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ABSTRACT

This is one of four performance assessment resources booklets for Level III of the Intermediate Science Curriculum Study (ISCS). The four booklets are considered one of four major subdivisions of a set of individualized evaluation materials for Level III developed as a part of the ISCS Individualized Teacher Preparation (ITP) program. Each of these booklets, which accompanies a pair of the student texts, is a teacher's handbook to be used in identifying the appropriate performance checks with which to evaluate each student. Each also indicates how to set up testing situations, correct responses, and give remedial help. This manual covers In Orbit (IO) and What's Up (WU) in three units. Each unit begins with a summary table that includes the objectives and performance checks of the unit. Immediately following each table comes the bulk of resource material for each objective introduced in that unit. Suggestions of ways teachers can use the manual are also included. (HM)

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INTERMEDIATE SCIENCE CURRICULUM STUDY

ISCS

ED178294

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INDIVIDUALIZED TESTING SYSTEM

Performance Assessment Resources

ISCS LEVEL III
IO-WU

SE 028 487

SILVER BURDETT
GENERAL LEARNING CORPORATION
Morristown, New Jersey · Park Ridge, Ill. · Palo Alto · Dallas · Atlanta

INDIVIDUALIZED TESTING SYSTEM

ALL LEVELS	**Individualizing Objective Testing** (an ITP module) **Evaluating and Reporting Progress** (an ITP module)
LEVEL I	**Performance Objectives**, ISCS Level I **Performance Checks**, ISCS Level I, Forms A, B, and C **Performance Assessment Resources**, ISCS Level I, Parts 1 and 2
LEVEL II	**Performance Objectives**, ISCS Level II **Performance Checks**, ISCS Level II, Forms A, B, and C **Performance Assessment Resources**, ISCS Level II, Parts 1 and 2
LEVEL III	**Performance Objectives**, ISCS Level III **Performance Checks**, ISCS Level III, ES-WB, Forms A, B, and C WYY-IV, Forms A, B, and C IO-WU, Forms A, B, and C WW-CP, Forms A, B, and C **Performance Assessment Resources**, ISCS Level III, ES-WB WYY-IV IO-WU WW-CP

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FOREWORD

To implement an educational approach successfully, one must match the philosophy of evaluation with that of instruction. This is particularly true when individualization is the key element in the educational approach. Yet, as important as it is to achieve this match, the task is by no means simple for the teacher. In fact, without specific resource materials to help him, he is apt to find the task overwhelming. For this reason, ISCS has developed a set of individualized evaluation materials as part of its Individualized Teacher Preparation (ITP) program. These materials are designed to assist teachers in their transition to individualized instruction and to help them tailor their assessment of students' progress to the needs of all their students.

The two modules concerned with evaluation, *Individualizing Objective Testing* and *Evaluating and Reporting Progress*, can be used by small groups of teachers in in-service settings or by individual teachers in a local school environment. Hopefully, they will do more than give each teacher an overview of individualized evaluation. These ITP modules suggest key strategies for achieving both subjective and objective evaluation of each student's progress. And to make it easier for teachers to put such strategies into practice, ISCS has produced the associated booklets entitled *Performance Objectives, Performance Assessment Resources,* and *Performance Checks.* Using these materials, the teacher can objectively assess the student's mastery of the processes, skills, and subject matter of the ISCS program. And the teacher can obtain, at the moment when they are needed, specific suggestions for remedying the student's identified deficiencies.

If you are an ISCS teacher, selective use of these materials will guide you in developing an individualized evaluation program best suited to your own settings and thus further enhance the individualized character of your ISCS program.

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THE ISCS INDIVIDUALIZED TESTING SYSTEM

The ISCS individualized testing system for each level of ISCS is composed of four major subdivisions:

1. The ITP modules *Evaluating and Reporting Progress* and *Individualizing Objective Testing,*
2. *Performance Objectives,*
3. *Performance Checks* in three alternate forms, and
4. *Performance Assessment Resources.*

Evaluating and Reporting Progress presents a comprehensive overview, with many refinements, for individualizing the grading and reporting of students' progress, based on both subjective and objective criteria. The module *Individualizing Objective Testing* describes more specifically those ISCS evaluation materials which have objective criteria – the performance objectives, checks, and resources – and it presents practical suggestions for their use. These two modules should be considered prerequisite to successful use of the other ISCS evaluation materials.

Each of the *Performance Objectives* booklets contains a composite list of selected measurable objectives considered important to a given level of the ISCS program. However, many of the long-range goals and aims that are at the heart of the ISCS program do not lend themselves to being expressed as measurable performance objectives. Thus, these booklets should not be construed as being all-inclusive anthologies of all the possible learning outcomes of ISCS.

Each of three *Performance Checks* booklets contains an equivalent but alternative set of performance checks which were developed to assess the students' achievement of the objective stated in the *Performance Objectives* booklets.

The *Performance Assessment Resources* booklet is a teacher's handbook to be used in identifying the appropriate performance checks with which to evaluate each student. The booklet also indicates how to set up testing situations, correct responses, and give remedial help.

NOTES TO THE TEACHER

An overview of evaluation, including both objective and subjective criteria, is given in the module *Evaluating and Reporting Progress* and many aspects of this booklet are described in more detail in Chapter 3 of the module *Individualizing Objective Testing*. These notes are meant to augment, not replace, Chapter 3 of that module. As you use this booklet, you will begin to see ways to modify its suggestions to meet your needs better. You are encouraged to enter your modifications at the points at which they apply. Only by altering these materials will you evolve an evaluation system best suited to your own classroom environment. It is important to remember that only principles involved in objective criterion-referenced evaluation are applied in this booklet. Therefore, you will obviously want to incorporate subjective criteria also.

Texts, Units, and Chapters

There are four *Performance Assessment Resources* booklets for Level III of ISCS. Each of these booklets accompanies a pair of the student texts. The pairs of texts and their abbreviated symbols are as follows:

Environmental Science - Well-Being (ES-WB)
Why You're You - Investigating Variation (WYY-IV)
In Orbit - What's Up? (IO-WU)
Winds and Weather - Crusty Problems (WW-CP)

The testing materials for each text are divided into units, thus breaking up each Level III text into easily handled sections of correlative chapters and related excursions. The relationships between the units and the chapters of *In Orbit* and *What's Up?* are shown in Table 1.

TEXT	UNIT	CHAPTERS
IO	1	1 and 2
IO	2	3 and 4
IO	3	5 thru 7
WU	1	1 and 2
WU	2	3 and 4
WU	3	5 thru 7

Table 1

Most units include the objectives and performance checks for two chapters and their related excursions. You will recall that the number before the hyphen in the identification number for an excursion states the chapter to which it is related. The individual objectives and performance checks for each unit are to be selected and used when the student has completed the designated chapters and any excursions he wishes to do. This delay should ensure that there is no premature assessment of the student's achievement of concepts and skills which may be introduced early in a unit, but which require development throughout the unit. Thus, subdividing units for assessment purposes should be done with great care. Keep this in mind if you decide to spot check students as they proceed through units, rather than conducting a formal evaluation at the end of the unit.

Summary Table

Each unit begins with a double-spread "Performance Check Summary Table." The left-hand page of the "Summary Table" serves as a table of contents for the unit. It provides a great deal of information about the objectives pertinent to the unit. Usually about twenty-five objectives for each unit are introduced for the first time in each "Summary Table." A maximum of ten relevant objectives from previous units are reintroduced.

On the left-hand side of the "Summary Table" is a list of code numbers, each of which is unique to one objective within the level. Two examples of code numbers and their meaning are illustrated in Figure 1 below.

IO - 01 - Core - 17 and WU - 02 - Exc 4-2 - 2

IO	01	Core	17	WU	02	Exc	4-2	2
text	unit	based on core material	17th objective in unit	text	unit	based on excursion material	excursion number	2nd objective for excursion

Figure 1

The core objectives appear first in an order that corresponds roughly to the text development. Exceptions to this ordering were made to place objectives based on related processes or content together. Objectives based on remedial excursions are numbered as core objectives because they involve skills essential to success in core activities. Next are listed the general or enrichment excursion objectives, and these are followed by objectives from prior units which are again considered important to the students' progress. These repeated objectives are easily spotted, as a capital R (for Repeated) appears after their identifying code number, giving a listing such as IO-01-Core-17R. The specific resource aids to be used with repeated objectives are given in the units designated by the code number (unit 1 in the just-cited example), and the information is not repeated each time within the textual material that follows the "Summary Table."

Each objective code number is followed by a short descriptive statement of that objective. These short statements were written, using the students' vocabulary. They should be helpful in communicating the objectives to the students should you desire to do so. Ways to involve your students in selecting the objectives are discussed in the module *Individualizing Objective Testing.*

The right side of the "Summary Table" is made up of eleven columns. Letters are used in the first five to designate the characteristics of the performance check. The letters and their meanings are as follows:

M - Completing the check requires regular ISCS materials.
O - An observer should view the student's performance as he does the check.
P - Completing the check requires the use of specially prepared materials.
Q - The answer to the check is of the quick-scoring variety.
T - The check will require more than three minutes of the student's time.

Check marks in the next four columns help the teacher assign appropriate performance checks to individual students. The first of these columns is entitled "Basal." Achieving the objectives checked in this column is considered essential to the student's progress. These performance checks may be assigned to any student; however, better students will find that many of these offer little or no challenge.

Check marks in the columns headed "Math," "Reading," and "Concept" indicate performance checks which require a higher level of computational skills, a higher reading level, or a greater ability to think abstractly than the performance checks for most other objectives. Performance checks which have no marks in any of these four columns are considered to be more than basal, but the skills which they require are within the capabilities of most students.

A tenth column lists the action verb that identifies the theoretical mental process required of the student to complete the performance check for the objective. A precise definition of each of the verbs used to designate mental processes is given in the module *Individualizing Objective Testing.*

Finally, in the eleventh column, space is provided for notes. Although you will find an occasional comment printed here, this space is mainly for your notes. It's a good place to put any special instructions or preparations you have found helpful.

As mentioned earlier, some objectives are repeated objectives – ones that have appeared in previous units. When such an objective is listed again in the "Summary Table," its classification as basal or as presenting math, reading, or conceptual difficulties is likely to be different. This change most often derives from a change in purpose. The first time a concept or skill is introduced, the intent may be only to introduce students to it. When reintroduced in a later unit, the skill or concept is frequently developed and used extensively. Thus, in the "Summary Table" for the earlier unit, objectives related to a concept are likely to be classified as conceptually difficult for many students, whereas in the later units, the same objective might be reclassified as basal.

Organization of Resources

Immediately following each "Summary Table" comes the bulk of the resource material for each objective introduced in that unit. Once more, each objective is identified by its code number, but this time it appears in bold, black print in the outer margin directly beside the applicable resource. A pair of horizontal lines separates the resources for each objective from those for the previous and following objectives. When no horizontal line appears at the bottom of a page, the resource material for the objective is continued on the next page.

The functions of the various component resources provided for the objectives are listed below. Two of the components (Regular Supplies and Special Preparations) appear only when they are needed for a particular check. When the performance check does not require any supplies, the suppy headings are omitted. Observe the functional descriptions carefully – they are the keys to the types of resource materials provided in the *Performance Assessment Resources* booklet.

COMPONENTS	FUNCTION
Descriptive Statement	This statement duplicates the one that appears in the "Summary Table." If you misread a code number and find yourself looking at material for the wrong objective, this should stop you and send you back to the Table to check. More important, it should briefly indicate to you the basic purpose of the objective.
Objective	The underlined verb in this statement of the objective indicates the theoretical mental process that the student will perform. The phrase following it indicates the content or process skill which the student must perform. A complete description of the verbs and their meanings can be found in the ITP module *Individualizing Objective Testing.*
Regular Supplies	This section lists any ISCS equipment that the student will need -- regular equipment that is being used in the unit on which the student is being evaluated or in previous units.
Special Preparations	Don't overlook this section. It lists and describes materials the teacher must collect or prepare in some way. Included are special solutions, special packaging, and labels required for materials for evaluation purposes. The section also specifies particular grids, charts, or maps that the students will need to complete the check.

Student Action	This is a general description of what the student should do in responding to any of the three performance checks based on the objective. If his expected response is to state a general principle, it is listed in this section. If the three performance checks require specific answers, they are provided below the general statement in the student action.
Performance Check A	Performance Check A is fully stated to allow for a quick review of the statement of the tasks as they are presented to the student. Performance Checks B and C generally present slightly different situations or wording but ask students to perform equivalent tasks.
Remediation	This final section outlines suggested action that can be taken if the student fails to achieve the objective. In some of the remediations, the listed steps are sequential; in others the steps represent options from which it is suggested that you select one or two. Some remediations suggest referring the student to review sections of the core, doing an excursion, or reviewing a self-evaluation question and its response.

How To Find It

Locating a particular objective whose number you know is easy. Just thumb through the pages watching for the unit number which appears in large black print above the word *core* or *excursion* in the margins. But suppose you wish to locate an objective pertinent to a given section or chapter of the text and you don't know the number. Here is a procedure to follow:

1. Determine the unit in which the chapter occurs, using Table 1.
2. Thumb through this booklet until you find that unit number as the beginning digits of any code number appearing in large black print in the outer margin.
3. Look for the "Summary Table" at the beginning of that unit.
4. Use the "Summary Table" to determine the number of the objective you seek.

Be Selective

The resource books for each level contain many more objectives and resources than any one teacher can use. If you add objectives and resources, and you probably will, your list will expand further. The most successful user of this catalog will be the teacher who picks and chooses selectively to meet the specific needs of his students. Therefore, once you are familiar with this book, it is imperative that you establish a system of selecting and assigning checks to the student. Suggestions on how to establish this are given in Chapter 3 of *Individualizing Objective Testing.*

Whatever selection and assignment system you develop, it must give due regard to the individual student's differences. For example, if you administer too many recall performance checks to a high-ability student, he will not only be bored but you will also fail to assess his progress adequately. Too many difficult items administered to a low-ability student leads to frustration and reinforcement of the "I knew I couldn't do it" attitude. On the other hand, even the best students need their egos inflated by some questions that they can answer easily. And, the less able student needs to be appropriately challenged. Be careful, too, of placing too much emphasis on objectives. This may lead students to place undue emphasis on tests, thus slowing their progress to the extent that they lose interest in the story line.

Assigning Performance Checks

How many performance checks should be assigned to a student? This question has no fixed answer. The primary concern is that performance checks provide the needed feedback to both you and the student. If, in your judgment, evaluating a student on a particular unit is unnecessary, then don't do it. If you feel a student needs to be evaluated, then assign an appropriate selection of performance checks. *Individualizing Objective Testing* makes suggestions about how to do this. In no case should any student be assigned all the performance checks or even a random sampling of them. Such a practice would subject the student to tasks which would be either unduly difficult and time-consuming or perhaps too simple for him and therefore meaningless, time-wasting activities.

You may wish to specify the equivalent form (A, B, or C) of performance checks that the student should do when assigning the specific performance check numbers. There is, of course, no difference in their difficulty level. In any case, have the student record both the number and the letter of the specific performance check he does. These numbers and letters should appear on his answer sheet, as they will be needed to check his response. Since the numbers are unique within each ISCS level, there is no need to use a student's time copying the performance checks. Listing the number with the response is sufficient. It's a good idea to remind students frequently that their answers must go on separate paper – not in the *Performance Checks* books.

As you assign checks, keep the supply situation in mind. You won't want too much of some equipment tied up in Special Preparations at any one time. To avoid this, keep abreast of the range of your students' progress and prepare only those materials you anticipate needing, referring to the P's appearing in the third column on the right-hand page of the "Summary Table." Batteries, of course, will need replacement or recharging occasionally, and specially boxed supplies should be checked periodically for missing or nonfunctioning parts.

At the back of the *Performance Assessment Resources*, you will find grids, charts, and maps identical to those the students must use in certain performance checks. The grids, charts, and maps at the back are suitable for reproduction. You may make copies directly, using one of the well-known commercial copiers. For large quantities at low cost, make a master by the thermo process and use it to make duplicates. If you make copies in either of these ways, your students will not be wasting time drawing grids, charts, and maps, and you will feel free to assign objectives that need these.

In Orbit 10

ERIC

Chapters 1 and 2

Excursions 1-1 and 2-1

Performance Check

Summary Table

Objective Number	Objective Description
10-01-Core-1	Observes a spectrum
10-01-Core-2	Observes the spectrum of a light source
10-01-Core-3	Defines the term *spectroscope*
10-01-Core-4	States the purpose of a diffraction grating
10-01-Core-5	Defines the term *spectrum*
10-01-Core-6	Matches spectral types with light sources
10-01-Core-7	Uses the known spectra of elements to identify them
10-01-Core-8	Describes the procedure for determining unknown salts, using a new fuel
10-01-Core-9	States the purpose of observing the spectrum of the alcohol flame by itself
10-01-Core-10	Suggest ways of changing the heating effect of a light bulb
10-01-Core-11	Lists the variables that affect an object's temperature change
10-01-Core-12	Predicts the surface that absorbs heat more readily
10-01-Core-13	Explains the blackening of the copper vane on the sun-energy measurer
10-01-Core-14	Explains why only one variable is changed at a time
10-01-Core-15	Predicts the temperature change of a sun-energy measurer from a graph
10-01-Core-16	Graphs data
10-01-Core-17	Explains why low wattage bulbs must be used in some lamps
10-01-Core-18	Reads the second coordinate of a pair from a graph

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
	M	O			T	√				manipulates	
	M				T	√				manipulates	
						√				recalls	
										recalls	
						√				recalls	
				Q						recalls	
				Q						applies	
								√	√	applies	
						√				applies	
						√				applies	
						√				recalls	
						√				applies	
										recalls	
						√				applies	
				Q		√				applies	
			P		T	√				applies	
										applies	
				Q		√				applies	

Objective Number	Objective Description
10-01-Core-19	Selects the wattage of a light bulb needed to get the same heat at increased distance
10-01-Core-20	Selects a graph of time vs temperature change for a sun-energy measurer
10-01-Core-21	Matches temperature change vs time graphs with wattages
10-01-Core-22	Reads the total temperature change from graphed data
10-01-Core-23	Selects a graph showing how temperature change varies with the distance from a
	light source
10-01-Core-24	Cleans up the work area at the close of class
10-01-Core-25	Cooperates with lab partners
10-01-Core-26	Returns equipment promptly to storage areas
10-01-Core-27	Responds to text questions
10-01-Core-28	Shows care for laboratory materials
10-01-Exc 1-1-1	Draws Fraunhofer lines
10-01-Exc 2-1-1	Describes what happens to energy as a battery-operated device is used.
10-01-Exc 2-1-2	States how work is calculated
10-01-Exc 2-1-3	Defines *conservation of energy*
10-01-Exc 2-1-4	Lists forms of energy

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs[a]	Notes
				Q						applies	
				Q					√	applies	
				Q		√				applies	
				Q		√				applies	
				Q		√				applies	
		O				√				chooses	
		O				√				chooses	
		O				√				chooses	
		O				√				chooses	
		O				√				chooses	
				Q						applies	
										generates	
						√				recalls	
						√				recalls	
				Q		√				recalls	

10 01 Core 1

Observes a spectrum.

The student manipulates the spectroscope safely to observe a spectrum on a sheet of white paper.

Regular Supplies: 1 ISCS spectroscope
1 150-watt bulb and receptacle
1 sheet of white paper

Student Action: Observing the spectrum of the 150-watt bulb on a sheet of white paper according to proper procedure for observing a spectrum.

Performance Check A: Before you begin, tell your teacher that you are going to do this check.

Get a spectroscope, a sheet of white paper, and a 150-watt bulb and receptacle. Pretend that the 150-watt bulb is the sun. Observe the spectrum through your left eye and then through your right eye. Does the spectrum look the same or different through each of your eyes?

Remediation: (1) Refer the student to the "Safety Note" on page 3. (2) Have him redo Activity 1-1, which shows the safe way to view the spectrum of the sun.

10 01 Core 2

Observes the spectrum of a light source.

The student manipulates an ISCS spectroscope to view a spectrum.

Regular Supplies: 1 150-watt bulb and socket
1 100-watt bulb and socket
1 ISCS spectroscope

Student Action: Using the spectroscope and stating the color of that area of the spectrum asked for.

A: 1. red (orange), 2. green
B: 1. yellow, 2. blue (purple)
C: 1. blue (purple), 2. yellow

Performance Check A: Get a 150-watt light bulb and socket, and assemble them. Use an ISCS spectroscope to observe the spectrum of the light source. Look at the spectrum on the left side of the spectroscope.

1. State the color to the left of the yellow area of the left spectrum.
2. State the color to the right of the yellow area of the left spectrum.

Remediation: (1) To be sure the student can find and see a spectrum, have him view a light source. Be sure he is looking at a side of the tube and not through the slit at the end. Then ask him to tell you the colors in order of either the left or the right spectrum, starting from the center of the tube. (2) Have him do an alternate performance check.

Defines the term *spectroscope*.

The student recalls the definition of *spectroscope*.

Student Action: Stating, in effect, that a spectroscope is a device which spreads light into its component colors as the light passes through it.

Performance Check A: State a definition of the term *spectroscope*.

Remediation: Review the student's answer to question 1-1 on page 3. Ask him what it was that spread out the colors.

10 01 Core 3

States the purpose of a diffraction grating.

The student recalls what the diffraction grating in the spectroscope does to sunlight.

Student Action: Responding to the effect that a diffraction grating causes sunlight to spread out into a color spectrum.

Performance Check A: Describe what a diffraction grating in a spectroscope does to sunlight.

Remediation: (1) Have the student redo Activities 1-1 through 1-3. (2) Have him review his response to question 1-3 and reread the paragraph following that question.

10 01 Core 4

Defines the term *spectrum*.

The student recalls the definition of *spectrum*.

Student Action: Stating, in effect, that a spectrum is a band of colors which is formed when light is broken up by a spectroscope, a prism, droplets of water, or another diffraction mechanism.

Performance Check A: What is a spectrum?

Remediation: (1) Refer the student to the photograph and text on page 2. (2) Refer him to Figure 1-1 on page 4. (3) Refer him to Figure 1-5 on page 9.

10 01 Core 5

Matches spectral types with light sources.

The student recalls the type of spectrum or spectra formed by each of several types of light sources.

10 01

Core 6

Student Action: Matching the spectrum produced by an incandescent light with a continuous spectrum, the spectrum produced by a heated element with a line spectrum, and the spectra produced by a fluorescent light with both line and continuous spectra.

A: 1. c, 2. b, 3. a
B: 1. b, 2. c, 3. a
C: 1. a, 2. b, 3. c

Performance Check A: After the number of each light source below, write the letter of the best description of the spectrum or spectra produced by light from that source.

Light Source	Description
1. Fluorescent lamp	a. Only a continuous spectrum
2. Crystals containing the element Li (lithium) heated in a flame	b. Only a line spectrum
3. Light bulb	c. Both line and continuous spectra
	d. Neither a line nor a continuous spectrum

Remediation: (1) Have the student review Activities 1-1 through 1-7 and then try to answer the check again. (2) Review the student's answers to Self-Evaluations 1-4, 1-5, and 1-6 with him.

10 01 Core 7

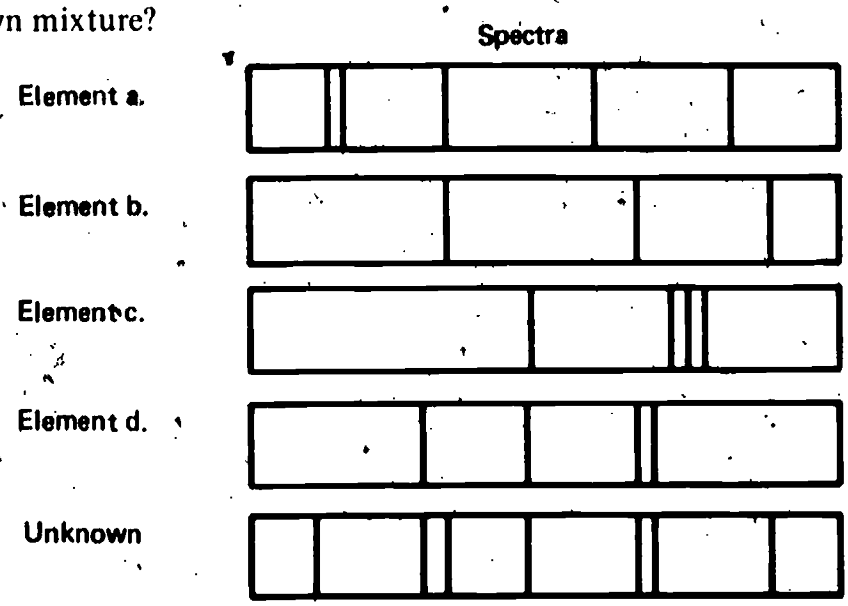
Uses the known spectra of elements to identify them.

The student applies the concept that the lines in a line spectrum can be used to predict the presence of definite elements in an unknown substance.

Student Action: Naming the elements in the unknown mixture.

A: Elements b and d
B: Elements a and c
C: Elements a and d

Performance Check A: Each of the first four spectra below was obtained by heating crystals containing one of four elements. The last spectrum was obtained by heating a solution containing two or more of these elements. Which elements (a, b, c, d) are in the unknown mixture?



Remediation: (1) Review the student's answer to question 1-12 on page 8. (2) Review his answer to Self-Evaluation 1-5.

