates.

TEST CONTENT DESCRIPTION

Student assessment will focus on invertebrates, or animals with no backbones. Emphasis is placed on the significance of certain invertebrates as health problems, as well as the economic roles of particular groups such as insects, mollusks, etc. Commonly known phyla and classes are used as examples.

This standard is associated with four enabling objectives which define the full range of content to be assessed.

B20.1	Explains the classification of organisms within each phylum.
B20.2	Identifies major structures and their functions for common organisms in each phylum of invertebrates.
B20.3	Describes the life processes of selected organisms in each phylum.
B20.4	Evaluates the economic significance of certain invertebrates.

Sample Items	★ Key	Cognitive Level

Low

1. Which feature must be included in an aquarium for a starfish to survive?

   A. a mate of the opposite sex
   B. a bottom-surface-growing seaweed
   C. a supply of minnows for food energy
   ★ D. a proper salt concentration in the water

Low

2. What similar features does an earthworm share with a grasshopper?

   A. Both are hermaphroditic.
   ★ B. Both have a ventral nerve cord.
   C. Both have open circulatory systems.
   D. Both have similar mechanisms of excretion.

Low

3. Invertebrates are defined as animals without

   ★ A. a backbone.
   B. an exoskeleton.
   C. mammary glands.
   D. specialization.

Low

4. Which would be an example of the biological control of unwanted garden pests?

   A. plowing
   B. weeding
   C. chemical pesticides
   ★ D. predator insects

Science QCC Standard: Biology (S. 9-12.21)

Describes the anatomy and physiology of classes of vertebrates.

TEST CONTENT DESCRIPTION

Student assessment will focus on characteristics and functions of common vertebrates. Students should relate the structure of organ systems to life processes among various groups of vertebrates.

This standard is associated with three enabling objectives which define the full range of content to be assessed.

B21.1	Explains the taxonomy of each class of vertebrates.
B21.2	Identifies major structures and their functions for common organisms in each class of vertebrates.
B21.3	Describes the life processes of common organisms in each class of vertebrates (reproduction, response, nutrition, and behavior).

Sample Items	★ Key	Cognitive Level

Low

1. Arteries in vertebrates are responsible for

   A. collection of waste products.
   B. transport of blood to the heart.
   C. maintenance of blood cholesterol levels.
   ★ D. transport of blood away from the heart.

Low

2. What is meant by "antagonistic paired muscles?"

   A. muscle pairs that hold joints in place, such as the elbow or knee
   B. muscle pairs that inhibit one another because of hormonal control
   ★ C. muscle pairs that counteract each other, or work in the opposite direction
   D. muscles that are connected and used together, such as in the thumb and index finger

Low

3. What purpose does an endoskeleton serve?

   A. It allows all vertebrates to walk upright.
   ★ B. It supports and protects the body.
   C. It aids in the process of respiration.
   D. It aids in the performance of the immune system.

Low

4. What do fish, frogs, snakes, birds, dogs, and humans have in common?

   A. lungs
   ★ B. backbones
   C. capacity for language
   D. four-chambered hearts

Science QCC Standard: Biology (S. 9-12.22/23)

Analyzes the overall organization of the human body.

TEST CONTENT DESCRIPTION

Student assessment will focus on identifying and labeling of human body systems, parts of organs within each system, and major bones and muscles of the human body.

This standard is associated with one enabling objective which defines the full range of content to be assessed.

B22.1	Describes the function of each body system.
B23.1	Identifies the organs and structural parts present in each basic system (e.g., circulatory, respiratory, digestive, reproductive).