Describes the procedure for determining unknown salts, using a new fuel.

10 01 Core 8

The student applies the concept that a control sample establishes data on the sample which is not subjected to the experimental variable.

Student Action: Stating a procedure that includes viewing the spectrum of the flame itself as a step in the procedure of determining the spectra of unknown mixtures of salts.

Performance Check A: Suppose that you ran out of burner fuel just after you had viewed the line spectra of solutions of several salts. And then your teacher gave you an unknown mixture of these salts in solution and substituted a different type of burner fuel. Describe the steps you would perform to identify any salts present in your unknown salt solution.

Remediation: (1) Have the student review Activity 1-5 on page 6. (2) Ask him how he would have to modify his solution to Problem Break 1-1 on page 8 if the teacher substituted a new burner fuel before he began the experiment.

States the purpose of observing the spectrum of the alcohol flame by itself.

10 01 Core 9

The student applies the concept of the need for a control.

Student Action: Stating, in effect, that the control is needed to establish that some of the spectral lines observed are caused by the crystals in the flame and not by the flame itself.

Performance Check A: You observed the spectrum of the alcohol flame alone before you put the crystals of several chemicals into the burner flame to observe their spectra. Explain why this extra step was necessary.

Remediation: (1) Have the student review the procedures in Activities 1-5 through 1-9. (2) Ask him how he knows that the lines observed in Activities 1-7 through 1-9 were not lines produced by the alcohol flame which have just shifted and are colored differently by the presence of the different kinds of crystals.

Suggests ways of changing the heating effect of a light bulb.

10 01 Core

The student applies the concept that the heating effect of a radiant energy source of fixed size can be varied.

Student Action: Stating solutions that involve two of the following: (1) changing the distance between the source and the heated object, (2) changing the absorbing surface, and (3) changing the heating time.

10

Performance Check A: Maria works as a waitress in a restaurant. Some customers have been complaining that their food is cold when they get it. The waitresses pick up the food on trays with silver-colored lids from a warming oven. The problem seems to be that the heating lamps in the warming oven are not heating the food enough. Maria's boss has decided to buy larger light bulbs so that the food will be warmer. Suggest two ways that he could increase the heating effect of the lamps without buying larger bulbs.

Remediation: (1) Check the student's answer to Self-Evaluation 2-2. If necessary, have him review the suggested answers, particularly parts B and C. (2) Check his answers to questions 2-12 through 2-15. Have him review those variables he had to change and those he had to keep constant in order to avoid confusion about which variables were responsible for the heating effects. (3) Suggest that he redo the check.

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11

Lists the variables that affect an object's temperature change.

The student recalls the variables that determine the amount by which the temperature of an object increases when it is placed in direct sunlight.

Student Action: Stating at least three of the following four variables or factors which determine them: (1) how large the object is, (2) how well it absorbs heat, (3) how quickly it conducts heat, and (4) how long it is heated.

Performance Check A: When an object is placed in direct sunlight, it warms up. What are four variables that affect how much its temperature increases?

Remediation: (1) Have the student review the first paragraph on page 13. (2) Ask him which of the variables is affected by Activity 2-5. (3) Have him review and, if necessary, correct Self-Evaluation 2-2.

10
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12

Predicts the surface that absorbs heat more readily.

The student applies the concept that darker surfaces absorb radiant energy more readily than light surfaces.

Student Action: Predicting, in effect, that objects with dark surfaces will be hotter because the dark surface is a better absorber of radiant energy.

A: The house with the black roof
B: The man in the dark blue suit
C: The block with the black cloth

Performance Check A: Suppose two houses are identical except that one has a white roof and the other has a black roof.

1. If you measured the temperature of the air in the attic of each house on a bright summer day, which would be hotter?
2. Explain your answer.

Remediation: (1) Review the student's answer to Self-Evaluation 2-1. (2) Review his answer to question 2-4 on page 14 of the text. (3) Have the student review the two paragraphs above question 2-4 on page 14.

---

10 01 Core 13

Explains the blackening of the copper vane on the sun-energy measurer.

The student recalls that a blackened copper surface absorbs and converts radiant energy more readily than a light-colored or shiny surface.

Student Action: Responding to the effect that blackening a copper surface increases the amount of light energy which the copper absorbs and converts into heat.

Performance Check A: When you built your sun-energy measurer, you blackened the copper strip. Explain why that was necessary.

Remediation: (1) Review the student's answer to Self-Evaluation 2-1. (2) Review his answer to question 2-4 on page 14. (3) Have him review the two paragraphs preceding questions 2-4 on page 14.

---

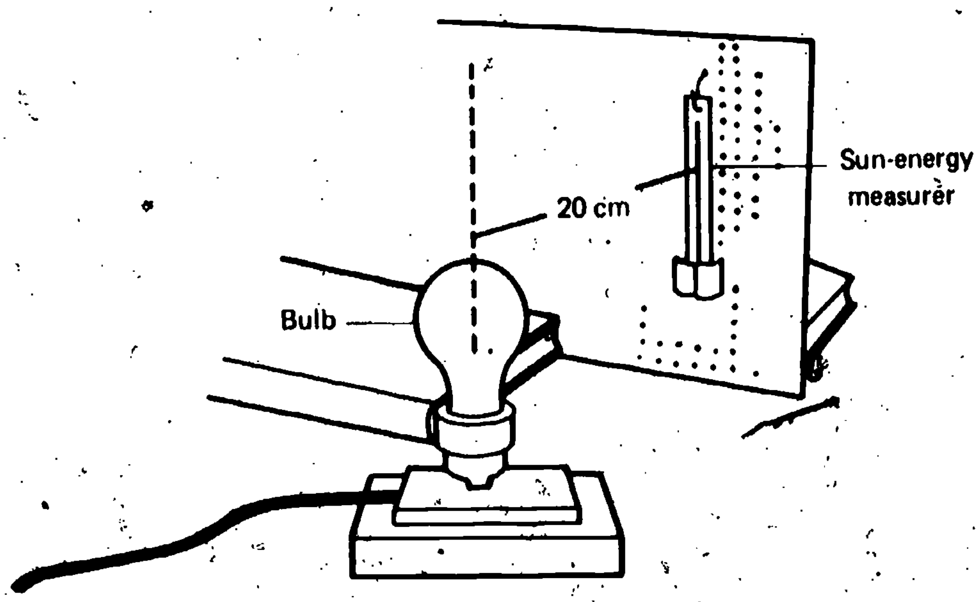
10 01 Core 14

Explains why only one variable is changed at a time.

The student applies the concept that only one experimental variable is changed at a time.

Student Action: Responding with the essence of the concept that only one experimental variable is changed at a time so that the effect of the variable is not confused with the effects of other variables.

Performance Check A: You measured the effect of different wattages of light bulbs on the temperature change of your sun-energy measurer, as shown below. When you did this, you were told to keep the distance between the light sources and the energy measurer the same at all times. You were also told to make sure the amount of time that each bulb shone on the measurer was the same. Why was it important to keep the variables time and distance constant?



Remediation: (1) Review the student's answer to question 2-16 on page 19. (2) If Level II materials are available, have the student review Excursion 4-1, "Controlled Variables and Experimental Variables," on pages 381 through 390.

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10 01 Core 15

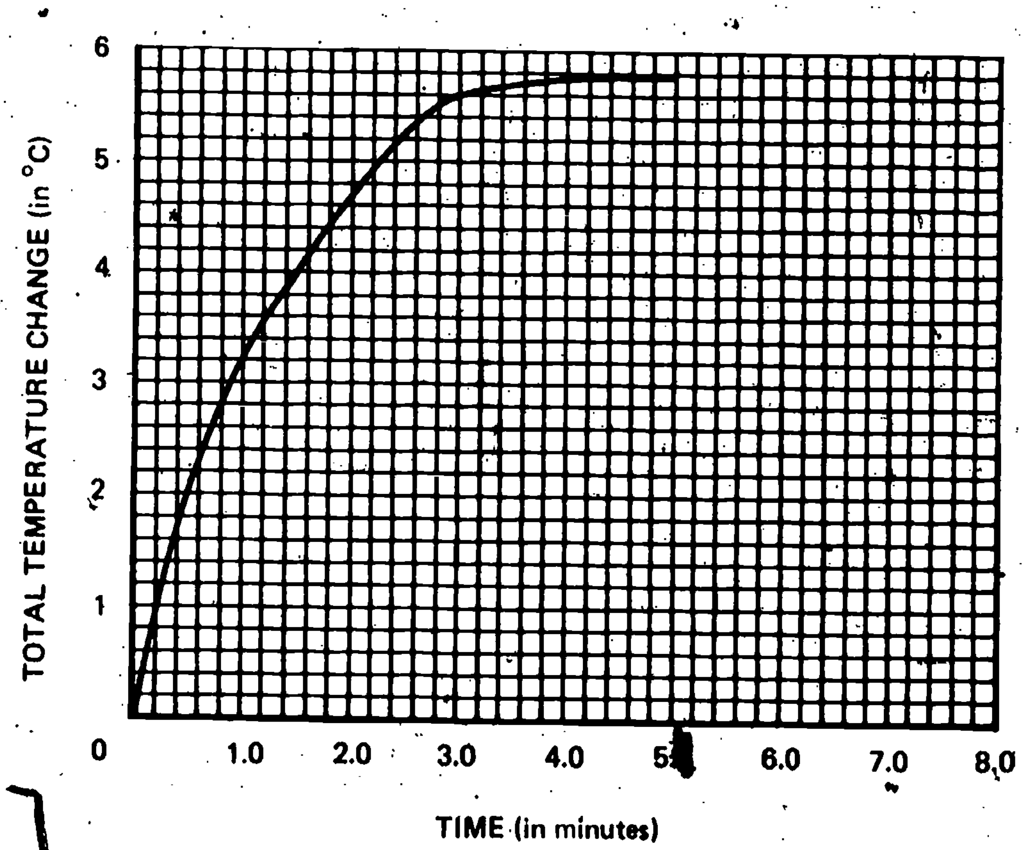
Predicts the temperature change of a sun-energy measurer from a graph.

The student applies the rule for extrapolating from a graph.

Student Action: Stating the same temperature change as that last recorded on the graph.

A, B, and C: 5.8 ±0.2°C

Performance Check A: Frank set up his sun-energy measurer near a 100-watt bulb and measured the temperature change for 5 minutes. He left the apparatus set up with the light bulb on while he drew the following graph of his data. What do you predict will be the total temperature change of his sun-energy measurer 8 minutes after he started collecting his data?



Remediation: (1) Check the student's answer to Self-Evaluation 2-6, and have him explain it. (2) Have him review his answer in Table 2-1, page 16, and the graph made from it. (3) Have him redo the check.

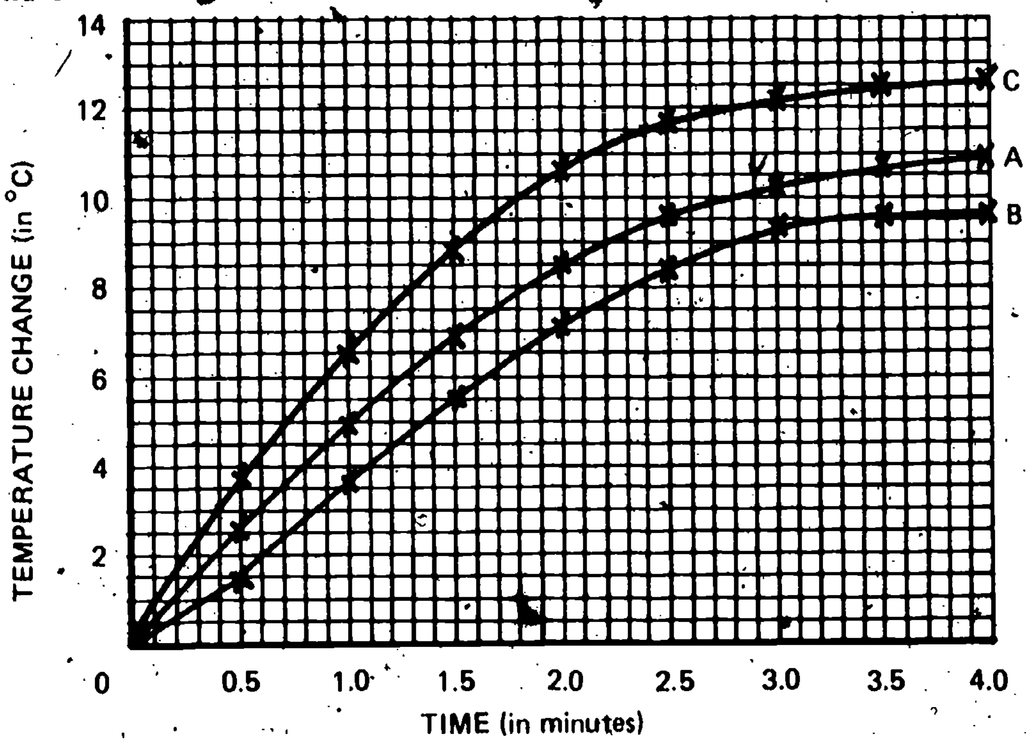
Graphs data.

The student applies the procedure for graphing data.

Special Preparations: Prepare a labeled grid or duplicate the appropriate labeled grid from the end of this *Performance Assessment Resources.*

Student Action: Constructing a graph so that the points are accurate to within ±1 grid division and the line of best fit is a smooth curve.

A, B, and C:

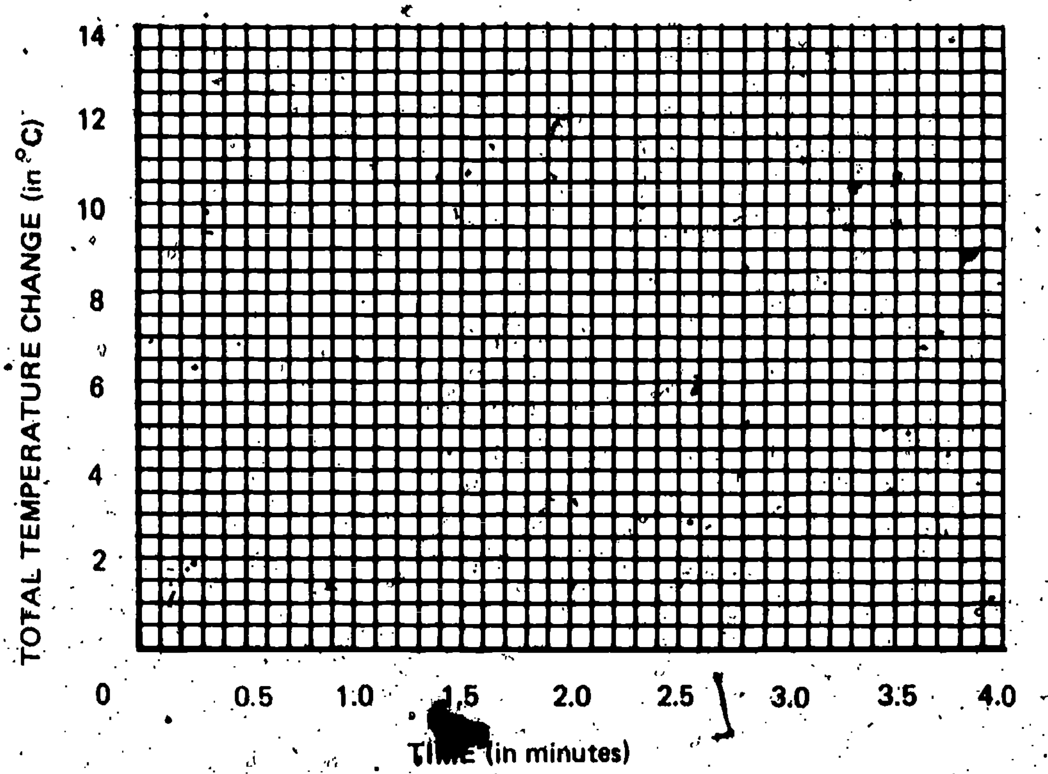


Performance Check A: Before you begin this check ask your teacher for graph paper or a labeled grid like the one shown below.

Henry placed his sun-energy measurer near a light source and recorded its temperature every 30 seconds. His data are shown below.

TIME (in min)	TEMPERATURE (in °C)	TOTAL TEMP. CHANGE (in °C)
0.0	20.4	0.0
0.5	22.8	2.4
1.0	25.5	5.1
1.5	27.6	7.2
2.0	28.8	8.4
2.5	30.0	9.6
3.0	30.7	10.3
3.5	31.0	10.6
4.0	31.1	10.7

Graph Henry's measurements of the temperature change and the time on the grid.



Remediation: (1) Review the student's graph in Figure 2-2 in his *Record Book*. (2) If Level II materials are avialable, have the student review Excursion 7-1, Part B, pages 428 through 434.

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10 01 Core 17

Explains why low wattage bulbs must be used in some lamps.

The student applies the concept that the higher the wattage of a bulb, the greater the amount of heat it generates.

Student Action: Responding to the effect that bulbs of higher wattage generate more heat than do bulbs of low wattage and thereby would damage devices or surrounding materials not designed to withstand higher temperatures.

Performance Check A: Jason bought a new reading lamp with a plastic shade. When he got it home, he noticed a sticker on it that read, "WARNING: BULBS OF MORE THAN 40 WATTS ARE NOT TO BE USED IN THIS LAMP." He wondered why he shouldn't use a bulb of more than 40 watts, since the wiring was the same as on the other lamps in the house.

1. Explain why the warning sticker is on the lamp.
2. Predict what might happen if Jason used a 100-watt bulb in this lamp.

Remediation: (1) Review the student's answer to question 2-13 on page 19 of the text. (2) Then refer the student to the paragraph below Table 2-2 on page 18. (3) Relate that information to heat energy if he still needs assistance.

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18

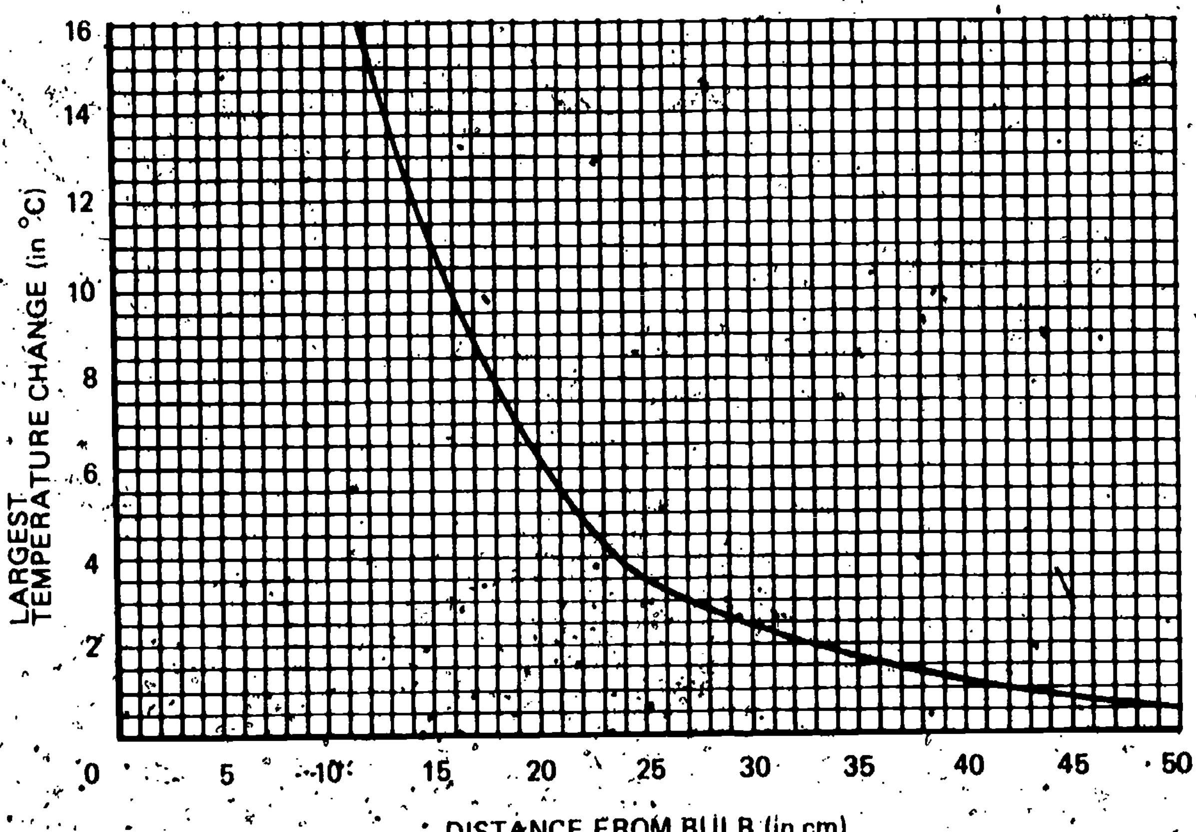
Reads the second coordinate of a pair from a graph.

The student applies the concept that a sun-energy measurer receives the same amount of energy from two sources when the temperature changes produced by the two sources are equal.

Student Action: Stating the distance within ±0.5 cm of the point where the bulb causes the same temperature change as the sun does.

A: 14 ±0.5 cm
B: 18 ±0.5 cm
C: 16 ±0.5 cm

Performance Check A: Maria put a sun-energy measurer in direct sunlight. She found that the largest temperature change of her sun-energy measurer was 12.5°C. She then measured the largest temperature changes of her measurer at different distances from a 150-watt bulb. She used her data to plot the graph shown below.



At what distance from the 150-watt bulb did her sun-energy measurer receive the same amount of energy as it did from the sun when it was placed in direct sunlight?

Remediation: (1) Refer the student to Activity 2-11 on page 19. (2) Review his answers to questions 2-17 and 2-18 on page 20. (3) If necessary, review with the student the graph he drew for Problem Break 2-1 on page 7 of the *Record Book*.

10 01 Core 19

Selects the wattage of a light bulb needed to get the same heat at increased distance.

The student applies the concept that in order for the heating effect of a light source to remain constant, the wattage of the source must increase at a rate greater than twice the rate of increase in distance from the source.

Student Action: Selecting the wattage that is more than twice the smaller source cited.

A: c
B: e
C: a

Performance Check A: Chris built a small chicken brooder to keep some baby chicks warm. It used a 25-watt bulb to produce enough heat to keep the chicks warm. He is planning to build a larger brooder to raise more chickens. In the new brooder, the bulb will be twice as far away from the baby chicks. Select the wattage of the light bulb he should use in order to produce nearly the same heating effect as in the smaller brooder.

a. 10 watts
b. 25 watts
c. 100 watts
d. 12½ watts
e. 50 watts

Remediation: (1) Review with the student both Activity 2-13 and his answers to questions 2-21 and 2-22. (2) Check his responses to Self-Evaluations 2-4 and 2-5. Help him if he has either of them wrong. When he understands each of these separately, use them to illustrate the concept tested in the performance checks.

10 01 Core 20

Selects a graph of time vs temperature change for a sun-energy measurer.

The student applies the fact that when a sun-energy measurer is placed in direct light, its temperature rises rapidly at first, then more slowly, and finally reaches a constant level.

Student Action: Selecting the curve that rises rapidly at first but whose rate of increase slows down gradually until it reaches some maximum temperature.

A: a
B: d
C: c

Performance Check A: Ashly read the temperature of her sun-energy measurer in the shade. Then she put the measurer in direct sunlight. Every 30 seconds she read the temperature. Later she drew a graph showing the temperature rise of her sun-energy measurer. Which of the graphs below best shows what her graph would look like?

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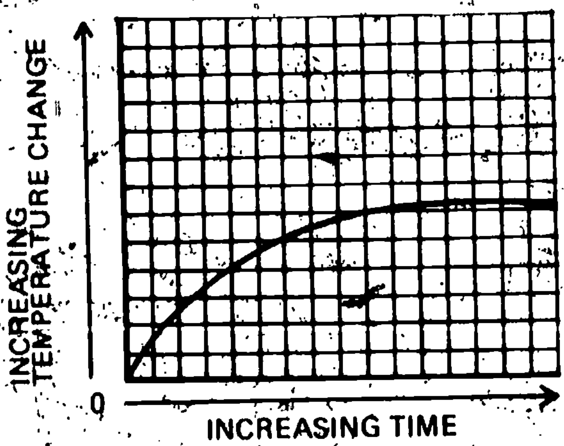
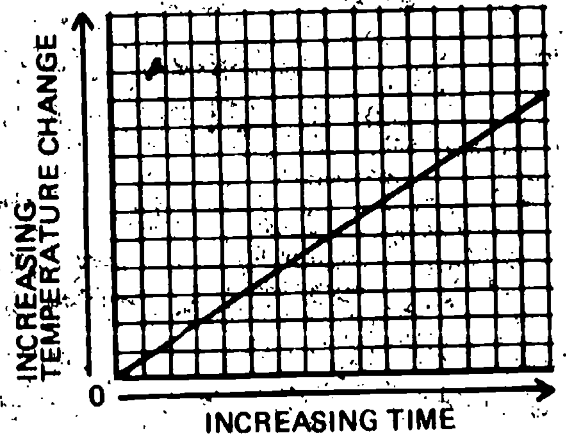
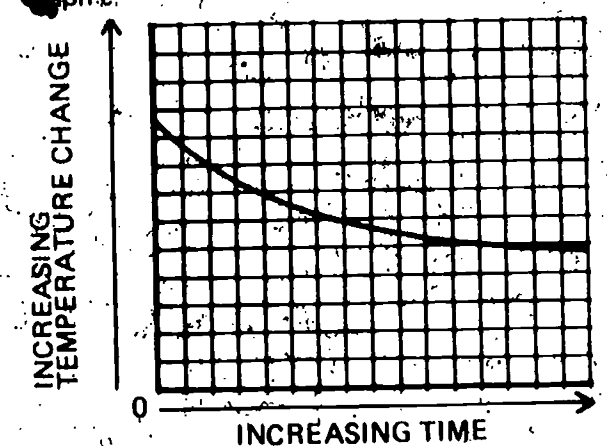
Graph a.



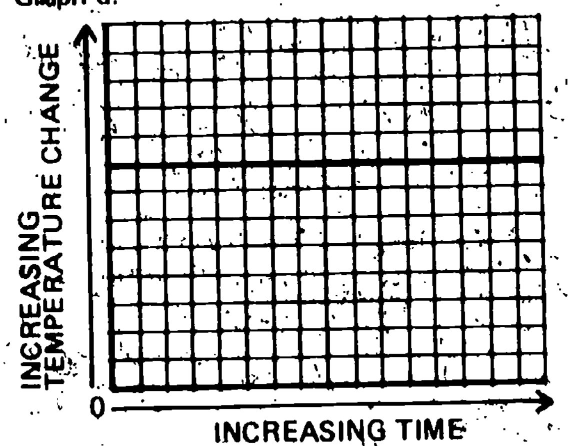
Graph b.



Graph c.



Graph d.



Remediation: (1) Review the student's graph on Figure 2-1 of his *Record Book.* (2) If necessary, review his completion of Table 2-1 in his *Record Book.*

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10 01 Core

Matches temperature change vs time graphs with wattages.

The student applies the concept that when energy sources of different wattage are placed at the same distance from an object, the object's temperature change will vary with the wattage of the energy source.

Student Action: Matching each graph with the correct bulb so that the largest bulb is matched with the greatest temperature change, and so forth.

A: 1. c, 2. d, 3. a, 4. b
B: 1. d, 2. c, 3. b, 4. a
C: 1. a, 2. d, 3. c, 4. b

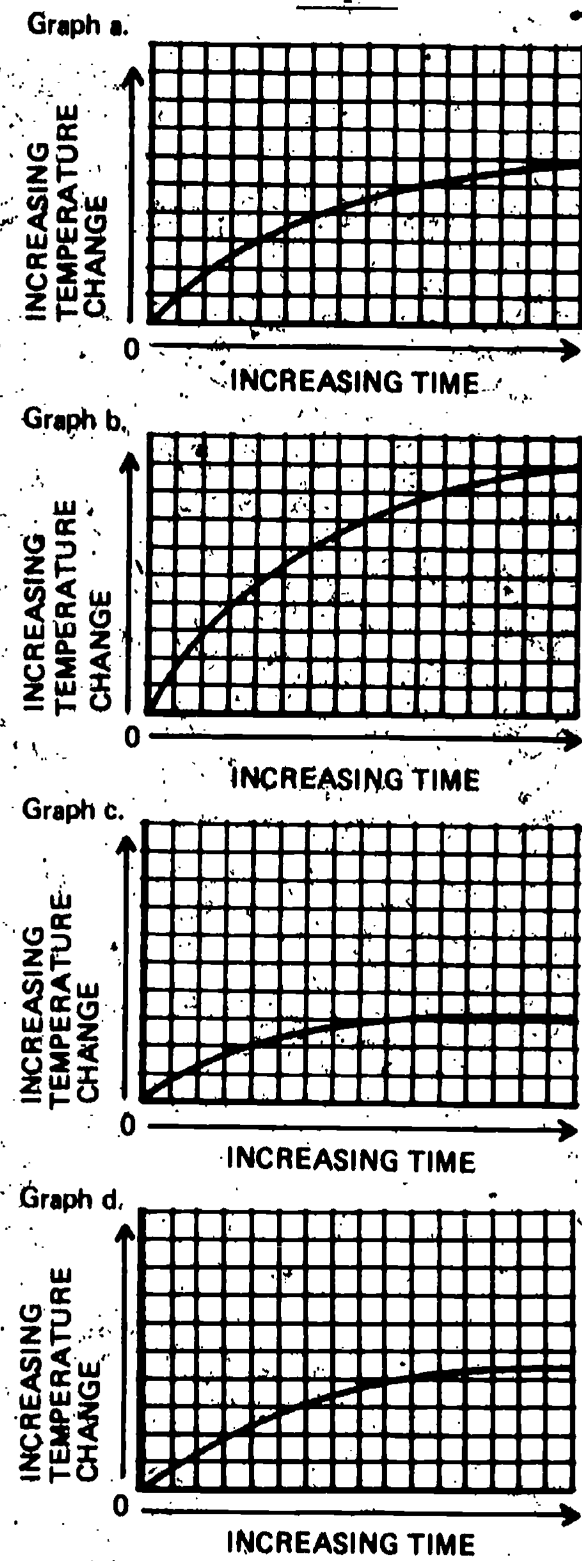
21

Performance Check A: Martha measured the temperature changes in her sun-energy measurer when she placed it 20 cm from a 50-watt light bulb. She then changed to a 75-watt bulb and measured the temperature changes again. She also made measurements for 100-watt and 150-watt bulbs. On your answer sheet, match the letters of the graphs she drew with the numbers of the light bulbs she used.

Bulbs

1. 50 watt
2. 75 watt
3. 100 watt
4. 150 watt

Graphs



Remediation: (1) Review the student's answer to question 2-12 on page 18. (2) Then review his answer to question 2-13 on page 19.

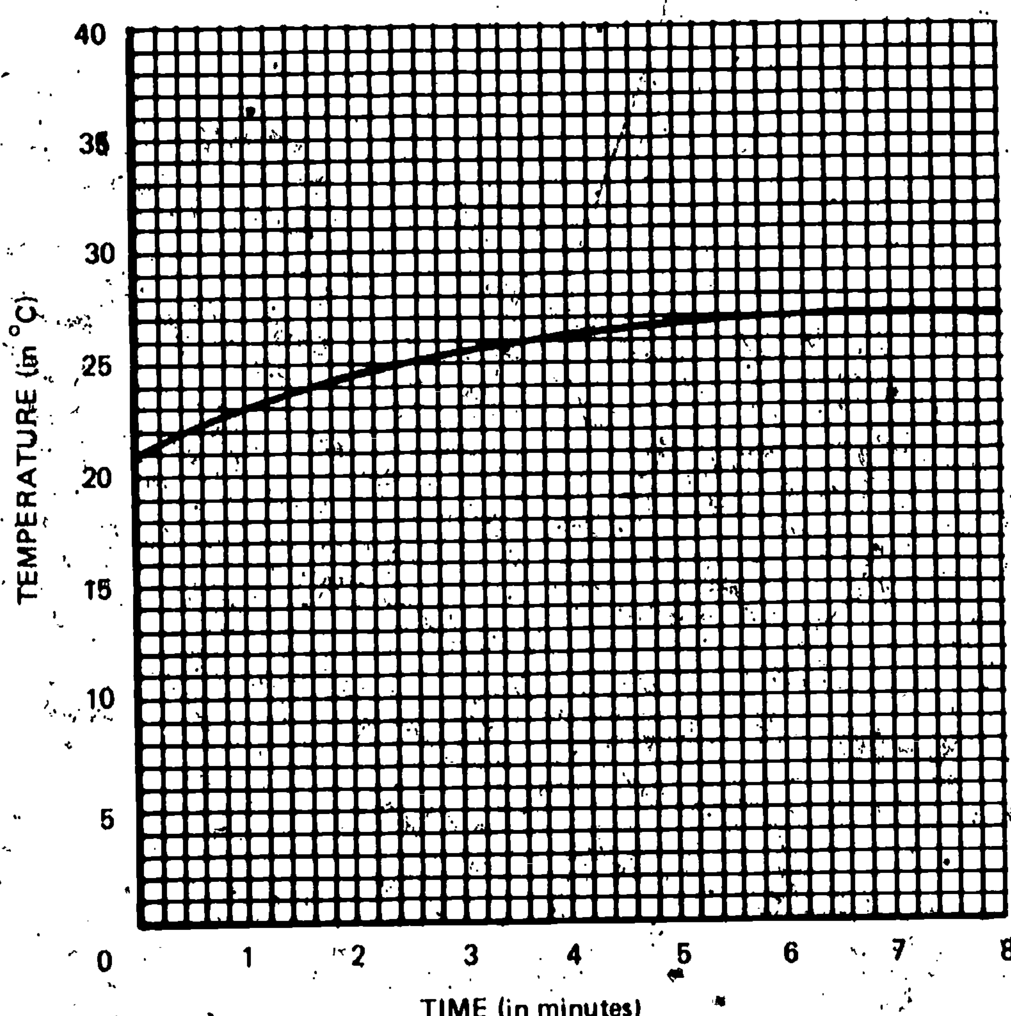
Reads the total temperature change from graphed data.

The student applies the concept of reading the total variable change from a graph.

Student Action: Stating the total temperature rise as the arithmetic difference between the starting temperature (at the zero point of the time axis) and the final temperature (after the graph flattens out) correctly within ±0.5°C.

A: 6.0 ±0.5°C
B: 9.0 ±0.5°C
C: 6.0 ±0.5°C

Performance Check A: Terry put his sun-energy measurer 30 cm from a light bulb and read its temperature. He then read it every 30 seconds. He plotted his temperature data on the graph shown below.



What was the total temperature change of Terry's sun-energy measurer?

Remediation: (1) Check the student's answer to Self-Evaluation 2-6. Special attention should be given to the transition from the table to the graph and how it was made. (2) Check his answer to question 2-9 on page 17. (3) Review Figure 2-1 with the student if necessary and suggest that he do an alternate check.

10 01 Core 23

Selects a graph showing how temperature change varies with the distance from a light source.

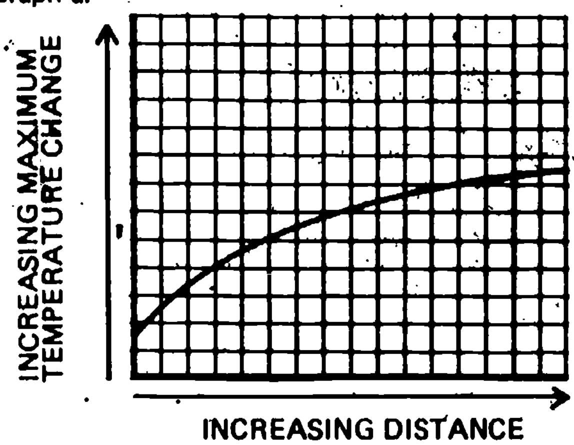
The student applies the concept that the temperature change produced in an object decreases as its distance from a radiant energy source increases.

Student Action: Selecting the graph that shows a decrease in temperature change as the distance from the light source increases.

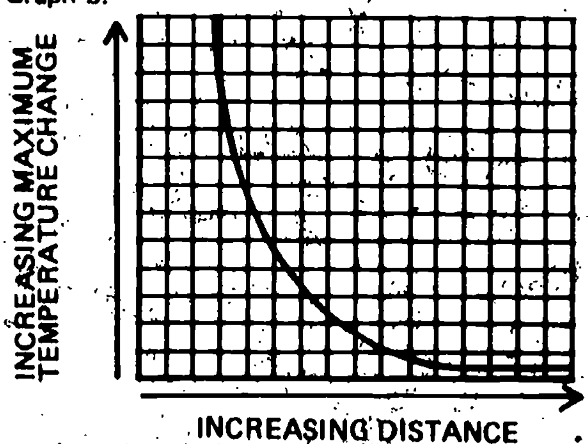
A: Graph b
B: Graph c
C: Graph d

Performance Check A: Select the graph that best shows how the temperature change of a sun-energy measurer varies as you increase its distance from the light source.

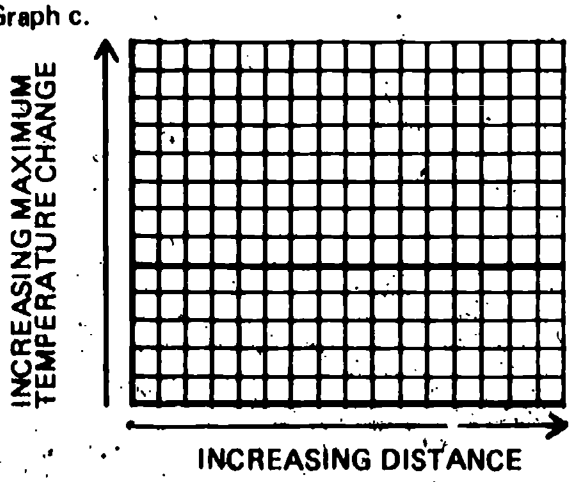
Graph a.



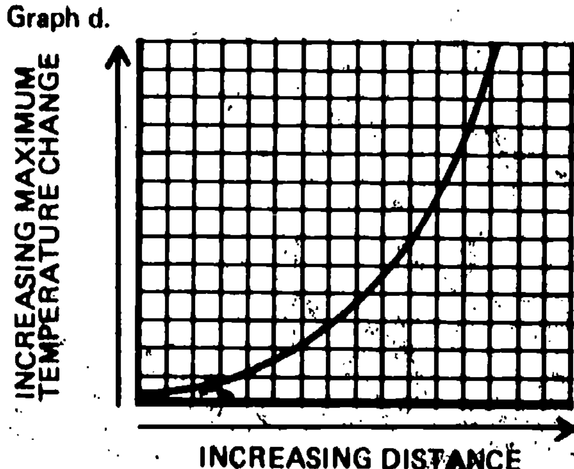
Graph b.



Graph c.



Graph d.



Remediation: (1) Review the data collected by the student in Problem Break 2-1. (2) Review the student's response to Self-Evaluation 2-6B.

Cleans up the work area at the close of class.

10 01 Core 24

The student chooses to close the laboratory activity period promptly upon receiving notification of the time to do so.

Student Action: Ceasing the ongoing laboratory activity when notified of the time, returning materials in usable, clean condition to storage, and participating in work area cleanup, on at least three separate occasions when being observed by the teacher or another designated person without his knowledge.

Teacher's Note: The opportunity for assessment of this objective arises almost every day during the course of regularly assigned laboratory activities. Use a few minutes of class time for group instruction early in the school year, and almost every week for reinforcement, to discuss the role of the student in the ISCS learning environment. To encourage personal responsibility in the student, discuss the reasons for his closing his activities promptly (to allow time for himself and others for lab-closing acitivites), returning materials to storage in clean condition (to facilitate their use by others), and participating in area cleanups (to leave the area as clean as he found it).

Performance Check A: Your teacher will observe you for this check when he can.

Remediation: (1) If a student fails to accept this responsibility, approach him individually and review the reasons for his acceptance of it. Emphasize the social responsibility for cooperation in the learning environment for the good of all students. Point out that he has received the benefit of other students' provisions for others as well as for themselves. (2) Do not, at first, suggest that he may lose his privileges unless he cooperates. But if he doesn't cooperate after you observe his behavior several times, ask him if he can suggest a proper penalty. (3) An alternate remedy may be to request him to assist in the process of overall classroom accounting of the materials for a period of time until he recognizes the importance of the student's role. (4) Do not use extra cleanup as a penalty for not cleaning up properly. In other words, don't use something as a penalty that you want done willingly.

Cooperates with lab partners.

10 01 Core

The student chooses to cooperate wih fellow students in the laboratory.

Student Action: Being polite, waiting his turn, being orderly when moving about, and observing the right of his classmates to work without being unnecessarily disturbed, when observed without his knowledge by the teacher or another designated person on at least three occasions.

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Teacher's Note: The opportunity for assessment of this objective arises almost every day during the course of regularly assigned laboratory activities. Use a few minutes of class time at the beginning of a session for a whole-group discussion early in the school year and several times later on to discuss the need for cooperation with and consideration of other students. Some particular points for discussion include being polite, waiting patiently, not making others wait longer than necessary, being orderly when moving about, and observing the right of others not to be disturbed. Talk about each student's accepting the personal responsibility for his own behavior in the group situation.

Performance Check A: Your teacher will observe you for this check when he can.

Remediation: (1) If a student fails to accept any of these responsibilities, approach him privately and review the reasons for his lack of cooperation with his fellow students. Suggest that he pay some attention to changing his behavior to more acceptable standards. (2) Find out if the student feels that he is behaving in a less than acceptable way. If so, ask him whether he feels some penalty should be imposed and what he things a suitable penalty would be.

IO
01
Core
26

Returns equipment promptly to storage areas.

The student chooses to show personal responsibility for returning laboratory equipment promptly to the proper storage places as soon as it is no longer needed, during the class period, and not just at the end of the period.

Student Action: Returning equipment and materials no longer needed to the proper storage places on at least three occasions when observed by the teacher or another designated observer without his knowledge of being checked.

Teacher's Note: This objective may be assessed at any time the student is responsible for learning activities requiring the use of equipment and supplies. Use a few minutes of class time for group discussion of the reasons for returning equipment to storage areas promptly when it is not being used by the student or by his group. The reasons include (1) the short supply of certain items and the need to cooperate with others, (2) the chances of equipment's being misplaced, (3) the possibility of accidental damage to equipment, and (4) the greater opportunity for pilferage by an irresponsible student when things are disorganized.

Performance Check A: Your teacher will observe you for this check when he can.

Remediation: In a private conference, discuss the reasons for the student's cooperation in this request. Ask for that cooperation. See also Remediations (1), (2), and (3) for IO-01-Core-24.

IO

Responds to text questions.

The student chooses to write in his *Record Book* the answers to 90% or more of the textbook questions.

Student Action: Exhibiting the written responses when requested to do so. At least nine out of ten questions should have responses, be they correct or incorrect.

Teacher's Note: It is intended that this objective be assessed throughout the year. Such a check provides opportunities to encourage students to work nearer their capacities while remaining independent of the teacher. Use a few minutes of class time for a group discussion of the reasons for writing the answers in the *Record Book*. Writing in the *Record Book* serves (1) to help the student think through what he sees and does, (2) to preserve ideas for future reference, (3) to make a record of the student's progress through the core, (4) to provide the teacher with a source of input for analyzing the student's difficulties and progress, and (5) to help the student learn the background ideas for conceptual understanding. Writing in the *Record Book* is "in"; writing in the text is "out."

Performance Check A: Your teacher will observe you for this check when he can.

Remediation: (1) In a private conference, discuss with the student the ideas enumerated and ask why he chooses not to write the answers. (Perhaps he cannot write!) Evaluate his reasons and counsel him accordingly. Encourage him to follow the pattern of his classmates and set down his ideas as they are doing. (2) Have him read "Notes to the Student," pages viii and ix in his text. (3) Follow up in a few days to determine his actions.

01 Core 27

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10 01 Core 28

Shows care for laboratory materials.

The student chooses to show proper care and use of ISCS laboratory materials.

Student Action: Using the materials only for their intended purpose or requesting permission to do other specific experiments with them when being observed without his knowledge by the teacher or another designated person on three or more occasions.

Teacher's Note: This objective may be assessed at any time that the student is responsible for a learning activity in which equipment and supplies are required. Use a few minutes of class time for a whole-group discussion of the reasons for handling laboratory materials properly. Such reasons include: (1) If damaged, they are lost to use by students who need them now. Short supply means waiting in line. (2) They cannot readily be replaced. Replacement usually takes several months at best. (3) If materials are handled properly, they may be used for other than regular activities (with the permission of the teacher and after making a proper request).

Performance Check A: Your teacher will observe you for this check when he can.

Remediation: (1) In a private conference, ask the student why he chooses to mishandle equipment. Help him to evaluate his reasons, and ask for his cooperation in the future. If he agrees, reassess the objective later. (2) If after the conference he still does not agree, ask him if he feels that he should be penalized and what he thinks should be an appropriate penalty. Give him another opportunity for compliance. (3) If he is still uncooperative, apply a penalty for mishandling equipment. This may mean denying him use of the equipment either temporarily or permanently or taking some other suitable action.

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10 01 Exc 1-1 1

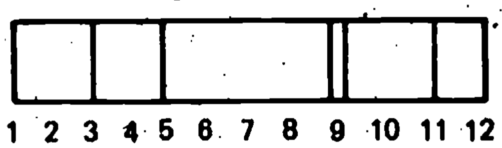
Draws Fraunhofer lines.

The student applies the concept that the Fraunhofer lines of an element appear in the same positions as the bright-line spectral lines.

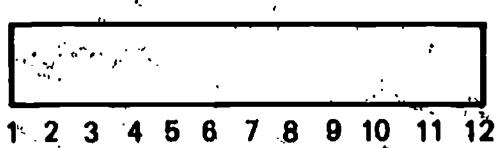
Student Action: Drawing the Fraunhofer lines so that the dark lines in an absorption spectrum of an element are in the same position as the bright lines in the bright-line spectrum for that element.

Performance Check A: Sally drew the diagram shown below of the bright-line spectrum of element X.

Element X
Bright-line spectrum



Copy the diagram below onto your answer sheet, and draw the spectrum that you would expect to see if you observed the dark Fraunhofer lines, or dark-line spectrum, of element X.



Remediation: (1) Check the student's answer to question 2 on page 74. (2) Suggest that the student read page 76.

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10 01 Exc

Describes what happens to energy as a battery-operated device is used.

The student generates an explanation for the operation of a self-contained device that does work.

Student Action: Responding (1) that the device uses stored energy to do work, (2) negatively to the notion of ceaseless operation, and (3) to the effect that the device will continue to operate until some or all of its energy is transferred or changed from one form to another, and then it will stop.

Performance Check A: George built a device that he then placed in a sealed, metal box. There is no way to get energy into the box. The box has an electrical outlet on the side and a motor has been plugged into it. The motor has been working for more than a week.

1. Describe what is happening inside the box to operate the motor.
2. Can George's device continue to make the motor work forever?
3. Explain your answer to part 2.

Remediation: (1) Have the student review Excursion 2-1 on pages 77 and 78 of the text. (2) Develop the ideas of Excursion 2-1 with your student by having Iggy possess the ability to do work and thus possess energy. Ask the student what happens to Iggy's ability to do work when he has transferred all of his energy to another object. (Assume that Iggy's exhausted, not dead.)

2-1
1

States how work is calculated.

The student recalls how to calculate the work done on an object.

Student Action: Responding that the amount of work done may be calculated by multiplying the force applied to an object by the distance the object is moved.

Performance Check A: How do you calculate the amount of work done to move a chair across a room?

Remediaton: (1) Have the student review Excursion 2-1. (2) Have him do the performance check with his book open to page 77.

10
01
Exc
2-1
2

Defines *conservation of energy.*

The student recalls what is meant by the term *conservation of energy.*

Student Action: Responding to the effect that energy may be changed from one form to another but cannot be created or destroyed.

Performance Check A: The term *conservation of energy* is frequently used by scientists. Explain the meaning of the term.

Remediation: Have the student review the last paragraph on page 78.

10
01
Exc
2-1
3

ERIC

10
01
Exc
2-1
4

Lists forms of energy.

The student recalls the different forms in which energy can exist.

Student Action: Listing three forms of energy included in or implied by the following list: light, heat, chemical, electrical, gravitational, nuclear, sound, kinetic (motion), or potential.

Performance Check A: Energy can exist in many different forms. List three different forms of energy.

Remediation: (1) Have the student review the top half of page 78 in the text. (2) Remind him of other forms of energy by asking him such questions as, "What type of energy does falling water have?" (3) Show him the list of forms in the Student Action section above, and have him state an example of each form.

ERIC

10
02

Chapters 3 and 4

Excursions 3-1 thru 4-4

Performance Check

Summary Table

Objective Number	Objective Description
10-02-Core-1	Describes two situations in which distances must be measured indirectly
10-02-Core-2	States the principle on which a range finder is based
10-02-Core-3	Explains why calibrated measuring devices are used
10-02-Core-4	Uses a range finder to measure distance
10-02-Core-5	Selects which range finder is being used to measure the larger distance
10-02-Core-6	States the variable which limits the accuracy of a range finder
10-02-Core-7	States variables that determine the greatest distance measurable by a range finder
10-02-Core-8	Uses a range finder to measure the distance from a light source
10-02-Core-9	States why a simple range finder cannot measure the distance to a star
10-02-Core-10	Lists assumptions made in drawing the Earth-sun-Venus model
10-02-Core-11	Compares the rates of revolution of Earth and Venus
10-02-Core-12	Selects the diagram with the greatest sighting angle
10-02-Core-13	Draws the maximum sighting angle
10-02-Core-14	Draws the orbit of the interior planet in a sun-planet-planet system
10-02-Core-15	Draws a scale model of a planet's orbit, using a sighting angle
10-02-Core-16	Calculates the actual radius of an orbit, using a scale diagram
10-02-Exc 3-1-1	States assumptions used in calculating the moon's diameter
10-02-Exc 4-1-1	Explains how radar measures distance

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
										generates	
						√				recalls	
						√				recalls	
			P			√				manipulates	Save the best range finder for this check.
										applies	
										applies	
						√				recalls	
	M	O				√				manipulates	
										applies	
						√				recalls	
				Q						applies	
						√				applies	
	M				T	√				applies	
	M					√				applies	
	M				T					applies	
					T		√			applies	
						√				recalls	
						√				recalls	

ERIC

IO 02

Objective Number	Objective Description
IO-02-Exc 4-2-1	Measures angles
IO-02-Exc 4-2-2	Uses a protractor to construct angles
IO-02-Exc 4-3-1	Determines actual distances from a scale drawing
IO-02-Exc 4-4-1	Determines the scale of a diagram
IO-01-Core-14R	Explains why only one variable is changed at a time

ERIC

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
	M			Q		✓				manipulates	
	M			Q		✓				manipulates	
	M					✓				applies	
	M				T	✓				applies	
						✓				applies	

ERIC

IO 02 Core 1

Describes two situations in which distances must be measured indirectly.