Sample Items	★ Key	Cognitive Level

Low

1. Which of the following **best** defines absorption?

★ A. movement of nutrient molecules into cells lining the digestive tract
B. passage of undigested material out of the digestive tract
C. chemical breakdown of food
D. act of eating

Low

2. Which of the following is the site of fertilization in humans?

A. endometrium
★ B. oviduct
C. uterus
D. ovary

Medium

3. When you exhale, air passes through the respiratory structures in which of the following sequences?

A. alveolus, trachea, bronchus, bronchiole, larynx, pharynx, nasal cavity
B. alveolus, bronchiole, bronchus, trachea, pharynx, larynx, nasal cavity
★ C. alveolus, bronchiole, bronchus, trachea, larynx, pharynx, nasal cavity
D. alveolus, bronchus, bronchiole, trachea, larynx, pharynx, nasal cavity

Low

4. What pushes the blood in the veins back to the heart?

A. gravity
B. the larger diameter of veins relative to capillaries
★ C. the contraction of skeletal muscle pinching the veins and squeezing the blood along
D. the peristaltic contractions of the smooth muscle surrounding the veins

Explains the structure of an ecosystem.

TEST CONTENT DESCRIPTION

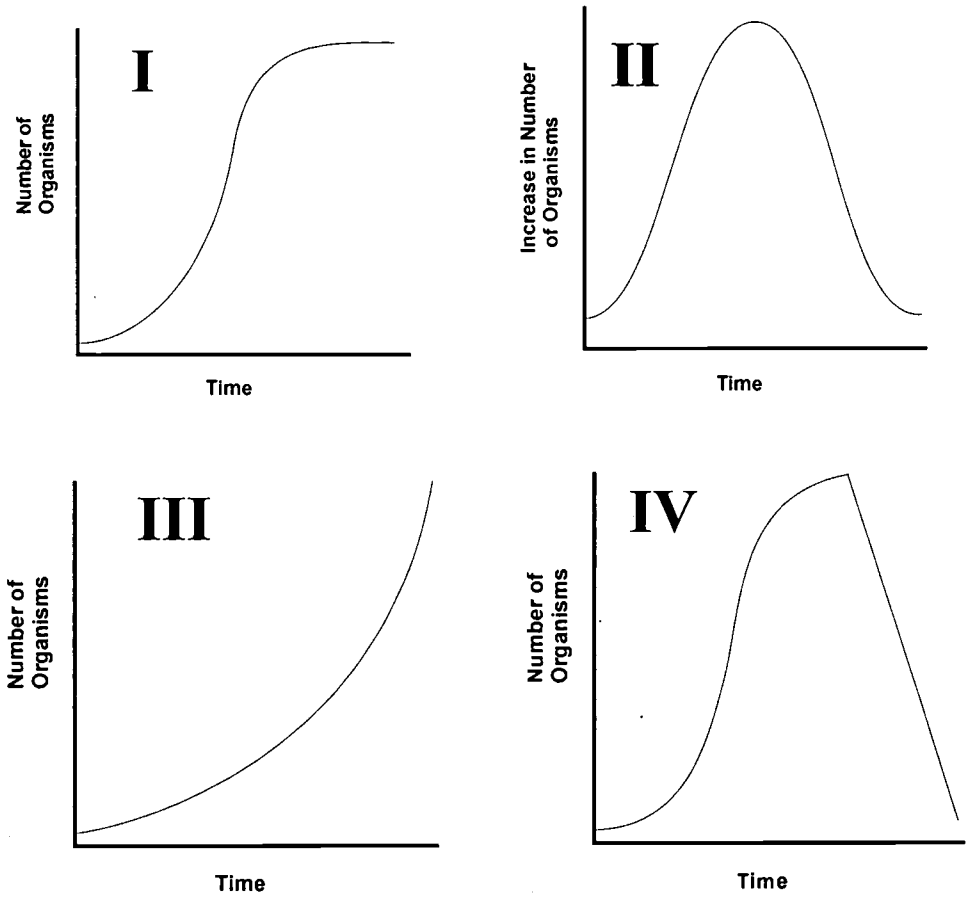
Student assessment will focus on food webs and chains, communities in various areas, change of communities over time, what constitutes a population, and the population change over time.

This standard is associated with five enabling objectives which define the full range of content to be assessed.

B25.1	Identifies and explains the interactions of biotic and abiotic factors in an ecosystem.
B25.2	Explains the components of a community (e.g., populations, species, niche, and habitat).
B25.3	Traces the flow of matter and energy through a food chain and food webs.
B25.4	Describes changes that occur in an ecosystem (e.g., ecological succession).
B25.5	Uses the principles of population growth to describe how a population changes.