The student generates descriptions of two possible situations in which distances must be measured indirectly.

Student Action: Describing two situations each of which requires that a distance be measured indirectly for one of the following reasons: (1) direct measuring devices are not suitable to the intervening distance, (2) making a direct measurement is too difficult or time-consuming, and (3) making a direct measurement may disturb the object whose distance is to be measured.

Performance Check A: You often use a ruler to measure distances directly. However, there are many reasons why distances must sometimes be measured by indirect methods, using a device such as a range finder which measures angles, These measured angles are then changed into distance measurements. Think of two such reasons. Then for each of them describe a situation in which making an indirect measurement of distance would be better than trying to measure the distance directly.

Remediation: (1) Have the student review page 23. Then ask him to state the reason for making an indirect measurement in each situation described. (2) If necessary, suggest several such situations to the student and have him identify the reasons for the indirect measurement. (3) Have him redo the performance check.

IO 02 Core 2

States the principle on which a range finder is based.

The student recalls the principle on which a range finder is based.

Student Action: Stating, in effect, that a range finder is based on the principle that the distance from an observer to an object can be determined from the angle formed when the observer looks at the object from two different positions.

Performance Check A: Explain briefly the principle on which the range finder works when you use it to measure distances.

Remediation: (1) Check the student's answers to questions 3-1, 3-2, and 3-3 on page 25. (2) Have him review Activities 3-1 through 3-3 on pages 24 and 25.

IO 02 Core

Explains why calibrated measuring devices are used.

The student recalls the reason that a measuring device must be calibrated.

Student Action: Responding, in effect, that with calibrated measuring devices, investigators can report their findings in the form of numbers which can be easily analyzed or compared with the findings of other investigators.

Performance Check A: You used calibrated measuring devices (measuring devices with scales) in your lab activities. Why is it necessary to use calibrated rather than uncalibrated measuring devices?

Remediation: (1) Ask the student which is more useful -- reporting a distance as 5200 feet or reporting the same distance as "large." Then have the student explain why he made the choice that he did. Help him with his reasoning if he chose the qualitative response. (2) Reassess the objective with an alternate check.

IO .02 Core 4

Uses a range finder to measure distance.

The student manipulates an ISCS range finder to measure a distance by standing at one point and lining up the sighting line and the sighting bar with the other point and reading the scale of distances.

Special Preparations: Save the best range finder made by your students in the Chapter 3 activities. Label it IO-02-Core-4. Measure the distances between several immovable objects in your room which are less than 15 meters apart, and fill in the following chart. Then, assign each student the task of measuring one of these distances with that range finder.

POINT A	POINT B	DISTANCE (in m)

Student Action: Reporting the measurement as found with the range finder accurately within ±20%.

Performance Check A: Get the ISCS range finder labeled IO-02-Core-4, and find the distance between the two points which your teacher names for you.

Remediation: (1) If the student does not remember how a range finder works, have him repeat Activities 3-2 and 3-3. (2) Review his answers to questions 3-1 through 3-3. (3) If necessary, have him repeat Activities 3-4, 3-5, and 3-6. (4) Have him redo the same performance check.

IO 02

Selects which range finder is being used to measure the larger distance.

The student applies the relationship between the distance being measured and the size of the sighting angle observed with a range finder.

Core 5

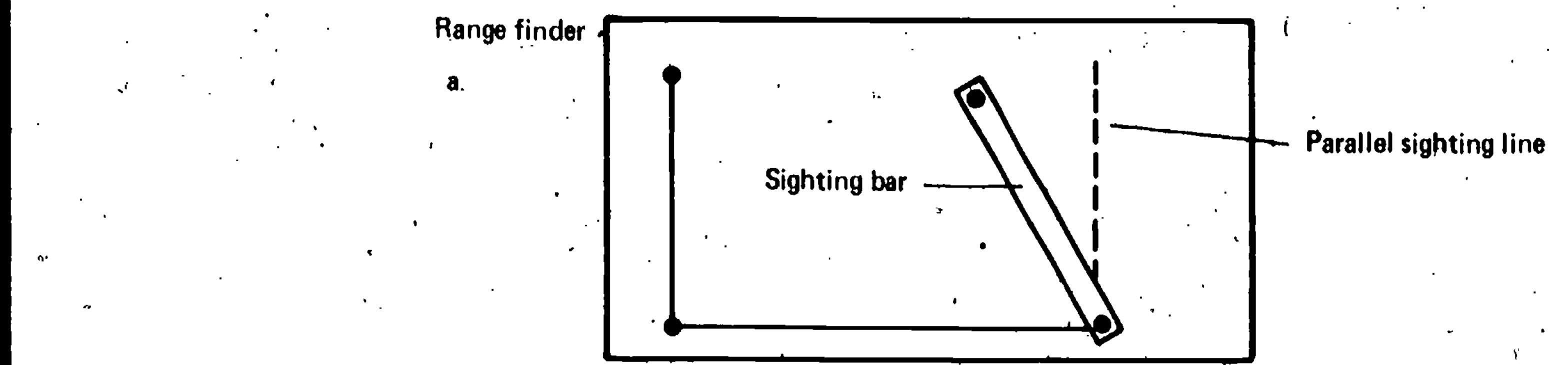
Student Action: Selecting the range finder with the smaller angle between the sighting bar and the parallel sighting line and stating, in effect, that the smaller size of the angle was the basis for his choice.

A: b
B: a
C: b

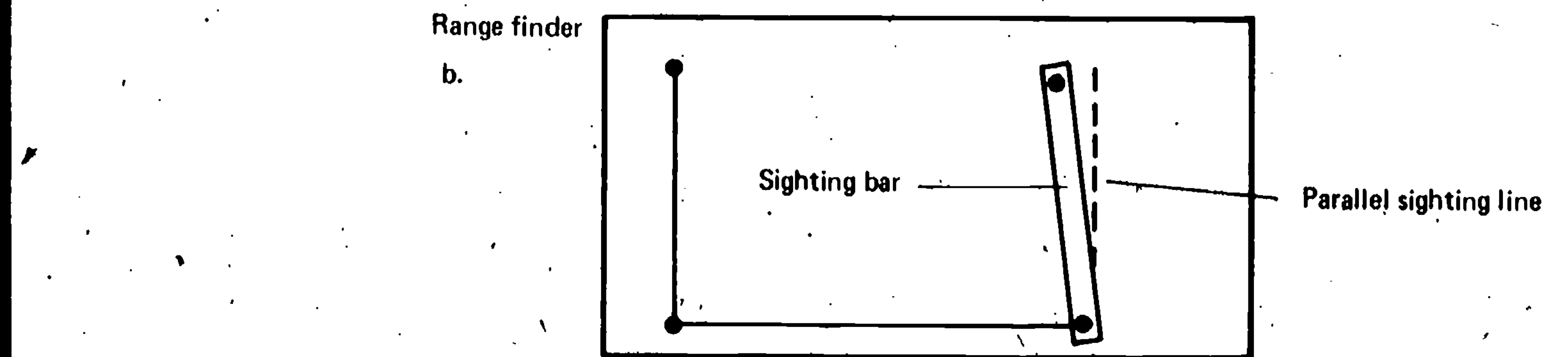
Performance Check A:

1. Which of the range finders diagramed below is being used to measure the larger distance?
2. Explain the reason for your choice.

Range finder a.



Range finder b.



Remediation: (1) Have the student redo or review Activities 3-4 through 3-6 on page 26. (2) Review his answers to questions 3-4 and 3-5 on page 27.

IO 02 Core

States the variable which limits the accuracy of a range finder.

The student applies the concept that the distance which a range finder can measure accurately is limited by the length of its baseline.

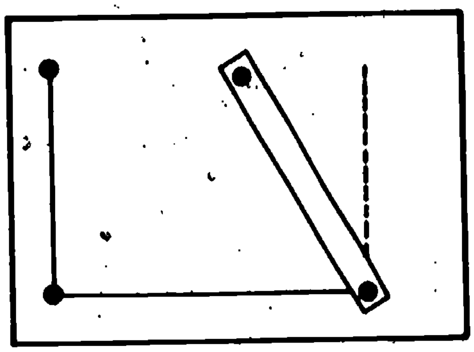
Student Action: Selecting the range finder with the longer baseline and stating in effect, either that the range finder with a longer baseline can measure large distances more accurately or that a longer baseline will result in a greater variation in the sighting angles to objects at different large distances.

A, B, and **C:** b

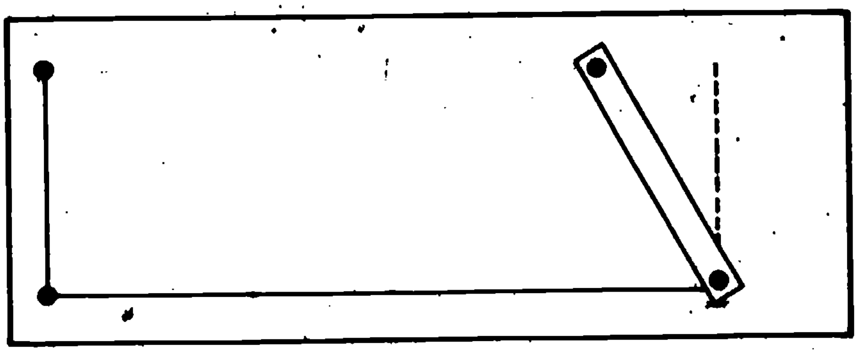
6

Performance Check A: Suppose you are asked to measure the distance to a tree on the other side of a wide river. You are to use one of the range finders shown below.

Range finder a.



Range finder b.



1. Which of the range finders could measure the large distance more accurately?
2. Explain your choice.

Remediation: (1) Have the student review pages 28 through 30. (2) Review his responses to Self-Evaluations 3-20 and 3-3.

---

10 02 Core 7

States variables that determine the greatest distance measurable by a range finder.

The student recalls the two variables which determine the greatest distance a range finder can measure.

Student Action: Stating, in effect, that the two variables are the length of the baseline and the smallest measurable angle formed by the sighting bar and the parallel sighting line.

Performance Check A: What are the two variables that limit the greatest distance you can measure accurately with a range finder?

Remediation: (1) Review the student's answer to Self-Evaluation 3-3. (2) Have him review the paragraph following Problem Break 3-1 on page 29.

10 02 Core 8

Uses a range finder to measure the distance from a light source.

The student manipulates the range finder in accordance with the safety note about the danger of looking directly at the sun.

Regular Supplies: 1 150-watt light bulb
1 range finder

Student Action: Sighting the shadows of the bolts rather than lining up the bolts while directly sighting the bright bulb.

Teacher's Note: Stop the student if he attempts to line up the bolts by sighting the bulb directly.

Performance Check A: Ask your teacher to watch you do this check. Place a 150-watt light at one side of your work area. Get a range finder from the supply area, and place it at the other end of your work area. Read the instructions for Activities 3-7 and 3-8 on page 28 of *In Orbit*. Pretend that the bright light is the sun, and go through the steps of the activities as though you were measuring the distance to the sun.

Remediation: (1) Have the student review the safety note at the top of page 28. (2) If necessary, stress the importance of this note by discussion.

---

10 02 Core 9

States why a simple range finder cannot measure the distance to a star.

The student applies the concept of the baseline limitation of simple range finders on measuring large distances.

Student Action: Stating the essence of the concept that the baseline on any range finder like the one made in class is too short.

Performance Check A: Why can't the distance from the earth to Polaris (the North Star) be measured by a range finder like the one you made in class?

Remediation: (1) Review the student's answer to Self-Evaluation 3-3. (2) Review his answers to questions 3-9 and 3-10 on pages 29 and 30. (3) Have him review the paragraph below Figure 3-4 on page 30.

---

10 02

Lists assumptions made in drawing the Earth-sun-Venus model.

The student recalls the assumptions made in drawing the Earth-sun-Venus model.

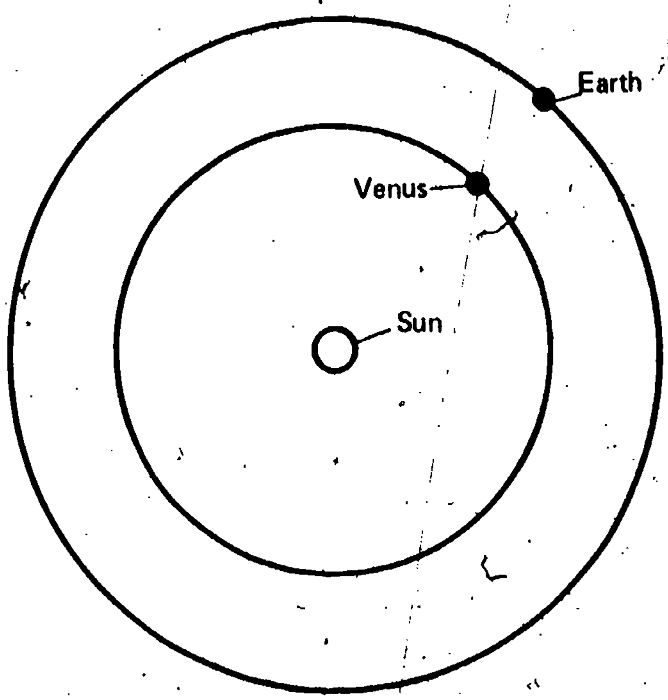
ERIC

Student Action: Stating the essence of four of the following five assumptions:

(1) the sun is the center of solar system,
(2) Earth and Venus are planets revolving around the sun,
(3) Venus and Earth move in the same plane,
(4) both Venus and Earth move in circular orbits, and
(5) Venus is closer to the sun than Earth is.

Core 10

Performance Check A: You drew a model of the Earth-sun-Venus system similar to the one shown below. Like all scientific models, it is based on certain assumptions. What were four assumptions you made in drawing this model?



Remediation: Refer the student to Table 4-1 on page 35 of the text.

Compares the rates of revolution of Earth and Venus.

10 02 Core

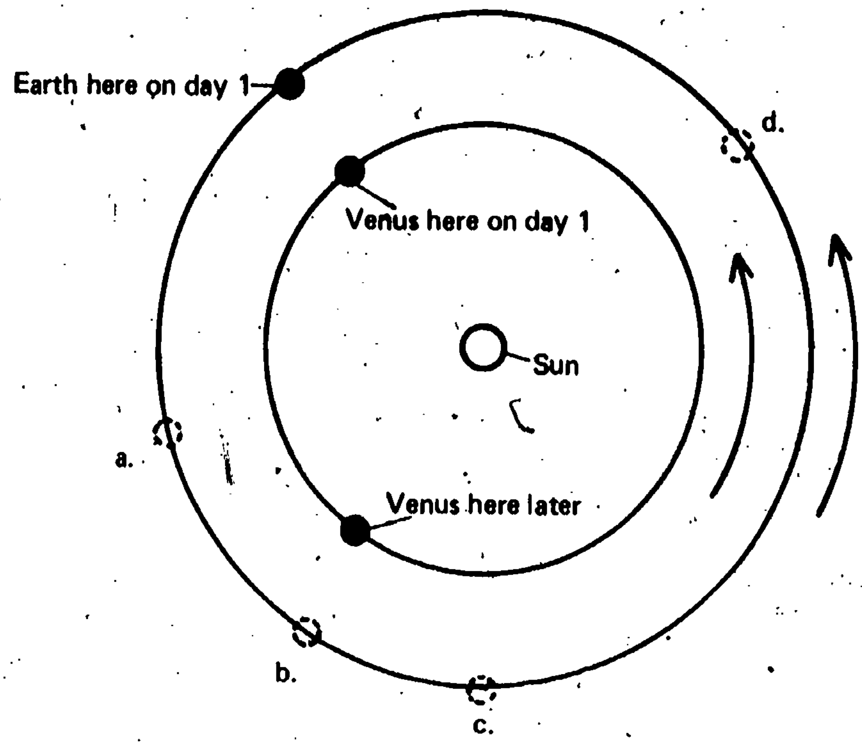
The student applies the fact that the angular speed of Venus is greater than that of Earth.

Student Action: Selecting a position for Earth which shows that it has moved through a smaller angle than Venus.

A, B, and **C:** a

11

Performance Check A: The diagram below shows the positions of Venus and Earth on the same day. It also shows the position of Venus a few months later. Select the letter of the approximate location of Earth at that later time.



Remediation: (1) Have the student review Activities 4-1 and 4-2 and questions 4-3, 4-4, and 4-5. (2) Check to see that he understands that in 225 days, Venus makes one complete revolution, whereas Earth makes about two-thirds of a revolution. (3) If the student would profit from using beans to illustrate the idea, have him do so. Then have him approximate positions 112 days from day 1 as shown in the checks. (4) Have him do the performance check again and explain his choice.

10
02
Core
12

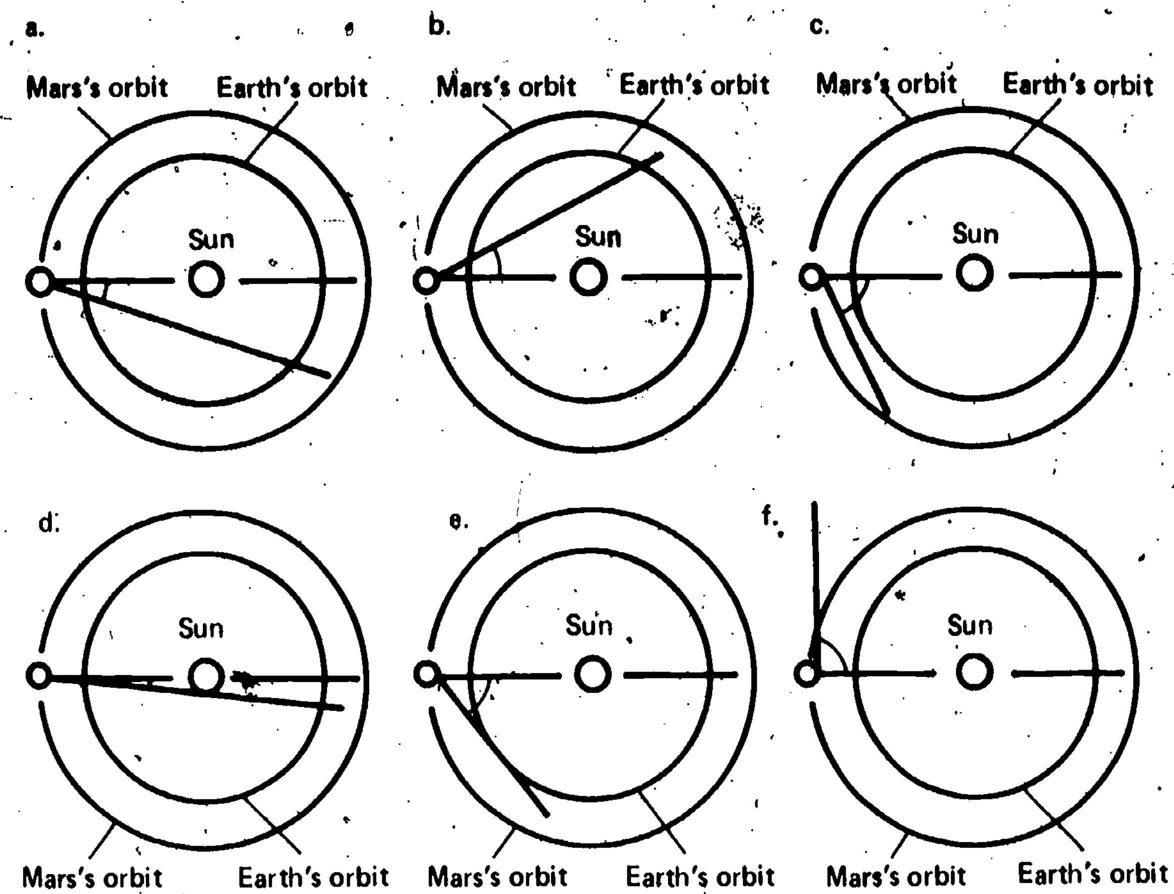
Selects the diagram with the greatest sighting angle.

The student applies the concept that the greatest sighting angle is determined by the line of sight to the sun from the planet which has the larger orbit and the line of sight from that same planet which is tangent to the orbit of the planet whose orbit is smaller.

Student Action: Selecting the drawing which shows the greatest sighting angle.

A: e
B: b
C: d

Performance Check A: Select the diagram below that shows the greatest possible ME-MS angle.



Remediation: (1) Refer the student to Figure 4-5 on page 38. (2) Have him repeat Activity 4-5 on page 38. (3) Review his answer to question 4-7 on page 38. (4) Review his answer to Self-Evaluation 4-3 B.

Draws the maximum sighting angle.

The student applies the concept that the largest Earth-sun-Planet angle is formed by a line joining Earth and the sun and a line from Earth tangent to the orbit of the planet.

Regular Supplies: 1 drawing compass
1 ruler

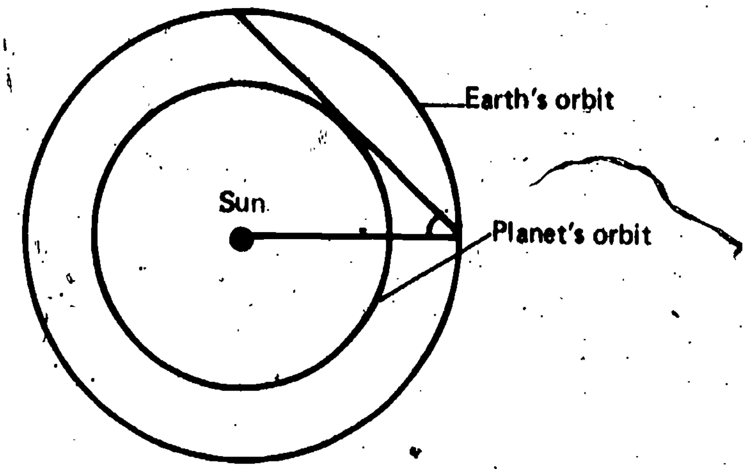
10
02
Core

ERIC Full Text Provided by ERIC

13

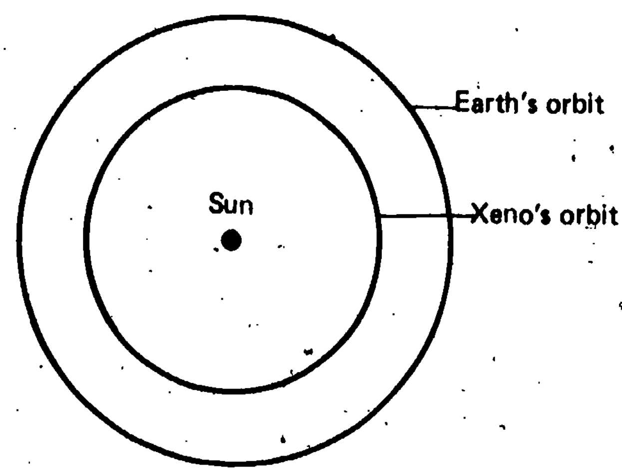
Student Action: Drawing the largest angle between the Earth-sun line and the Earth-Planet line.

A, B, and C:



Performance Check A; Get a drawing compass and a ruler, and copy the diagram below.

Suppose that planet Xeno were discovered between the Earth and the sun. A model of the Earth-sun-Xeno system is shown in the diagram.



On your copy of the diagram, draw in the lines of sight from Earth to Xeno and from Earth to the sun that would give the largest ES-EX angle.

Remediation: (1) Have the student review Activity 4-5 and questions 4-7 and 4-8. (2) Have him observe Figure 4-5 carefully.

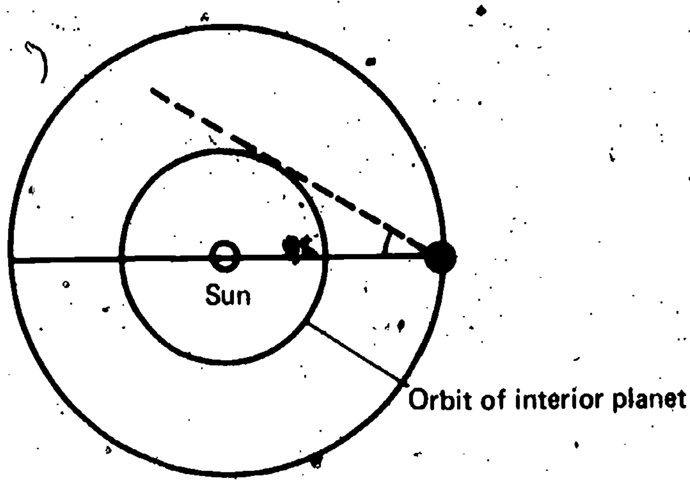
Draws the orbit of the interior planet in a sun-planet-planet system.

The student applies the procedure for diagraming the orbit of an interior planet, given the sighting line which produces the largest sighting angle from the outer planet to the interior planet.

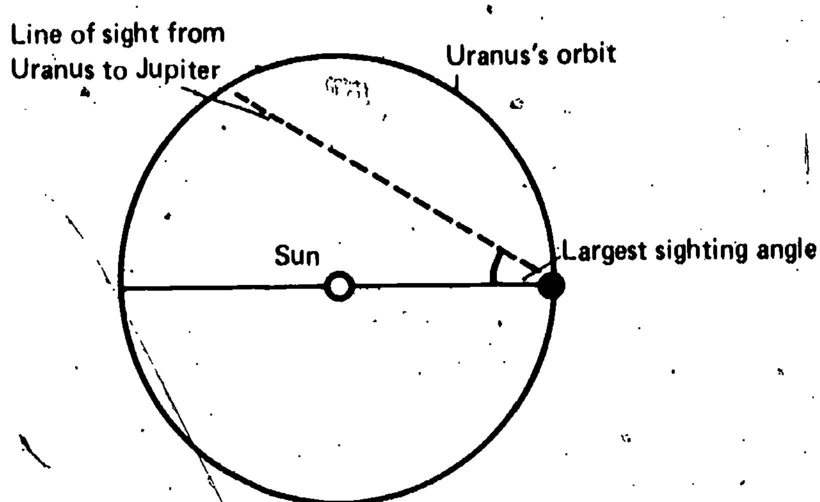
Regular Supplies: 1 drawing compass
1 ruler

Student Action: Constructing a circle whose center is at the center of the sun and which just touches the sighting line to represent the planet's orbit.

A, B, and C: The student's diagram should resemble the following diagram.



Performance Check A: Get a drawing compass. Suppose you were an ISCS student on the planet Uranus. You have just drawn a model of the sun-Uranus-Jupiter system. The sighting line from Uranus to Jupiter, which is shown below, is the line which makes the largest US-UJ angle. Copy the model below onto your answer sheet, and complete the model by drawing a circle to represent the orbit of Jupiter.



Remediation: (1) Review the student's answer to Self-Evaluation 4-4 C. (2) Refer him to Figure 4-5 on page 38. (3) Have him read the paragraph preceding Figure 4-5 on page 38.

IO 02 Core 15

Draws a scale model of a planet's orbit, using a sighting angle.

The student applies the procedure of constructing a scale model of a planet's orbit, using the maximum sighting angle observed on a planet whose orbit is specified.

Regular Supplies: 1 drawing compass
1 metric ruler
1 protractor

Student Action: Drawing a circle of the specified radius, constructing an angle equal to the largest sighting angle with its vertex on the circle and one arm passing through the center of that circle, and drawing a second circle which has the same center as the first circle and which just touches the second arm of the largest sighting angle.

Performance Check A: Suppose that a colony of men lived on Mars, which is farther from the sun than Venus. They have measured the maximum angle between Venus, Mars, and the sun to be 33°. Draw a scale diagram of the orbits of Venus and Mars. Use a circle with a radius of 9 cm to represent the orbit of Mars. You may use a protractor, a drawing compass, and a metric ruler.

Remediation: (1) Have the student review Figure 4-6 and carefully consider Activities 4-7 through 4-9. (2) Review his responses to Self-Evaluation 4-4 A, B, and C. (3) Have him do an alternate performance check.

IO 02 Core 16

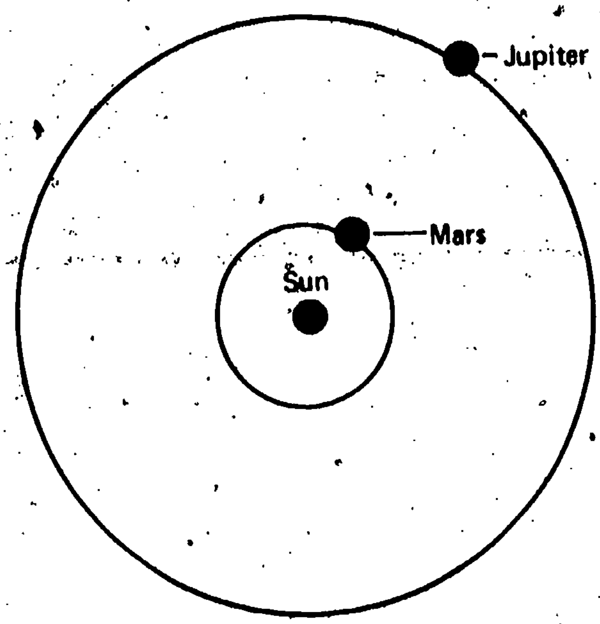
Calculates the actual radius of an orbit, using a scale diagram.

The student applies the rules of linear scaling in calculating the radius of a specific orbit.

Student Action: Reporting the distance within [illegible] of the correct answer by measuring the scaled distances that represent the known and unknown distances, finding the ratio of unknown to known scaled distances, and multiplying this ratio by the actual known distance to calculate the distance from the sun to the planet.

A: 485 ±73 million miles
B: 879 ±132 million miles
C: 143 ±22 million miles

Performance Check A: The scale diagram shown below represents the orbits of Mars and Jupiter. The minimum distance between Mars and Jupiter is 342 million miles.



What is the radius of Jupiter's orbit? State your answer in millions of miles.

Remediation: (1) Check the student's answers to questions 4-12, 4-13, and 4-14 on pages 40 and 41. (2) If linear scaling is a problem, suggest to the student that he do Excursion 4-3. (3) Ask him to do an alternate check.

States assumptions used in calculating the moon's diameter.

The student recalls the assumptions about the earth-moon system that are useful when calculating the moon's diameter.

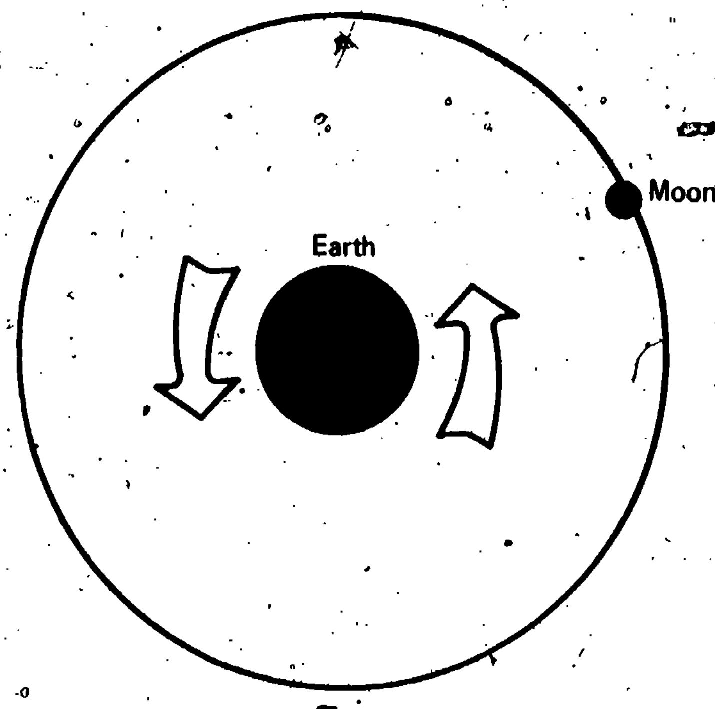
10
02
Exc
3-1
1

Student Action: Responding with the notion of two of the following:

(1) the moon's orbit is a circle,
(2) the earth is at the center of the moon's orbit,
(3) the earth turns at a constant speed,
(4) either the moon is 240,000 miles from the earth or the moon's orbit is 1,500,000 miles around, and
(5) all the motion observed, when the moon is viewed for short periods, is due to the earth's turning.

ERIC

Performance Check A: When you found the moon's diameter, you made use of several assumptions about the earth-moon system shown below. What were two of those assumptions?



Remediation: (1) Have the student review the first and second paragraphs on the top of page 80. (2) Discuss with him what is meant by *assumptions* and how assumptions are useful in science.

---

10 02 Exc 4-1 1

Explains how radar measures distance.

The student recalls the method by which radar measures the distance to an object.

Student Action: Stating, in effect, that radar measures the distance to an object by measuring the amount of time it takes for a radio signal of known speed to travel from the antenna, bounce off the object, and return to the antenna.

Performance Check A: Explain briefly the process by which radar measures the distance to an object.

Remediation: Have the student review the first two paragraphs on page 83 and the top paragraph on page 84.

ERIC

Measures angles.

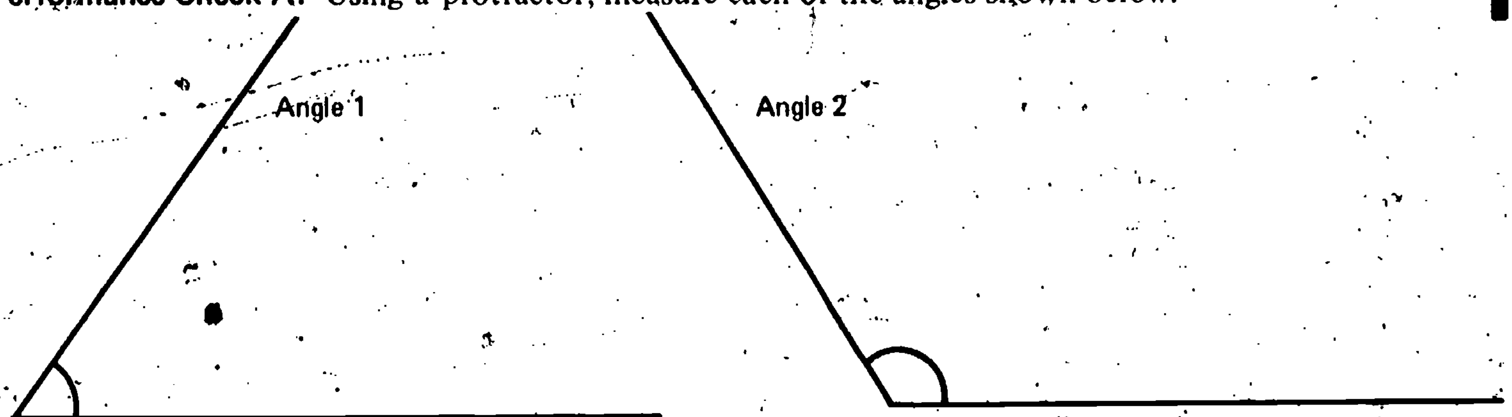
The student manipulates a protractor to measure angles of less than 180° by placing the protractor so that its reference point is at the vertex of the angle and the side of the baseline with the 0° marking lies along one of the arms of the angle and reading the size of the angle from the protractor scale.

Regular Supplies: 1 protractor

Student Action: Reporting the size of each angle correctly within ±2°.

A: 1. 53 ±2°, 2. 122 ±2°
B: 1. 114 ±2°, 2. 76 ±2°
C: 1. 106 ±2°, 2. 48 ±2°

Performance Check A: Using a protractor, measure each of the angles shown below.



Remediation: (1) Check the student's response to Self-Evaluation 4-1. (2) Have him review Excursion 4-2 and check his responses in Table 1, page 88. If necessary, help him make the measurements to fill in Table 1. (3) Have him do an alternate performance check.

10
02
Exc
4-2
1

Uses a protractor to construct angles.

The student manipulates a protractor to construct two specified angles.

Regular Supplies: 1 protractor

Student Action: Constructing the two angles within ±2° of the specified sizes. The student's angles should be

A: 37 ±2° and 124 ±2°
B: 28 ±2° and 126 ±2°
C: 48 ±2° and 133 ±2°

Performance Check A: Use your protractor to construct angles of 37° and 124°.

Remediation: (1) Check the angles the student drew for question 6 on page 88. (2) If you believe that the student is having difficulty reading a protractor, review his completions of Table 1 on page 88. (3) Review the procedure of angle construction with him, and have him do an alternate check.

10
02
Exc
4-2
2

10
02
Exc
4-3
1

Determines actual distances from a scale drawing.

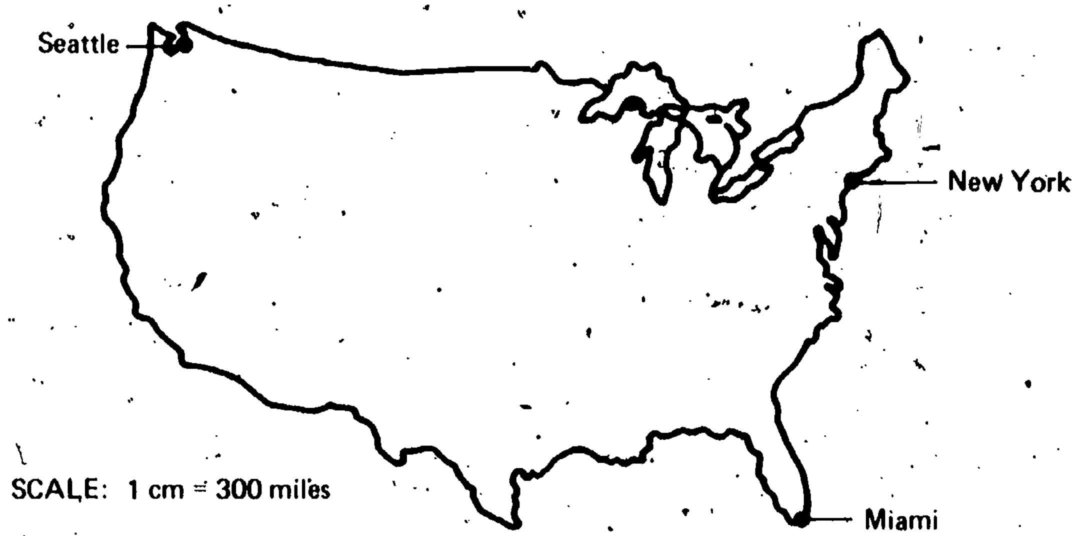
The student applies the procedures for determining actual distances from a scale drawing, which include measuring the distance on the drawing in the units of the drawing and multiplying the numerical value obtained by the distance each scale unit represents.

Regular Supplies: 1 ruler

Student Action: Reporting distances within ±5%.

- **A:** 1. 2400 ±120 miles, 2. 2700 ±125 miles
- **B:** 1. 2100 ±105 miles, 2. 1200 ±60 miles
- **C:** 1. 2400 ±120 miles, 2. 1900 ±95 miles

Performance Check A: Use the scale drawing below to answer the questions that follow.



1. What is the actual distance from New York to Seattle?
2. What is the actual distance from Miami to Seattle?

Remediation: (1) Review the student's answer to question 4 on page 90. (2) Review the student's answer to Self-Evaluation 4-28.

10 02 Exc 4-4 1

Determines the scale of a diagram.

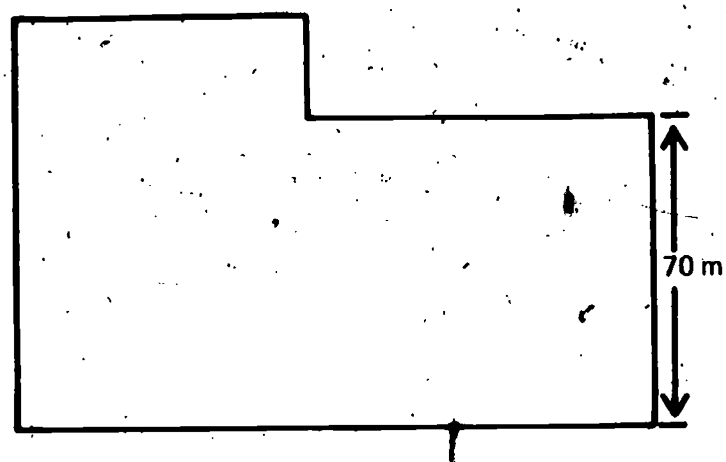
The student applies the rule for determining the scale of a diagram drawn to scale.

Regular Supplies: 1 metric ruler

Student Action: Reporting the scale in the proper units for the diagram to an accuracy of ±5%.

A: 1 cm = 20 ±1.0 meters
B: 1 cm = 30 ±1.5 meters
C: 1 cm = 6 ±0.3 meters

Performance Check A: The drawing below is a scale diagram of a warehouse. What is the scale of this diagram?



Remediation: (1) Review the student's answer to question 4-15 on page 41. (2) If necessary, review his answers to questions 1 through 4 on page 92, Excursion 4-4. (3) Review his response to Self-Evaluation 4-4.

IO 03

Chapters 5 thru 7

Excursions 5-1 thru 7-2

Performance Check

Summary Table

Objective Number	Objective Description
IO-03-Core-1	Adjusts a sighting scope to obtain an image
IO-03-Core-2	Decides whether it is possible to measure the sun
IO-03-Core-3	Determines the distance across an object, using a sighting scope
IO-03-Core-4	Calculates the distance across the sun
IO-03-Core-5	Calculates the number of degrees that the sun appears to move each hour
IO-03-Core-6	Explains the difficulty of proving that the sun does not orbit the earth
IO-03-Core-7	States the number of degrees a planet rotates in give time periods
IO-03-Core-8	States why the year has an extra day every fourth year
IO-03-Core-9	Calculates apparent sun speed from a scale diagram
IO-03-Core-10	Calculates the speed of the sun if it were to travel around a planet
IO-03-Core-11	States why it is unlikely that the sun travels around the earth
IO-03-Core-12	Explains why the earth is divided into time zones
IO-03-Core-13	Calculates the wattage needed to maintain the same heat at double the distance
IO-03-Core-14	Calculates the wattage required to produce a particular heating effect
IO-03-Core-15	Compares data relating to the composition and power of stars
IO-03-Core-16	Defines *transit*
IO-03-Exc 5-1-1	Calculates the power of a telescope
IO-03-Exc 5-1-2	Selects the focal length of a lens on a diagram

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
	M		P		T	√				manipulates	Save acetate and cardboard for this check.
						√				applies	
	M		P		T	√				applies	
										applies	
				Q						applies	
						√				recalls	
				Q						applies	
										recalls	
	M			Q	T		√			applies	
	M			Q	T		√			applies	
						√				recalls	
										generates	
				Q		√				applies	
					T		√		√	applies	
				Q			√		√	applies	
										recalls	
				Q		√				applies	
				Q						applies	

10
03

Objective Number	Objective Description
10-03-Exc 5-1-3	Measures the focal length of a lens
10-03-Exc 5-1-4	Locates the positions of lenses for a telescope
10-03-Exc 6-1-1	States why calendars were invented
10-03-Exc 6-1-2	States the reason for rejecting older calendars
10-03-Exc 6-1-3	Explains the reason that historical events sometimes have two dates
10-03-Exc 6-2-1	Selects a reason why one model is better than another
10-03-Exc 6-2-2	Recognizes Ptolemy's and Copernicus's models of the solar system
10-03-Exc 7-1-1	States the variable besides work involved in power
10-03-Exc 7-1-2	States the scientific meaning of the term *power*
10-03-Exc 7-1-3	Interprets the use of the word *powerful* in a statement
10-03-Exc 7-2-1	Calculates by the method of squares
10-03-Exc 7-2-2	Squares numbers
10-01-Core-7R	Uses the known spectra of elements to identify them
10-01-Core-10R	Suggests ways of changing the heating effect of a light bulb
10-01-Core-11R	Lists the variables that affect an object's temperature change
10-01-Core-14R	Explains why only one variable is changed at a time
10-01-Core-19R	Selects the wattage of a light bulb needed to get the same heat at increased distance
10-01-Core-23R	Selects a graph showing how temperature change varies with the distance from a light source

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
	M		P		T					applies	
				Q		√				applies	
						√				recalls	
										recalls	
										recalls	
				Q		√				applies	
				Q						identifies	
				Q		√				recalls	
						√				recalls	
										applies	
				Q			√			applies	
				Q		√				applies	
				Q						applies	
						√				applies	
										recalls	
						√				applies	
				Q		√				applies	
				Q		√				applies	

IO 03

Objective Number	Objective Description
IO-02-Core-10R	Lists assumptions made in drawing the Earth-sun-Venus model

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
						√				recalls	

ERIC

10
03
Core
1

Adjusts a sighting scope to obtain an image.

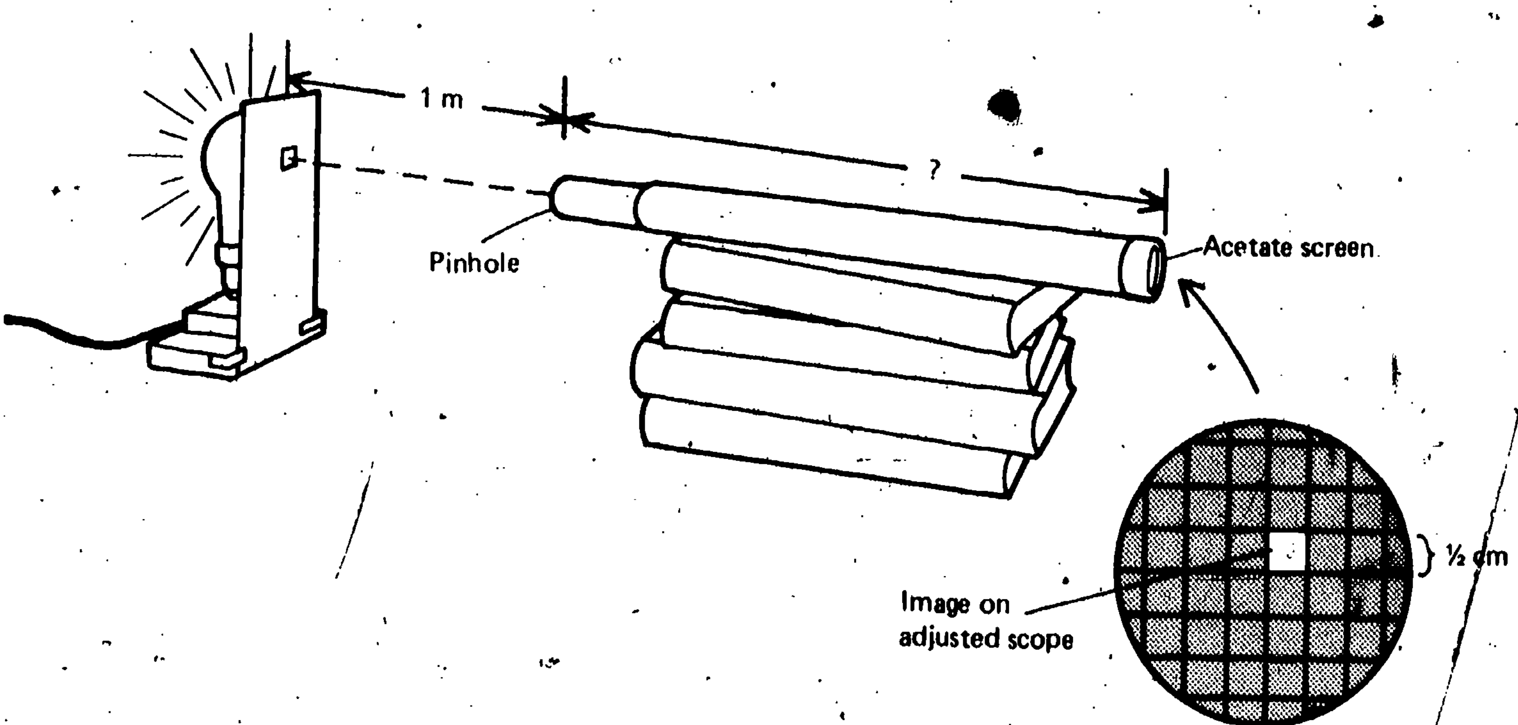
The student manipulates a sighting scope.

Regular Supplies: sighting scope
150-watt light bulb and socket

Special Preparations: Save one of the acetate screens and the cardboard with the 1-cm^2 hole in it from the Chapter 5 activities. Have the student do this check in a darkened area of the room.

Student Action: Reporting the length of the adjusted sighting scope to within ±5 cm.
A: 50 ±5 cm
B: 40 ±5 cm
C: 60 ±5 cm

Performance Check A:



Get a piece of cardboard with a 1-cm^2 hole in it, a sighting scope, and a 150-watt light bulb and socket. In a darkened area of the room, set up the apparatus as shown in the diagram above. Position the sighting scope so that the pinhole is 1 meter from the cardboard with the 1-cm^2 opening. Adjust the scope so that the image on the acetate screen is ½ cm across. Now measure and record the distance between the pinhole and the acetate screen.

Remediation: (1) Have the student review pages 46 and 47. (2) If he is unable to decide which way to adjust the sighting scope, have him review Self-Evaluation 5-1.

10 03 Core 2

Decides whether it is possible to measure the sun.

The student applies the concept that indirect measurements can be used when direct measurements are impossible or inconvenient.

Student Action: Stating that he disagrees with the given statement because he accepts the notion that indirect methods of measurement can be used to measure objects that are impossible or inconvenient to measure directly.

Performance Check A: Frank was reading a science book and noticed that in one chapter it gave a measurement for the diameter of the sun. He showed the page to his brother and said that the book must be wrong. No one has ever been to the sun to measure its size, and if someone ever did try to get close enough to measure it, he would get fried to a crisp.

1. Do you agree with Frank that it is impossible to measure the size of the sun?
2. Explain your answer.

Remediation: (1) Have the student review the first and second paragraphs on pages 43 and 44. (2) If necessary, discuss with the student the problems involved in attempting to measure a large, hot object at a great distance by direct methods.

10 03 Core 3

Determines the distance across an object, using a sighting scope.

The student applies the procedure for determining the distance across a brightly illuminated object, using a sighting scope.