Sample Items **★ Key** **Cognitive Level**

Use the graphs below to answer the question that follows.



Low

1. Which graph most closely represents the seasonal change in an insect population in the temperate zone?

   A. I
   B. II
   C. III
★ D. IV

Low

2. An organism which feeds only on consumers is

★ A. a carnivore.
   B. an herbivore.
   C. an omnivore.
   D. a saprophyte.

Sample Items	★ Key	Cognitive Level

Medium

3. Skyrocketing growth of the human population since the beginning of the Industrial Revolution appears to be mainly a result of

   A. migration to thinly settled regions of the globe.
   B. better nutrition boosting the birth rate.
★ C. a drop in the death rate due to better health care.
   D. the concentration of humans in cities.

Medium

4. To figure out the human population density of your community, you would need to know the number of people living there and

★ A. the land area in which they live.
   B. the birth rate of the population.
   C. whether population growth is logistic or exponential.
   D. the dispersion pattern of the population.

Science QCC Standard: Biology (S. 9-12.26)

Lists and describes the major biomes of the world.

TEST CONTENT DESCRIPTION

Student assessment will focus on relating geography and climate to the biome type of a given area.

This standard is associated with one enabling objective which defines the full range of content to be assessed.

B26.2 Compares the biotic and abiotic factors that distinguish the major biomes.

Sample Items **★ Key** **Cognitive Level**

Low

1. Changes in the seasons are caused by

   ★ A. the tilt of Earth□s axis toward or away from the sun.
   B. annual cycles of temperature and rainfall.
   C. variation in the distance between Earth and the sun.
   D. an annual cycle in the sun□s energy output.

Medium

2. What makes the Gobi Desert of Asia a desert?

   A. Its vegetation is sparse.
   B. It is hot.
   C. Temperatures vary little from summer to winter.
   ★ D. It is dry.

High

3. Andrea was a passenger on a plane that flew over temperate deciduous forest, then grassland and desert, finally landing at an airport in chaparral. The route of Andrea□s flight was **most likely** between

   A. New York and Denver.
   ★ B. Philadelphia and Los Angeles.
   C. Denver and Los Angeles.
   D. Washington, D. C., and Phoenix.

Science QCC Standard: Biology (S. 9-12.27)

Assesses the impact of man□s activities on the environment and explores ways to help solve ecological problems.

TEST CONTENT DESCRIPTION

Student assessment will focus on the causes of pollution, its effect on the environment, and likely solutions and preventative measures for the future.

This standard is associated with two enabling objectives which define the full range of content to be assessed.

B27.1	Analyzes the possible causes of certain ecological problems (e.g., acid rain, pollution).
B27.2	Identifies possible solutions to current ecological problems.

Science QCC Standard: Biology (S. 9-12.27)

Sample Items	★ Key	Cognitive Level

Low

1. Which of the following are associated with acid rain?

★ A. sulfur oxides
B. chlorofluorocarbons
C. carbon monoxide
D. phosphates

Medium

2. Ospreys and other top predators in food chains are **most severely** affected by pesticides such as DDT because

A. their systems are especially sensitive to chemicals.
★ B. the pesticides become concentrated in their prey.
C. they cannot store the pesticides in their tissues.
D. they have rapid reproductive rates.

Read the information and answer the question that follows.

In the long-standing war between coyotes and sheep ranchers in New Mexico, studies show that (a) coyotes kill sheep, and (b) the percentage of sheep lost from herds in areas where coyotes have been exterminated is about the same as the percentage lost in areas where coyotes are still present.

High

3. What is a likely explanation for the similarity in the percentage of sheep lost in both areas?

A. Coyotes were protecting sheep.
B. The sheep died from overcrowding.
C. Another predator was killing sheep.
★ D. Coyotes were preying upon sick or weak sheep.

Medium

4. The fruits in an apple orchard are being destroyed by larval insects. The owner wants to get rid of the insects without harming other animals. His first step should be to

A. spray DDT on the fruit trees.
★ B. introduce a natural predator of the pest.
C. remove all trees bearing the infected fruits.
D. coat the trees with a mild oil-based insecticide.

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