Regular Supplies: 1 meterstick
1 sighting scope

Special Preparations: Set up a bright object similar to the one described in Activities 5-5 and 5-6, but using a square hole that is 1.5 cm square.
A, B, and **C:** 1.5 cm

Student Action: Calculating the distance across an object within ±10%.

Performance Check A: Your teacher has set up for you a light bulb and a piece of cardboard with a hole in it. Get a meterstick and a sighting scope from the supply area. Use the sighting scope, the meterstick, and the formula below to calculate the distance across the hole in the cardboard.

$$\text{Distance across the hole} = \frac{\text{distance from object to pinhole}}{\text{distance from pinhole to screen}} \times \text{distance across image}$$

Remediation: With the student, review the sample calculation on page 47 of the text.

10 03 Core 4

Calculates the distance across the sun.

The student applies the formula

$$\text{distance across sun} = \frac{\text{distance from sun to planet X distance across image}}{\text{distance from pinhole to screen}}$$

Student Action: Calculating the distance across the sun from the measurements given, using the equation above.

- **A:** 858,974 ±43,000 miles
- **B:** 876,543 ±44,000 miles
- **C:** 860,714 ±43,000 miles

Performance Check A: Skug is an ISCS student on Venus. He wants to measure the distance across the sun, using a sighting scope. Here is the information he has collected.

Sun to Venus distance = 67 million miles
Distance across sun's image on sighting scope = ½ cm
Distance from pinhole to screen = 39 cm

Use the formula shown below to calculate the distance across the sun.

$$\text{Distance across sun} = \frac{\text{distance from sun to planet X distance across image}}{\text{distance from pinhole to screen}}$$

Remediation: (1) Review the student's answer to question 5-6 on page 49. (2) If necessary, review pages 47 through 49 with him so that he understands the relationship between the numbers involved. (3) Have him review Self-Evaluation 5-3. (4) Have him do an alternate performance check.

10 03 Core 5

Calculates the number of degrees that the sun appears to move each hour.

The student applies the rule that the number of degrees which the sun appears to move each hour equals 360° divided by the number of hours in the planet's day.

Student Action: Calculating the number of degrees that the sun appears to move each hour as equal to 360° divided by the number of hours in the planet's day.

- **A:** 12 degrees per hour
- **B:** 36 degrees per hour
- **C:** 24 degrees per hour

Performance Check A: A day on planet Xeno is 30 hours long. If you measured the number of degrees that the sun appears to move in one hour on Xeno, what would your measurement be?

Remediation: (1) Check the student's answer to Self-Evaluation 6-3. (2) Discuss Problem Break 6-2 with the student. Then suggest that he do an alternate performance check.

10 03 Core 6

Explains the difficulty of proving that the sun does not orbit the earth.

The student recalls why it is difficult to prove whether it is that the earth rotates or that the sun revolves around the earth.

Student Action: Responding, in effect, that both motions would produce the same apparent motion of the sun across the sky.

Performance Check A: Why is it hard to prove that the earth turns and that the sun does not travel around the earth each day?

Remediation: (1) Have the student review the data he collected in Activities 6-1 through 6-10 beginning on page 52. (2) The paragraph preceding Problem Break 6-1, page 54, summarizes the difficulties encountered in trying to prove either point of view.

---

10 03 Core 7

States the number of degrees a planet rotates in given time periods.

The student applies the concept that planets rotate about one-quarter of a rotation (90°) between sunrise and noon and about one-half of a rotation (180°) between sunrise and sunset when the sun is following an equatorial path.

Student Action: Stating that the planet rotates about 90° between sunrise and noon and about 180° between sunrise and sunset.

A, B, and **C:** 1. 90°. 2. 180°

Performance Check A: A day on the planet Mars lasts 25 hours, not 24 as on earth. Assume that the sun's path is directly over Mars's equator on the day in question.

1. How many degrees does Mars turn from sunrise until the sun is most nearly overhead?
2. How many degrees does Mars turn from sunrise to sunset?

Remediation: (1) Review the student's answers to questions 6-3 through 6-6. (2) Have him check his response to Self-Evaluation 6-1. (3) If he is confused by the time factor stated in the performance check, use Activities 6-5 through 6-8 to show him that the factor is irrelevant.

---

10 03 Core

States why the year has an extra day every fourth year.

The student recalls why the year has an extra day once every four years.

Student Action: Responding to the effect that the earth's period is not exactly 365 days long but is closer to 365¼ days; therefore, an extra day is added each four years to keep the calendar in step with the seasons or to keep Easter at a specific time.

8

Performance Check A: Almost ~~every fourth~~ year is a leap year, ~~and February~~ has 29 days instead of 28.

1. Why is the extra day added to most fourth years?
2. What is the purpose of leap year?

Remediation: Have the student read pages 102 and 103 of the text.

---

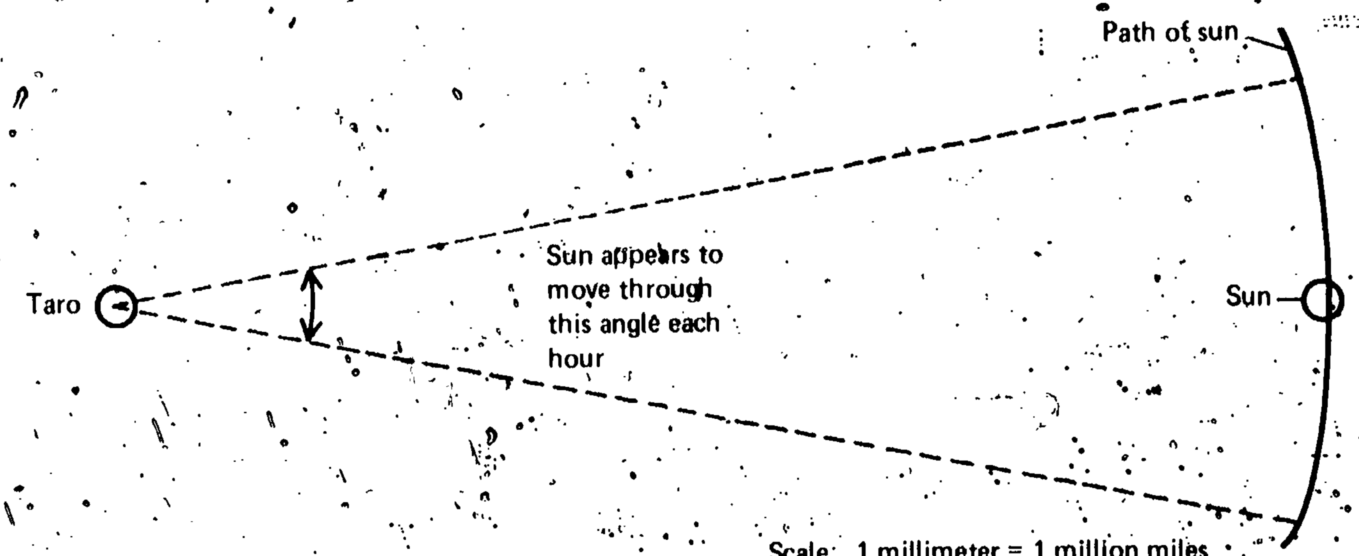
10 03 Core 9

Calculates apparent sun speed from a scale diagram.

The student applies the procedure for determining from a scale diagram the speed at which the sun would have to travel to make one complete trip around a planet each day, which includes measuring the length of the chord between the intersections of the arms of the angle through which the sun appears to move each hour and multiplying the distance in millimeters by 1,000,000 to determine the speed of the sun.

Student Action: Reporting within ±10% the speed of the sun in miles per hour.
- **A:** 50 ±5 million miles per hour
- **B:** 40 ±4 million miles per hour
- **C:** 60 ±6 million miles per hour

Performance Check A: Suppose you are a student on the planet Taro. You are trying to decide whether Taro turns on its axis each day or the sun makes one complete trip around Taro each day. You drew the scale diagram shown below of the sun and Taro. The angle through which the sun appears to move each hour is shown on the diagram.



Use this scale diagram to find the speed at which the sun would have to travel (in miles per hour) to make one complete trip around Taro each day.

Remediation: (1) Check the student's answers to questions 6-10 through 6-15. (2) If necessary, have the student explain his work in Activities 6-11 through 6-13.

ERIC

10 03 Core 10

Calculates the speed of the sun if it were to travel around a planet.

The student applies the concept that measurements can be determined from scale diagrams.

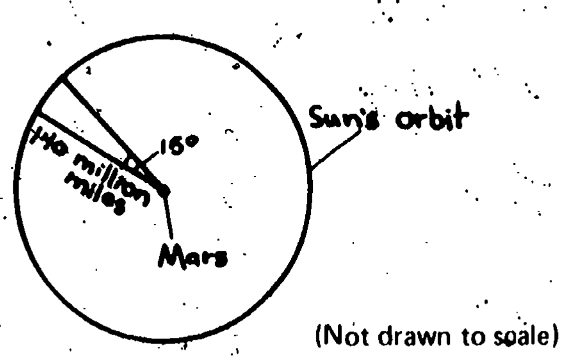
Regular Supplies: 1 compass
1 protractor
1 ruler

Student Action: Calculating and reporting within ±10% the speed in miles per hour at which the sun would have to travel if it were to make one complete trip around the planet each day.

- **A:** 37 ±3.7 million miles per hour
- **B:** 42 ±4.2 million miles per hour
- **C:** 40 ±4.0 million miles per hour

Performance Check A: Suppose you lived on Mars and wanted to find out how fast the sun would travel if it made one trip around Mars each day. You have made the following measurements and drawn the sketch below.

The distance from the sun to Mars is 140 million miles.
The apparent motion of the sun across the sky is 15° per hour.



(Not drawn to scale)

How fast would the sun have to travel in miles per hour to make one trip around Mars each day? (Hint: Constructing a scale diagram with a compass, protractor, and ruler will be helpful.)

Remediation: (1) Have the student review Activity 6-14 on page 57 and consider questions 6-12 through 6-15. (2) Have him redo the performance check with an open book.

---

10 03

States why it is unlikely that the sun travels around the earth.

The student recalls why it is unlikely that the sun revolves around the earth.

Student Action: Responding to the effect that the speed at which the sun would have to travel to go around the earth each day would be much greater than the speed of any known planet or satellite.

Core 11

Performance Check A: Why is it unlikely that the sun travels around the earth each day?

Remediation: (1) Have the student review both his response to question 6-15 and the first paragraph on page 58. (2) Check his response to Self-Evaluation 6-6.

---

10 03 Core 12

Explains why the earth is divided into time zones.

The student generates a rationale for time zones.

Student Action: Stating in effect that time zones were created for convenience so that at a given clock time, the sun is in the same relative east-west position in each zone.

Performance Check A: Explain briefly why the earth has been divided into time zones.

Remediation: Together, review the student's response to Problem Break 6-2.

---

10 03 Core 13

Calculates the wattage needed to maintain the same heat at double the distance.

The student applies the concept that the intensity of heat from a source varies with the square of the distance from the source.

Student Action: Stating the necessary wattage as four times the wattage of the bulb in the smaller device.

- **A:** 500 watts
- **B:** 800 watts
- **C:** 400 watts

Performance Check A: Henry bought a heating device that uses a 125-watt bulb to keep fried eggs at a certain temperature. Joe wants to build a device of the same type, but one in which the bulb will be twice as far from the eggs as in Henry's. What wattage light bulb would Joe need to keep his eggs at the same temperature as Henry's?

Remediation: (1) Check the student's answer to Self-Evaluation 7-2. (2) Check his answer to question 7-2 on page 62. (3) If necessary, review Figure 7-1 on page 63 with the student, and suggest that he do an alternate check.

---

10 03

Calculates the wattage required to produce a particular heating effect.

The student applies either the doubling method or the squaring method to calculate the wattage necessary for a heat source to heat a surface to the same extent as a smaller, closer heat source.

Core 14

Student Action: Calculating the wattage within ±10%, using either the doubling method, which involves drawing a table of distances and wattages, writing the known wattage and the distance in the table as the initial column entries, finding the remaining table entries by multiplying the previous distance by two and the previous wattage by four until the last entry in the distance column equals the required distance, and reporting that entry in the wattage column which corresponds to this distance as the required wattage, or the squaring method, which involves the rule that the intensity of radiant energy varies inversely as the square of the distance from the source, finding the ratio of the new distance to the original distance, squaring this ratio, and multiplying the squared ratio by the power of the original source to find the required wattage, and showing his work.

A:

MEASURED DISTANCE	WATTAGE
20	75
40	300
80	1200
160	4800
320	19,200

B:

MEASURED DISTANCE	WATTAGE
20	100
40	400
80	1600
160	6400

C:

MEASURED DISTANCE	WATTAGE
15	5
30	20
60	80
120	320
240	1280

ERIC

Performance Check A: Mario finds that a 75-watt bulb placed 20 cm from his sun-energy measurer has the same heating effect as a larger bulb placed 320 cm from the measurer. Find the wattage of the larger bulb. Show all your work.

Remediation: (1) Check the student's answers to Self-Evaluations 7-2 and 7-3. (2) Have him do question 7-2 and carefully consider Table 7-1. (3) Suggest that he do an alternate check.

---

10 03 Core 15

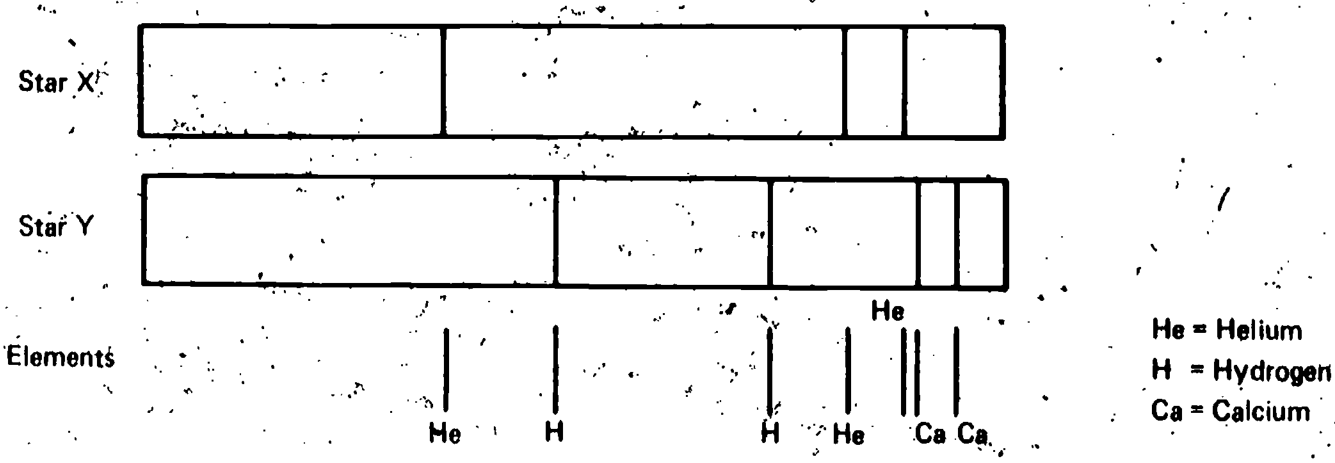
Compares data relating to the composition and power of stars.

The student applies the concept that the composition of a star is shown by the appearance of absorption lines in its spectrum which correspond to the spectra of various elements and the concept that the relative powers of two stars are functions of the heating effect that they produce on a sun-energy measurer and of their distance from the earth.

Student Action: Stating a description of the two stars based on the concepts above and interpretation of the data, specifically utilization of the lines in their spectra and comparisons of their composition and power (wattage).

- **A:** Composition: star X, helium; star Y, hydrogen and calcium
  Power: Star X is eight times more powerful than star Y.
- **B:** Composition: Alpha, calcium and hydrogen; Beta, helium and hydrogen
  Power: Beta is twelve times more powerful than Alpha.
- **C:** Composition: Delta, helium and hydrogen; Gamma, calcium and hydrogen
  Power: Delta is eight times more powerful than Gamma.

Performance Check A: Suppose that the light from two different stars, X and Y, is passed through a spectroscope. Their spectra and the spectral lines of some common elements are also given below. Use the spectra and the data in the table below to say as much as you can about the two stars. You should include a comparison of their composition and power (wattage) in your answer.



STAR	DISTANCE FROM EARTH	TEMPERATURE RISE IN SUN-ENERGY MEASURER
X	30 light-years away	13.6°C
Y	15 light-years away	6.8°C

Remediation: (1) Have the student review pages 6 through 9 if he has trouble with the concept of spectral lines. (2) If the relationship among distance, power, and ΔT of the sun-energy measurer presents a problem, have him review page 21. (3) Review with him question 7-4 on page 65 and Self-Evaluations 7-2 and 7-3.

---

10 03 Core 16

Defines *transit*.

The student recalls the definition for the term *transit* as it applies to the movement of planets.

Student Action: Responding to the effect that the term *transit* refers to the apparent passing of a planet across the face of another heavenly body, such as the sun.

Performance Check A: The term *transit* is often used when talking about planets. What is the definition for the term *transit* when referring to the sun and its planets?

Remediation: (1) Have the student review Figures 7-4 and 7-5 and the paragraph between them, beginning on page 66.

---

10 03 Exc 5-1 1

Calculates the power of a telescope.

The student applies the mathematical relationship that

$$\text{Power} = \frac{\text{focal length of object lens}}{\text{focal length of eyepiece}}$$

Student Action: Calculating the power of the telescope within ±5%.

A: 9 ±0.5
B: 8 ±0.4
C: 6 ±0.3

Performance Check A: Frances made a telescope. The object lens of her telescope has a focal length of 27 cm. The eyepiece lens has a focal length of 3 cm. Use the formula given below to calculate the power of the telescope.

$$\text{Power} = \frac{\text{focal length of object lens}}{\text{focal length of eyepiece}}$$

Remediation: (1) Review the student's answer to question 1 on page 94. (2) If necessary, discuss the activities in Excursion 5-1, which relate to the power of a telescope and discuss the implications on the image size of using lenses of different focal lengths. (3) Have the student do an alternate check.

---

10 03

Selects the focal length of a lens on a diagram.

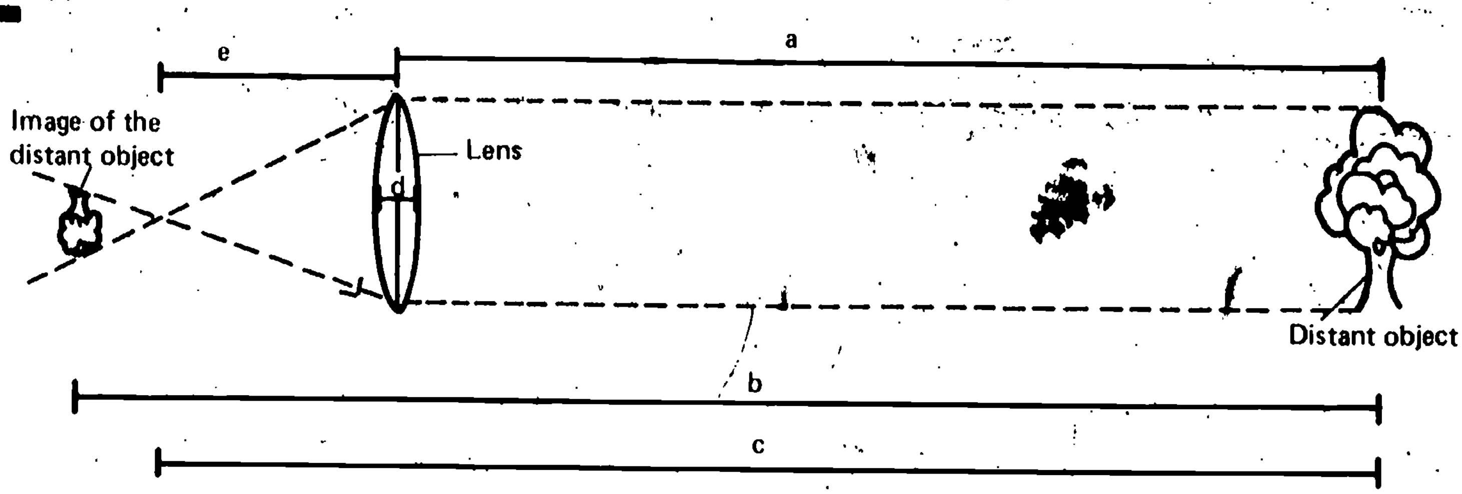
The student applies the concept that the focal length of a lens is the distance between the lens and the focal point (focus).

Exc 5-1 2

Student Action: Selecting the line which indicates the distance between the lens and the point at which the lines of light are shown to converge.

A: e
B: a
C: b

Performance Check A: Select the letter of that line on the diagram below which best represents the focal length of the lens.



Remediation: (1) Have the student review the definition of *focus* on page 94 and Activity 1, page 95, which identifies the distance which represents the focal length of a lens. (2) If the student objects to the use of the focal point in the performance check rather than the focused image as used in Excursion 5-1, point out to him that these distances are nearly the same and that the focused image was a convenient approximation used in the excursion.

IO 03 Exc 5-1 3

Measures the focal length of a lens.

The student applies the procedure for measuring the focal length of a specific lens.

Regular Supplies: 1 cardboard, 15 cm square, with white surface
1 meterstick
masking tape

Special Preparations: A convex lens with a focal length of about 10 cm should be kept in the supply area and marked IO-03-Exc 5-1-3.

Student Action: Reporting the focal length within ±10%.

Performance Check A: Get the lens marked IO-03-Exc 5-1-3 and a meterstick, masking tape, and a piece of cardboard, 15 cm square, with a white surface. With your text open to page 95, follow the directions in Activity 1 and measure the focal length of the lens.

Remediation: Work through the activity with the student.

ERIC

Locates the positions of lenses for a telescope.

10
03
EXC
5-1
4

The student applies the concept of lens positioning for a telescope.

Student Action: Indicating that the lens with the short focal length is placed near the eye and the lens with the longer focal length is placed farther from the eye and stating that for maximum magnification their spacing is the sum of their focal lengths.

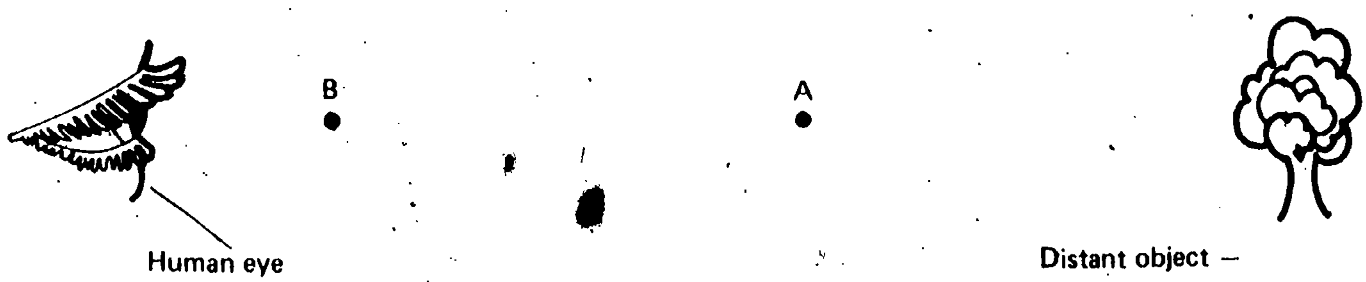
A: 1. 4 cm
2. 25 cm
3. 29 cm

B: 1. 55 cm
2. 5 cm
3. 60 cm

C: 1. 80 cm
2. 4 cm
3. 84 cm

Performance Check A: Two lenses with focal lengths 4 cm and 25 cm are to be used to make a telescope to magnify the distant object shown below.

1. What should be the focal length of the lens at B?
2. What should be the focal length of the lens at A?
3. Approximately how far apart will the lenses have to be placed to get the maximum magnification?



Remediation: (1) Check the student's answer to question 8 on page 97. (2) Have him review Figure 2 on page 93 and discuss it with him if necessary. (3) Suggest that he do an alternate check.

States why calendars were invented.

10
03

The student recalls why calendars were invented.

Student Action: Responding, in effect, that they were invented so that people could tell the time of the year more accurately and could describe or predict when important events had or were going to happen.

Exc 6-1 1

Performance Check A: For many thousands of years people did not have calendars. Explain why people began to develop and use calendars.

Remediation: (1) Refer the student to the second paragraph on page 99. (2) Ask him how he could keep track of when the last day of school comes without a calendar.

---

10 03 Exc 6-1 2

States the reason for rejecting older calendars.

The student recalls why it was necessary to reject older calendars.

Student Action: Responding to the effect that the early calendars were not accurate enough for the seasons to begin in the same calendar month each year and, therefore, had to be frequently adjusted.

Performance Check A: Throughout the past several thousand years many different calendars have been devised and rejected. Explain why these older calendars were rejected.

Remediation: Ask the student to review Excursion 6-1.

---

10 03 Exc 6-1 3

Explains the reason that historical events sometimes have two dates.

The student recalls the consequence of the changeover from one calendar to another.

Student Action: Responding to the effect that the date an event occurred is sometimes reported according to the calendar used at the time of the event and sometimes according to today's calendar and so dates from each of the calendars are given in different texts.

Performance Check A: John has found several history books that say that the Pilgrims landed at Plymouth Rock on December 21, 1620. Other books report December 11, 1620, as the landing date. Explain why two different dates are listed for the same event.

Remediation: Have the student review the section of Excursion 6-1 entitled "The Gregorian Calendar" on pages 103 and 104.

Selects a reason why one model is better than another.

10 03 Exc 6-2 1

The student applies the concept for determining whether one model is better than another.

Student Action: Selecting the option which states that Copernicus's model agreed more closely with Galileo's observations.

A: d
B: b
C: e

Performance Check A: Galileo decided to accept the Copernican model of the solar system and reject the Ptolemaic model. Select the best reason that Galileo could have had for accepting one model and rejecting the other.

a. The Copernican model had been thought up more recently.
b. All the other scientists believed in the Copernican model.
c. Copernicus's model was more logical, and it was just common sense to reject Ptolemy's model.
d. Copernicus's model agreed more closely with Galileo's observations.
e. Copernicus was an important official in the church.

Remediation: (1) Refer the student to the paragraph below Figure 2 on page 106. (2) Review his answers to questions 1 and 2.

Recognizes Ptolemy's and Copernicus's models of the solar system.

10 03 Exc 6-2

The student identifies Ptolemy's and Copernicus's models of the solar system.

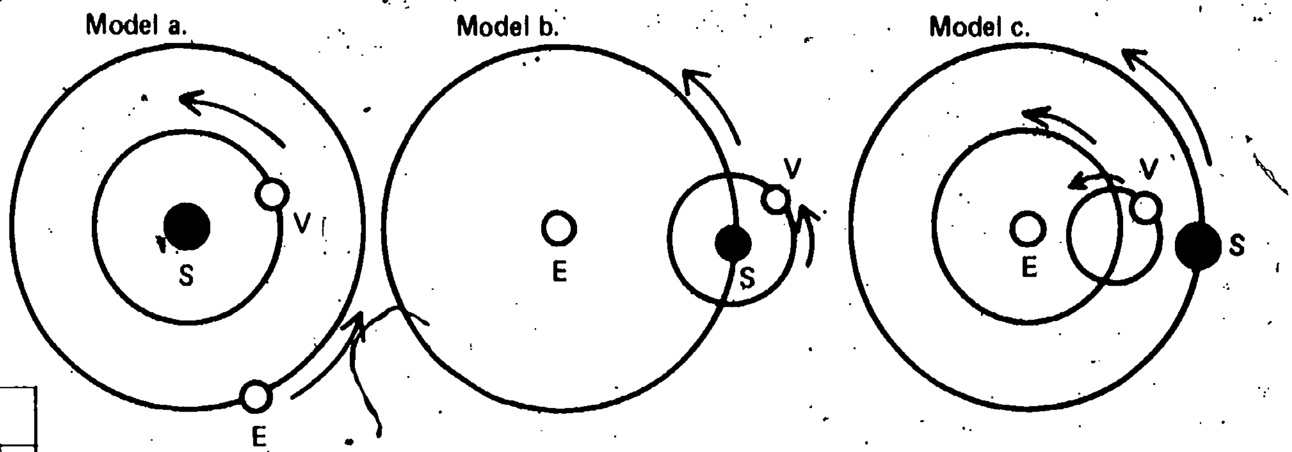
Student Action: Selecting the earth-centered system with Venus traveling around a deferent as Ptolemy's model and the sun-centered system with the earth and Venus in circular orbits around the sun as Copernicus's model.

A: 1. c, 2. a
B: 1. c, 2. b
C: 1. a, 2. b

2

Performance Check A:

1. Identify the model shown below which represents Ptolemy's model of the solar system.
2. Identify the model below which represents Copernicus's model of the solar system.



KEY	
SYMBOL	BODY
S	sun
V	Venus
E	earth

Remediation: (1) Have the student review Excursion 6-2, particularly Figures 1 and 2. (2) Have him answer an alternate check.

10
03
Exc
7-1
1

States the variable besides work involved in power.

The student recalls time as the variable in addition to work involved when calculating power.

Student Action: Naming time as the variable.

Performance Check A: Work is one of the two variables required to calculate power. Name the other variable.

Remediation: (1) Have the student reread the paragraph below Figure 3 on page 108. (2) Ask the student if it would require a more powerful engine to accomplish a certain amount of work in less time.

10
03

States the scientific meaning of the term *power*.

The student recalls the definition of the term *power* when it is used in the scientific sense.

Student Action: Responding to the effect either that power is the rate at which work can be done or that it is the rate at which energy can be transferred.

Performance Check A: The city has just purchased an electrical generator which has more power than the one it was using before.

What is the meaning of the term *power* as used in the sentence above?

Remediation: (1) Refer the student to the definition given in the third paragraph below Figure 3 on page 108. (2) If the student seems to have an inadequate knowledge of energy, suggest that he repeat Excursion 2-1. (3) If you think he may not recognize that time is a variable in determining power, have him do Performance Check IO-03-Exc 7-1-1.

Exc 7-1 2

Interprets the use of the word *powerful* in a statement.

The student applies the scientific definition of *power*.

Student Action: Responding affirmatively and to the effect that power is a measure of the rate at which work can be done and that if a device performs more work in the same amount of time or less than another it could scientifically be called a powerful device.

Performance Check A: In Excursion 7-1, the terms *power* and *powerful* were defined as they are used by scientists. A heavy-equipment manufacturer advertises his new line of bulldozers as more powerful than last year's models.

1. Is this manufacturer using the word *powerful* in the same way a scientist does?
2. Explain your answer.

Remediation: Have the student review Excursion 7-1, page 107.

IO 03 Exc 7-1 3

Calculates by the method of squares.

The student applies the rule that the intensity of radiant energy varies inversely as the square of the distance from the source.

Student Action: Reporting the power of the new source correctly within ±10%.

- **A:** 12,100 ±1210 watts
- **B:** 6,050 ±605 watts
- **C:** 6,075 ±608 watts

Performance Check A: Kate found that her sun-energy measurer warmed up 12°C when it was held 25 cm from a 100-watt bulb. Use the method of squares to calculate the power of the light bulb that would have the same heating effect at a distance of 275 cm.

Remediation: (1) Review the student's answer to question 4 on page 111. (2) Refer him to the paragraph preceding and following question 4 on page 111. (3) Review his answer to question 5 on page 111.

IO 03 Exc 7-2 1

ERIC

10
03
Exc
7-2
2

Squares numbers.

The student applies the concept that a number is squared by multiplying it by itself.

Student Action: Reporting the squares of at least two of the three numbers correctly.

A: 1. 49, 2. 81, 3. 256
B: 1. 9, 2. 64, 3. 196
C: 1. 16, 2. 36, 3. 289

Performance Check A: Square each of the following numbers.

1. 7
2. 9
3. 16

Remediation: (1) Have the student review the definition of *square* on the bottom of page 110. (2) Review his answers to questions 2 and 3 on page 111.

What's Up? **WU**

WU 01

Chapters 1 and 2

Excursion 2-1

Performance Check

Summary Table

Objective Number	Objective Description
WU-01-Core-1	Fuels and launches a water rocket
WU-01-Core-2	Measures height, using a quadrant
WU-01-Core-3	States reasons for using indirect rather than direct methods to measure height
WU-01-Core-4	Reads a height from an angle-height conversion table
WU-01-Core-5	States the reason for repeating measurements
WU-01-Core-6	Defines *performance* operationally for a water rocket
WU-01-Core-7	States why only one experimental variable is changed at a time
WU-01-Core-8	States a procedure to study a specific variable
WU-01-Core-9	States variables involved in water-rocket experiments
WU-01-Core-10	Names a system, subsystems, and components in a diagram
WU-01-Core-11	Draws arrows to show the direction of force for pressurized gas
WU-01-Core-12	Draws an arrow showing the direction of an unbalanced force
WU-01-Core-13	States how an unbalanced force can be measured
WU-01-Core-14	States a method for measuring the initial thrust of a water rocket
WU-01-Core-15	States properties of measuring devices necessary for comparing data
WU-01-Core-16	Designs a plan to measure the effect the speed of water through jets has on an unbalanced force
WU-01-Core-17	States the effect of location on a rocket's unbalanced force
WU-01-Core-18	States reasons for experimenting with simplified systems

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
	M	O			T	√				manipulates	
	M		P	Q	T	√				manipulates	
										generates	
				Q		√				applies	
						√				applies	
										recalls	
						√				applies	
					T					generates	
						√				recalls	
										applies	
				Q		√				applies	
										applies	
										applies	
									√	generates	
						√				applies	
									√	generates	
										applies	
						√				recalls	

WU 01

Objective Number	Objective Description
WU-01-Core-19	Cleans up the work area at the close of class
WU-01-Core-20	Cooperates with lab partners
WU-01-Core-21	Returns equipment promptly to storage areas
WU-01-Core-22	Responds to text questions
WU-01-Core-23	Shows care for laboratory materials
WU-01-Exc 2-1-1	Defines *force* operationally
WU-01-Exc 2-1-2	Defines *unbalanced force* operationally

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
		O				√				chooses	
		O				√				chooses	
		O				√				chooses	
		O				√				chooses	
		O				√				chooses	
						√				recalls	
						√				recalls	

ERIC

WU 01 Core 1

Fuels and launches a water rocket.

The student manipulates the water rocket and air pump, filling the rocket with water to the designated level, attaching the air pump to the rocket, pointing the rocket upward, pumping a maximum of twenty strokes of air into the rocket, bracing his hands, and pulling on the trigger release slide.

Regular Supplies: 1 water rocket
1 air pump
1 funnel
1 100-ml beaker
1 meterstick (or post) for support
water

Student Action: Launching the rocket approximately straight up over an open area.

Performance Check A: Get a water rocket with its pump and funnel, a meterstick, a 100-ml beaker, and some water. Tell your teacher you are ready to be observed. With the observer, go to the place outside designated by your teacher, and launch the rocket, using 50 ml of water.

Remediation: (1) Have the student review Activities 1-1 through 1-4 on pages 2 and 3 for the proper launching procedures. Stress the importance of following directions. (2) Have a student who was successful in fueling and launching a rocket help the student who is having difficulty.

WU 01 Core 2

Measures height, using a quadrant.

The student manipulates the quadrant to measure an angle that corresponds to a specified height 7.6 meters from a specific spot in the classroom.

Regular Supplies: 1 quadrant
1 meterstick

Special Preparations: Place three marks on the classroom walls: one mark one meter above the floor where the walls intersect at a corner of the room, a second mark one meter above the floor on the wall directly below the clock, and a third mark one meter above the floor ~~on the~~ wall below the blackboard. Then mark and label as A, B, or C three spots on the classroom floor. The spot for WU-01-Core-2A should be 7.6 meters from the mark you made on the wall intersection in one corner of the room. The spot for WU-01-Core-2B should be 7.6 meters from the mark you made on the wall directly below the clock. The spot for WU-01-Core-2C should be 7.6 meters from the mark you made on the wall below the blackboard. Record the correct answers for each check in the Student Action below.

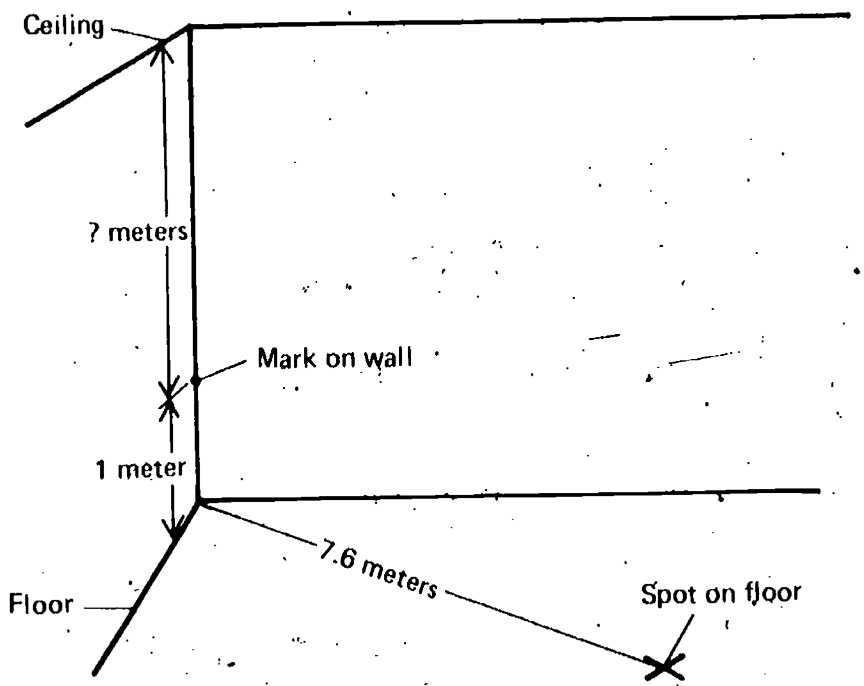
Student Action: Reporting the height that corresponds to the nearest 5° angle.

A: Height of classroom ______

B: Height of top of clock ______

C: Height of top of blackboard ______

Performance Check A: Get a quadrant and a meterstick. Study the diagram below. Station yourself at the spot on your classroom floor which is 7.6 meters from a corner designated by your teacher. Use the quadrant and the table below to measure the difference in height between the ceiling of your classroom and the mark 1 meter off the floor.



HEIGHT CONVERTER FOR OBSERVER AT 7.6 METERS									
Angle	0°	5°	10°	15°	20°	25°	30°	35°	40°
Height (in m)	0	0.7	1.3	2.1	2.8	3.6	4.4	5.3	6.4

Remediation. (1) Have the student review pages 6 and 7 with another student who successfully completed the activities. (2) Have him redo the performance check with the aid of the more successful student.

States reasons for using indirect rather than direct methods to measure height.

The student generates an explanation for using indirect methods to measure the height of the water rocket's flight.

Student Action: Stating at least two of the following or examples of them:

1. Indirect methods involve less equipment or more available equipment.
2. Indirect methods are easier to use.
3. Indirect methods produce more accurate results than direct measurements.
4. Indirect methods can be done more quickly.
5. Indirect methods do not affect the variable being measured.
6. Indirect methods are the only ones that seem possible in the situation.

WU 01 Core 3

Performance Check A: Rather than measuring the height of the rocket's flight directly, you made an indirect measurement of height. To do this, you estimated the angle size. What are the advantages of finding the height indirectly?

Remediation: (1) Have the student review the top paragraph on page 19. (2) Have the student answer the following problem.

Suppose you wanted to know the height of a mountain. There are several ways to measure it. Here are three.

1. Fly a helicopter to the top of the mountain, and drop a chain until it touches the base of the mountain. Mark and measure the length of the chain.
2. Climb the mountain. Dig a shaft down through the mountain and measure its height.
3. Measure the angle size with an altitude measurer at a distance of 1,000 meters from the mountain. Using a conversion table similar to Table 1-1 but for a distance of 1,000 meters, calculate the height of the mountain.

What are some advantages of using method 3?

WU 01 Core

- Reads a height from an angle-height conversion table.

The student applies the procedure of reading an angle-height conversion table.

Student Action: Stating the distance that corresponds to the given angular measurement in the angle-height conversion table.

A: 53.6 meters
B: 141.8 meters
C: 29.8 meters

Performance Check A: Use the table below to answer the question that follows.

HEIGHT CONVERTER FOR OBSERVER AT 25 METERS									
Angle	0°	5°	10°	15°	20°	25°	30°	35°	40°
Height (in m)	0	2.2	4.4	6.9	9.1	11.7	14.4	17.5	21.0
Angle	45°	50°	55°	60°	65°	70°	75°	80°	85°
Height (in m)	25.0	29.8	35.7	43.3	53.6	68.7	93.3	141.8	285.8

Suppose you were an observer standing 25 meters from the site of a rocket launch. When the rocket was at its maximum height, you measured the angle to be 65°. What was the maximum height to which the rocket climbed?

Remediation: (1) Review with the student his answers to questions 1-4 and 1-5 on pages 7 and 8. (2) Review his answer to Self-Evaluation 1-3. (3) If he cannot read a height from the table when given the angle, help him practice using the table.

4

States the reason for repeating measurements.

The student applies the concept that experimental measurements should be repeated.

Student Action: Stating, in effect, that several measurements are made of the same thing in order to reduce the effects of the random errors in individual measurements.

Performance Check A: When you and your team members measured the maximum heights of the rocket's flights, there were two observers. Why were two observers used to make each of the measurements rather than just one?

Remediation: Review the student's answer to Self-Evaluation 1-4. (2) Review his answers to questions 1-1, 1-2, and 1-3 on page 7, emphasizing the note to the teacher found in the margin on page 7 of the Teacher's Edition.

WU 01 Core 5

Defines *performance* operationally for a water rocket.

The student recalls the operational definition of *performance* for a water rocket.

Student Action: Responding to the effect that it is the maximum height to which the rocket rises when it is launched.

Performance Check A: Write an operational definition for *performance* for a water rocket, based upon your activity with the quadrant.

WU 01 Core 6

ERIC

Remediation: (1) Have the student read the two paragraphs immediately following question 1-6 on page 8 of the text. The main emphasis in those paragraphs is the height reached by the rocket. (2) If the student just doesn't understand the term *operational definition* or if you believe he needs practice in writing operational definitions, refer him to Excursion 1-2, "Writing Operational Definitions," on page 91 of the Level III text *Why You're You.*

WU 01 Core 7

States why only one experimental variable is changed at a time.

The student applies the concept that in an experiment, only one variable is changed at a time.

Student Action: Stating, in effect, that in an experiment, only one variable is changed at a time so that the effects of changes in the experimental variable can be identified as related to that variable alone and cannot be confused with effects produced by changes in other variables.

Performance Check A: You designed an experiment to determine the effects of changing the amount of air and water in a rocket. You were told to change only one of those variables at a time. Why was this important?

Remediation: (1) If a Level II text is available, have the student review Excursion 4-1, Part A, "Holding Variables Constant," pages 381 through 386. (2) Ask him how he would determine what effect each of the variables had on the rocket's behavior without checking them independently. If necessary, point out that the variables might have had opposite effects.

WU 01 Core 8

States a procedure to study a specific variable.

The student generates a procedure for investigating the effect of a specific variable on the performance of a rocket.

Student Action: Stating a procedure which includes a way of systematically changing the variable to be investigated while holding the other variables constant so as to investigate the effect of the variable on a rocket's performance.

Performance Check A: One variable that might affect the performance of the water rocket you used in the activities is the weight of the empty rocket. Design a procedure you could use to investigate the effect of this variable.

Remediation: (1) Review the student's experimental plan in Problem Break 1-1 on page 8. (2) If a Level II text is available, have the student review "Holding Variables Constant," Part A of Excursion 4-1, pages 381 through 386.

ERIC

States variables involved in water-rocket experiments.

WU 01 Core 9

The student recalls the two variables which affect the performance of a water rocket.

Student Action: Stating that the two variables are the amount of water the rocket contains and the number of strokes of air forced into the rocket.

Performance Check A: What are the two variables that affect the performance of the water rocket you used in class activities?

Remediation: (1) Have the student review Activities 1-1 and 1-3 on pages 2 and 3. (2) Review the student's answers to questions 1-7 and 1-8 on page 9. (3) Review his answer to Self-Evaluation 1-5a.

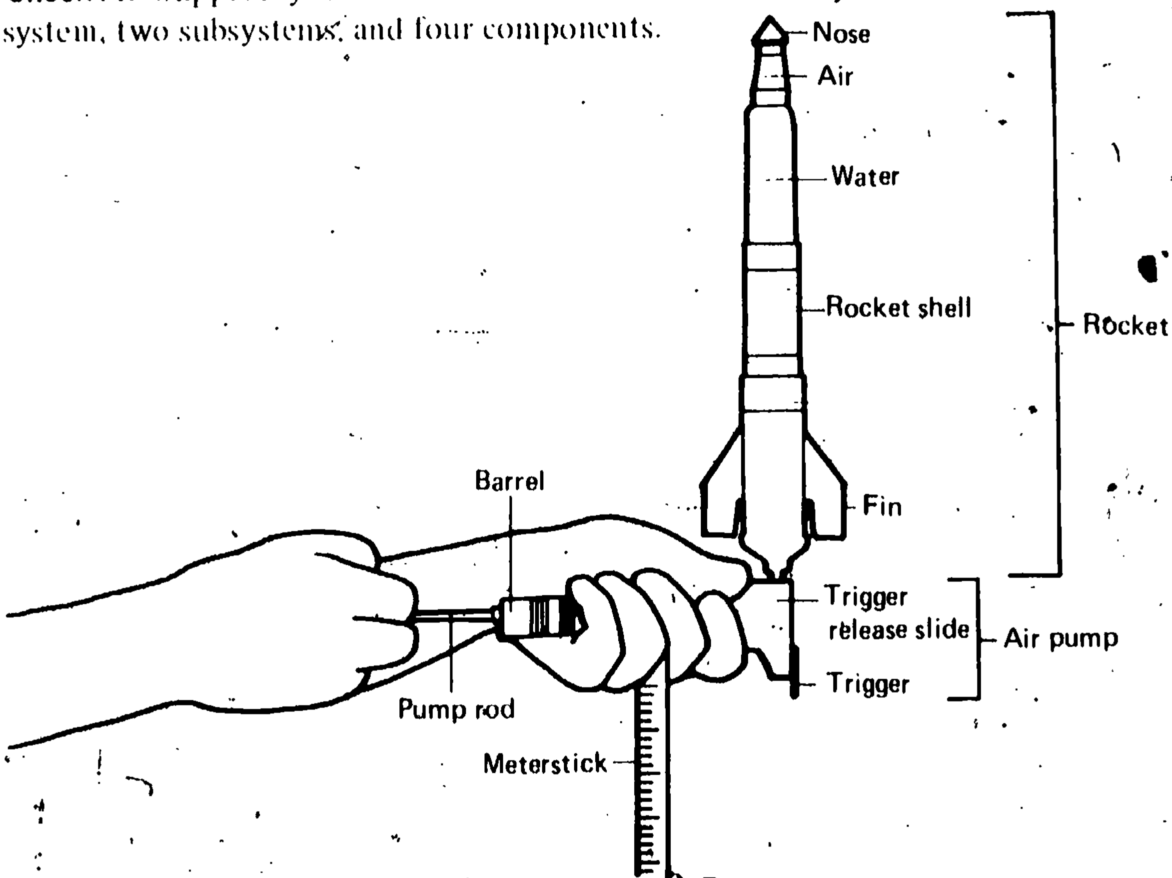
Names a system, subsystems, and components in a diagram.

WU 01 Core 10

The student applies the concepts that a system is a group of objects that influence each other, a subsystem is a group of two or more objects which directly influence each other within the system, and a component is an individual part of the system.

Student Action: Naming the rocket and launcher as a system, the parts of the air pump and the rocket itself as two subsystems, and any four of the following as components: (1) pump rod, (2) barrel, (3) trigger, (4) trigger release, (5) water, (6) rocket shell, (7) fin, (8) air, (9) nose; or any other combination that fits the definitions of *system, subsystem,* and *component.*

Performance Check A: Suppose you had the rocket shown below ready to launch. Identify one system, two subsystems, and four components.



Remediation: (1) If a Level I text is available, have the student read from the middle of page 8 to the bottom of page 9. (2) Have the student read page 11 in the Level III text *Environmental Science* for a review of systems, subsystems, and components. (3) Perhaps the student correctly identified either the rocket or the air pump (launcher) as a system and then had difficulty in identifying a subsystem of his system. Explain that the subsystem needs a minimum of two interacting components.

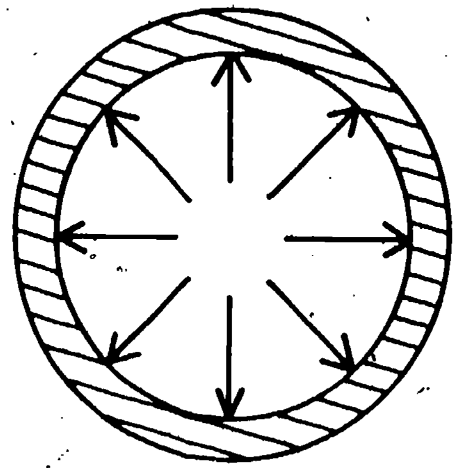
WU 01 Core 11

Draws arrows to show the direction of force for pressurized gas.

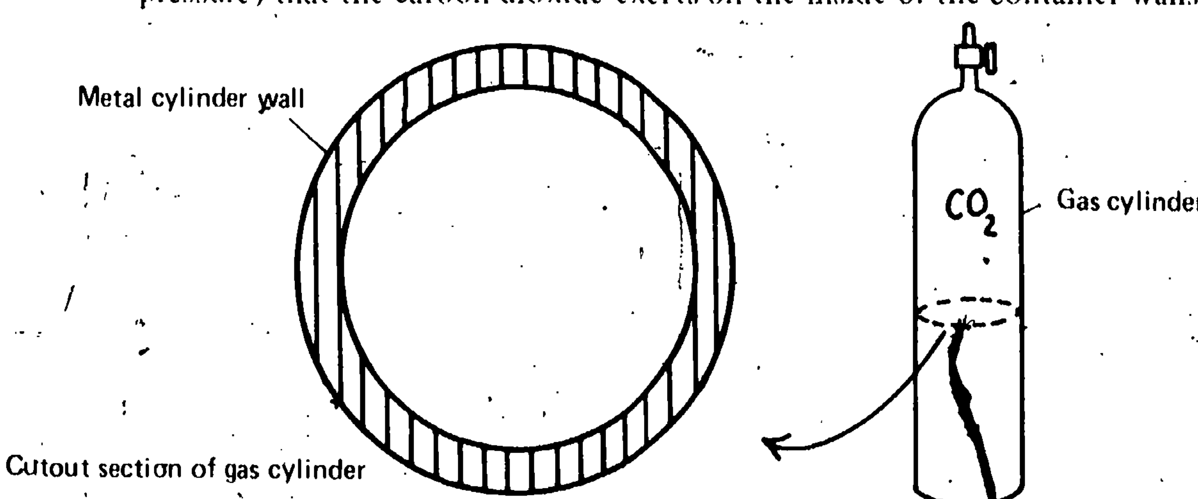
The student applies the concept that a confined gas under pressure exerts an equal force in all directions.

Student Action: Drawing arrows of approximately equal length that point radially outward in all directions against the inside of the container.

A, B, and **C:**



Performance Check A: The gas cylinder shown below is filled with carbon dioxide gas under pressure. The diagram also shows a cutout section of the container. Copy the cutout section onto your answer sheet. Draw arrows to show the force (the pressure) that the carbon dioxide exerts on the inside of the container walls.



Remediation: (1) Refer the student to the top paragraph and Figure 2-1 on page 13. (2) Review the diagram in Self-Evaluation 2-1 with the student.

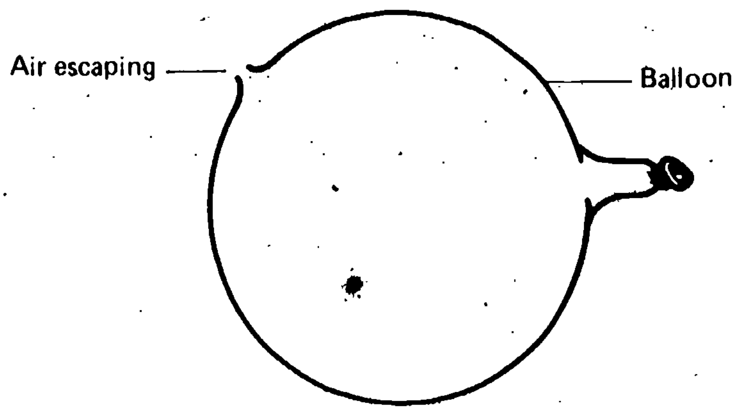
Draws an arrow showing the direction of an unbalanced force.

The student applies the concept that the reaction force on an object acts in the direction opposite to the direction in which the gas is escaping.

Student Action: Drawing an arrow in the direction opposite to that of the escaping gas.

WU 01 Core 12

Performance Check A: Shown in the diagram below is a balloon with air escaping through a hole in its side. Copy the diagram onto your answer sheet, and draw an arrow to show the direction of the unbalanced force acting on the balloon.



Remediation: (1) Have the student read the second paragraph on page 13. (2) Have him look at Figure 2-2. (3) Review his answer to Self-Evaluation 2-1.

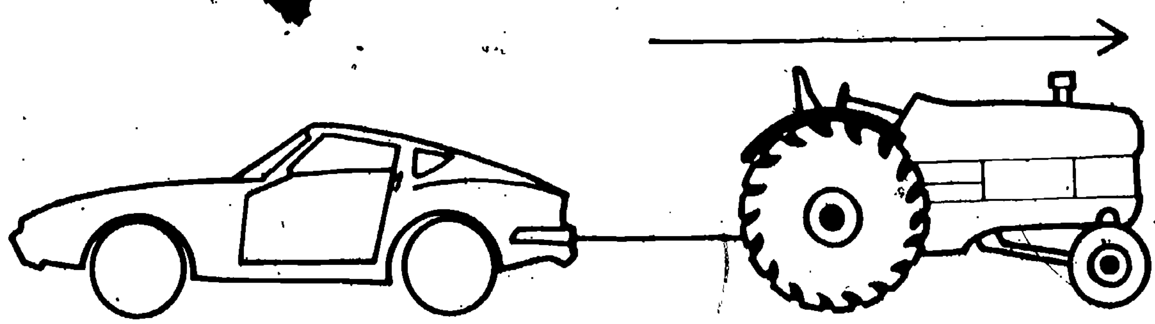
States how an unbalanced force can be measured.

The student applies the concept that an unbalanced force can be measured in the same way that a single force can be measured.

Student Action: Responding to the effect that the unbalanced force can be measured with a force measurer.

WU 01 Core 13

Performance Check A: Cyrus has a toy tractor and a toy car, both operated by batteries. When he hooks them up as shown in the diagram below, they each exert a force in opposite directions. However, the toys move in the direction shown by the arrow. Therefore, an unbalanced force is acting, since the tractor pulls the car backwards. How could this unbalanced force be measured?



ERIC

Remediation: (1) Refer the student to Activities 2-1 through 2-3 on pages 11 and 12 for an example of a force measurer being used to measure an unbalanced force. (2) The idea of an unbalanced force's being measured by a force measurer is summarized in the second paragraph of page 13.

WU 01 Core 14

States a method for measuring the initial thrust of a water rocket.

The student generates a method for measuring the initial thrust of a water rocket, which involves the idea of connecting a force-measuring device to the rocket and then releasing the rocket from its launcher.

Student Action: Stating a method which includes the idea of properly connecting a force-measuring device to the rocket and then releasing the rocket from its launcher.

Performance Check A: Suppose you want to measure the initial thrust, or force, of your water rocket. Describe a method that you might use to measure this thrust.

Remediation: (1) Review page 21 with the student, from Problem Break 2-3 through question 2-23. (2) Discuss together how measuring force by measuring the extent to which the force-measurer blade bends applies to the performance check.

WU 01 Core 15

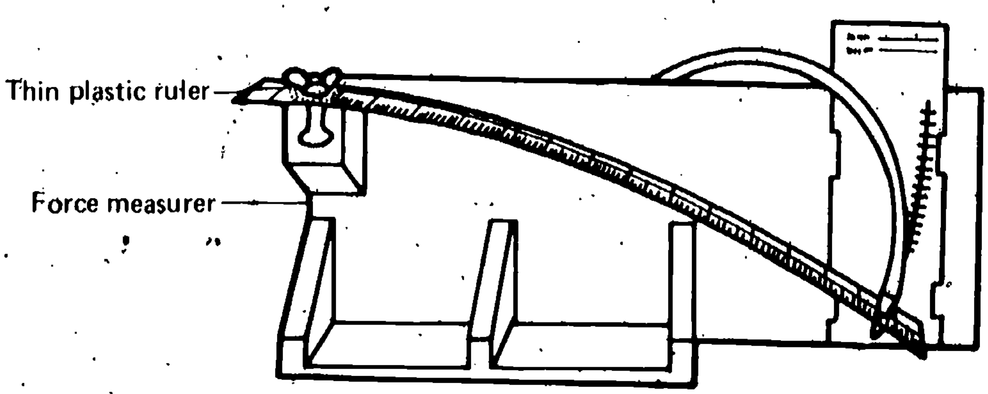
States properties of measuring devices necessary for comparing data.

The student applies the concept that measuring devices must be calibrated against a standard if the values of measurement made with them are to be easily compared.

Student Action: Stating, in effect, that the rulers and the units must be identical because comparisons of results depend upon getting similar numerical results when making the same measurement.

Performance Check A: You made your force measurer more sensitive when you used a thin plastic ruler, as shown below. Suppose you wanted to compare your results with your classmates' results.

1. What would have to be true of all the rulers?
2. Would your classmates have to use the same units to mark their scales?
3. Explain your answer to question 2.



Remediation: (1) Ask the student if the thickness of the blade affects the amount the blade bends when a force is applied to it and what affect it would have on measurements if the ruler blades were different. (2) Put a ruler blade on the force measurer. Have the student apply the same small force to the ruler blade, but read the answer first using the 0 to 1 N card and then the 0 to 10 N card. Ask him if using different size units changes the measurement he reports. (3) Ask him how he and a classmate could compare their measurements of a certain force if they both used rulers and units that were different.

WU 01 Core 16

Designs a plan to measure the effect the speed of water through jets has on an unbalanced force.

The student generates a description of a procedure to find the effect on an unbalanced force of changing just the speed at which water leaves a jet.

Student Action: Responding with a procedure that includes the ideas of (1) changing the size of the jet, (2) adjusting the rate of flow so that a standard volume of water flows from the jet in a certain amount of time, (3) measuring the speed of flow, and (4) measuring the unbalanced force using a force measurer.

Performance Check A: Gerry wanted to find out what effect the speed at which water left a jet had on the unbalanced force. He wanted to keep the rate of flow the same and change only the speed. In the storeroom, he found some water jets that had different-sized openings. Describe a plan that Gerry could carry out to measure the effect on the unbalanced force of changing the speed at which water leaves a jet.

Remediation: (1) Refer the student to Activity 2-8 on page 18 for information about obtaining a standard flow of water. (2) Refer him to the top half of page 19 for information about measuring the speed of flowing water directly.

WU 01 Core 17

States the effect of location on a rocket's unbalanced force.

The student applies the concept that the thrust produced by a jet is less when it discharges into a fluid than when it discharges into empty space.

Student Action: Stating that the greater thrust (unbalanced force) is produced in a vacuum and, in effect, that the rocket thrust is less when a rocket discharges into matter (a fluid).

Performance Check A:

1. Will a rocket produce a greater unbalanced force when it is in the near vacuum of outer space or when it is still in the atmosphere?
2. Explain your answer.

Remediation: (1) Review the student's answers to questions 2-20 through 2-22 on page 21. (2) Review his answer to Self-Evaluation 2-5.

ERIC

WU 01 Core 18

States reasons for experimenting with simplified systems.

The student recalls the reasons that simplified rather than larger, more complex systems are studied.

Student Action: Stating the effect of two of the following: (1) to decrease the expense and time of investigation, (2) to have a more manageable and easily observed system, and (3) to control variables more easily.

Performance Check A: You studied a simple rocket system rather than a complex Saturn rocket system. Give two reasons why experiments are performed on simplified systems rather than on more complex systems.

Remediation: Discuss the following situation with the student.

Suppose that two engineers at the Space Center in Houston want to study the effect of temperature on the surface coating of a particular metal shield. They decide to expose a piece of the coating to various temperatures in a heating chamber at the Center. Another engineer suggests that a flight to the moon should be made to test the metal shield. The two engineers agrue that it is better to use a simplified system at the Center to study the temperature effect rather than the complex system in outer space. Their argument is based on four considerations, comparisons of

1. the expense and time required for investigation,
2. the ease of observation,
3. the manageability of the system, and
4. the control of variables.

If you were one of the two engineers, what would your arguments be?

WU 01 Core 19

Cleans up the work area at the close of class.

The student chooses to close the laboratory activity period promptly upon receiving notification of the time to do so.

Student Action: Ceasing the ongoing laboratory activity when notified of the time, returning materials in usable, clean condition to storage, and participating in work area cleanup, on at least three separate occasions when being observed by the teacher or another designated person without his knowledge.

Teacher's Note: The opportunity for assessment of this objective arises almost every day during the course of regularly assigned laboratory activities. Use a few minutes of class time for group instruction early in the school year, and almost every week for reinforcement, to discuss the role of the student in the ISCS learning environment. To encourage personal responsibility in the student, discuss the reasons for his closing his activities promptly (to allow time for himself and others for lab-closing activities), returning materials to storage in clean condition (to facilitate their use by others), and participating in area cleanups (to leave the area as clean as he found it).

ERIC

Performance Check A: Your teacher will observe you for this check when he can.

Remediation: (1) If a student fails to accept this responsibility, approach him individually, and review the reasons for his acceptance of it. Emphasize the social responsibility for cooperation in the learning environment for the good of all students. Point out that he has received the benefit of other students' provisions for others as well as for themselves. (2) Do not, at first, suggest that he may lose his privileges unless he cooperates. But if he doesn't cooperate after you observe his behavior several times, ask him if he can suggest a proper penalty. (3) An alternative remedy may be to request him to assist in the process of overall classroom accounting of the materials for a period of time until he recognizes the importance of the student's role. (4) Do not use extra cleanup as a penalty for not cleaning up properly. In other words, don't use something as a penalty that you want done willingly.

Cooperates with lab partners.

WU 01 Core 20

The student chooses to cooperate with fellow students in the laboratory.

Student Action: Being polite, waiting his turn, being orderly when moving about, and observing the right of his classmates to work without being unnecessarily disturbed, when observed without his knowledge by the teacher or another designated person on at least three occasions.

Teacher's Note: The opportunity for assessment of this objective arises almost every day during the course of regularly assigned laboratory activities. Use a few minutes of class time at the beginning of a session for a whole-group discussion early in the school year and several times later on to discuss the need for cooperation with and consideration of other students. Some particular points for discussion include being polite, waiting patiently, not making others wait longer than necessary, being orderly when moving about, and observing the right of others not to be disturbed. Talk about each student's accepting the personal responsibility for his own behavior in the group situation.

Performance Check A: Your teacher will observe you for this check when he can.

Remediation: (1) If a student fails to accept any of these responsibilities, approach him privately and review the reasons for his lack of cooperation with his fellow students. Suggest that he pay some attention to changing his behavior to more acceptable standards. (2) Find out if the student feels that he is behaving in a less than acceptable way. If so, ask him whether he feels some penalty should be imposed and what he thinks a suitable penalty would be.

Returns equipment promptly to storage areas.

WU 01

The student chooses to show personal responsibility for returning laboratory equipment promptly to the proper storage places as soon as it is no longer needed, during the class period, and not just at the end of the period.

Core 21

Student Action: Returning equipment and materials no longer needed to the proper storage places on at least three occasions when observed by the teacher or another designated observer without his knowledge of being checked.

Teacher's Note: This objective may be assessed at any time the student is responsible for learning activities requiring the use of equipment and supplies. Use a few minutes of class time for group discussion of the reasons for returning equipment to storage areas promptly when it is not being used by the student or by his group. The reasons include (1) the short supply of certain items and the need to cooperate with others. (2) the chances of equipment's being misplaced, (3) the possibility of accidental damage to equipment, and (4) the greater opportunity for pilferage by an irresponsible student when things are disorganized.

Performance Check A: Your teacher will observe you for this check when he can.

Remediation: In a private conference, discuss the reasons for the student's cooperation in this request. Ask for that cooperation. See also Remediations (1), (2), and (3) for WU-01-Core-19.

WU 01 Core 22

Responds to text questions.

The student chooses to write in his *Record Book* the answers to 90% or more of the textbook questions.

Student Action: Exhibiting the written responses when requested to do so. At least nine out of ten questions should have responses, be they correct or incorrect.

Teacher's Note: It is intended that this objective be assessed throughout the year. Such a check provides opportunities to encourage students to work nearer their capacities while remaining independent of the teacher. Use a few minutes of class time for a group discussion of the reasons for writing the answers in the *Record Book*. Writing in the *Record Book* serves (1) to help the student think through what he sees and does, (2) to preserve ideas for future reference, (3) to make a record of the student's progress through the core, (4) to provide the teacher with a source of input for analyzing the student's difficulties and progress, and (5) to help the student learn the background ideas for conceptual understanding. Writing in the *Record Book* is "in"; writing in the text is "out."

Performance Check A: Your teacher will observe you for this check when he can.

Remediation: (1) In a private conference, discuss with the student the ideas enumerated and ask why he chooses not to write the answers. (Perhaps he cannot write!) Evaluate his reasons and counsel him accordingly. Encourage him to follow the pattern of his classmates and set down his ideas as they are doing. (2) Have him read "Notes to the Student," pages viii and ix in his text. (3) Follow up in a few days to determine his actions.

Shows care for laboratory materials.

The student chooses to show proper care and use of ISCS laboratory materials.

Student Action: Using the materials only for their intended purpose or requesting permission to do other specific experiments with them when being observed without his knowledge by the teacher or another designated person on three or more occasions.

Teacher's Note: This objective may be assessed at any time that the student is responsible for a learning activity in which equipment and supplies are required. Use a few minutes of class time for a whole-group discussion of the reasons for handling laboratory materials properly. Such reasons include: (1) If damaged, they are lost to use by students who need them now. Short supply means waiting in line. (2) They cannot readily be replaced. Replacement usually takes several months at best. (3) If materials are handled properly, they may be used for other than regular activities (with the permission of the teacher and after making a proper request).

Performance Check A: Your teacher will observe you for this check when he can.

Remediation: (1) In a private conference, ask the student why he chooses to mishandle equipment. Help him to evaluate his reasons, and ask for his cooperation in the future. If he agrees, reassess the objective later. (2) If after the conference he still does not agree, ask him if he feels that he should be penalized and what he thinks should be an appropriate penalty. Give him another opportunity for compliance. (3) If he is still uncooperative, apply a penalty for mishandling equipment. This may mean denying him use of the equipment either temporarily or permanently or taking some other suitable action.

WU 01 Core 23

Defines *force* operationally.

The student recalls the operational definition of *force*.

Student Action: Responding, in effect, that a force is that which can change an object's shape, speed, or direction and can be measured by observing the extent to which it changes the shape (how far it bends the blade of a force measurer), or motion (speed, direction, or both) of an object.

Performance Check A: State an operational definition of *force*.

Remediation: (1) Have the student review from page 101 to the top of page 103 in Excursion 2-1. (2) Ask him how he could measure the force that a water clock cart exerts on a desk. If it is necessary to show him a way to measure force, refer him to Activities 1 and 2 on page 103.

WU 01 Exc 2-1 1

ERIC

WU
01
Exc
2-1
2

Defines *unbalanced force* operationally.

The student recalls the operational definition of *unbalanced force.*

Student Action: Stating, in effect, that an unbalanced force causes a change in the motion or shape of an object and that the size of the change is a measure of the size of the force.

Performance Check A: Give an operational definition of *unbalanced force.*

Remediation: (1) Have the student review pages 101 and 102 of Excursion 2-1 if he needs help with the notion of an unbalanced force. (2) If the student needs help with the concept of an operational definition, it is presented in Level III texts *Why You're You,* pages 91 and 92, and *Investigating Variation,* pages 6 and 7.

WU 02

Chapters 3 and 4 — **Performance Check**

Excursions 3-1 thru 4-4 — **Summary Table**

Objective Number	**Objective Description**
WU-02-Core-1	Recognizes the relationship between thrust and rocket weight
WU-02-Core-2	Relates unbalanced force on objects to their distance traveled
WU-02-Core-3	Interprets water-clock cart tracks
WU-02-Core-4	Matches graphs of speed vs water-drop intervals with water-clock cart drop records
WU-02-Core-5	Relates masses of objects to their speed when equal forces are applied
WU-02-Core-6	Graphs data
WU-02-Core-7	Selects a graph showing the relationship between mass and change of speed
WU-02-Core-8	Selects the graphs showing a change in an unbalanced force vs a speed change
WU-02-Core-9	Relates the length of time an unbalanced force acts and the speed of an object
WU-02-Core-10	Relates unbalanced horizontal force and projectile range
WU-02-Core-11	Explains why the ball which fell straight down was used
WU-02-Core-12	Relates time of fall to the weight and horizontal speed of an object
WU-02-Core-13	Determines the orbiting speed of a satellite
WU-02-Core-14	Selects a graph which shows the period of a satellite vs its distance from the earth
WU-02-Core-15	Selects the graph showing the minimum orbiting speed vs height
WU-02-Core-16	States two forces that slow down rockets leaving the earth
WU-02-Core-17	Selects the graph showing the relationship between the weight of an object and its
	distance from the earth

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
						√				applies	
						√				applies	
				Q		√				classifies	
				Q		√				classifies	
						√				applies	
			P		T	√				applies	
				Q			√			applies	
				Q			√			applies	
						√				applies	
						√				applies	
										applies	
						√				applies	
				Q			√			applies	
				Q			√			identifies	
				Q						identifies	
						√				recalls	
				Q			√			identifies	

WU
02

Objective Number	Objective Description
WU-02-Core-18	States whether gravity reaches zero at some distance from the earth
WU-02-Core-19	Defines the term *period* of a satellite
WU-02-Core-20	Selects a numerical value for the period of a satellite
WU-02-Core-21	Characterizes the speed of satellites by the shape of their paths
WU-02-Core-22	Selects a diagram of a free-return path
WU-02-Core-23	States the relative rocket speed necessary for lunar orbit
WU-02-Core-24	States the purpose of a spacecraft's heat shield
WU-02-Core-25	States a way that a returning spacecraft is slowed down
WU-02-Exc 3-1-1	Explains recoil in a launching device
WU-02-Exc 3-1-2	States the effect on force of a change in the masses being ejected
WU-02-Exc 3-2-1	Calculates the thrust of a rocket
WU-02-Exc 3-2-2	Lists two ways to increase the thrust of a rocket
WU-02-Exc 3-2-3	States why rockets are built so that they burn their fuel in stages
WU-02-Exc 4-1-1	Selects a reason incorrect ideas about nature tended to be accepted for a long time
WU-02-Exc 4-1-2	Selects the variable or variables which affect the period of a pendulum
WU-02-Exc 4-2-1	Explains why scientists prefer mathematical models
WU-02-Exc 4-3-1	Selects the period necessary for a fixed-position satellite
WU-02-Exc 4-3-2	Reads a graph which has two curves on it

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
										recalls	
						√				recalls	
				Q						classifies	
				Q		√				classifies	
				Q						identifies	
						√				recalls	
						√				recalls	
						√				recalls	
										generates	
										applies	
				Q						applies	
						√				recalls	
						√				recalls	
				Q		√				applies	
				Q						identifies	
										generates	
				Q		√				applies	
				Q			√			applies	

WU 02

Objective Number	Objective Description
WU-02-Exc 4-4-1	Selects a graph showing the heating of a substance from solid to gaseous form
WU-02-Exc 4-4-2	States why a spacecraft does not burn up on reentry
WU-01-Core-7R	States why only one experimental variable is changed at a time
WU-01-Core-9R	States variables involved in water-rocket experiments
WU-01-Core-12R	Draws an arrow showing the direction of an unbalanced force

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	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
				Q			√			applies	
						√				recalls	
						√				applies	
						√				recalls	
										applies	

WU O2 Core 1

Recognizes the relationship between thrust and rocket weight.

The student applies the concept that the thrust of a rocket must be greater than its total weight for it to lift off.

Student Action: Selecting the smallest engine that provides sufficient thrust and stating in effect that the thrust of a rocket must be greater than its total weight for it to lift off.

- **A:** d
- **B:** e
- **C:** b

Performance Check A: Hank has carved a rocket out of some balsa wood. He wants to buy a small rocket engine to make it fly. Since he is short of cash, he wants the smallest engine that will launch his rocket. The rocket without the engine or fuel weighs 0.8 newtons. His catalog of engines gives the following information.

ENGINE MODEL	TOTAL WEIGHT OF ENGINE AND FUEL (in N)	THRUST (in N)
a	0.1	0.4
b	0.2	0.8
c	0.3	1.1
d	0.4	1.5
e	0.5	2.0

1. Which is the smallest rocket engine that will allow his rocket to lift off?
2. Explain the reason for your choice.

Remediation: (1) Have the student read the last paragraph on page 24. (2) Review his answers to questions 3-4 and 3-7 on page 25. (3) Review his answer to Self-Evaluation 3-1.

WU O2 Core 2

Relates unbalanced force on objects to their distance traveled.

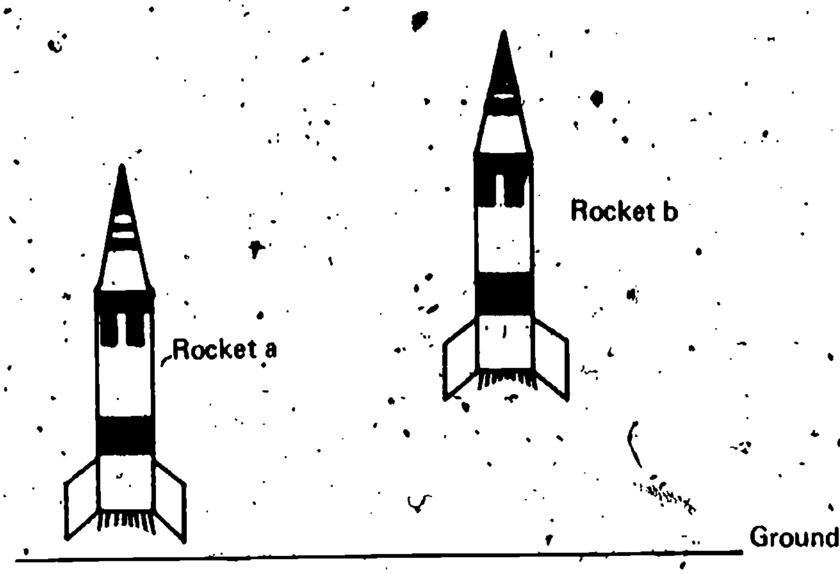
The student applies the concept that the distance a movable object will travel in a given amount of time varies directly with the size of the unbalanced force applied to it.

Student Action: Selecting the higher rocket and stating, in effect, that the greater the unbalanced force on a rocket, the farther the rocket will travel in a given amount of time.

- **A:** b
- **B:** b
- **C:** Yggi

Performance Check A: Identical rockets a and b shown below, lifted off the launch pad at the same time.

1. Which rocket has had the greater unbalanced force acting on it?
2. Explain your answer.



Remediation: (1) Have the student read the last paragraph on page 25 and the first paragraph on page 26. (2) Discuss with him Figure 3-1 on page 26. (3) If he has trouble with the concept of unbalanced force, review his answer to question 3-7 on page 25.

WU O2 Core 3

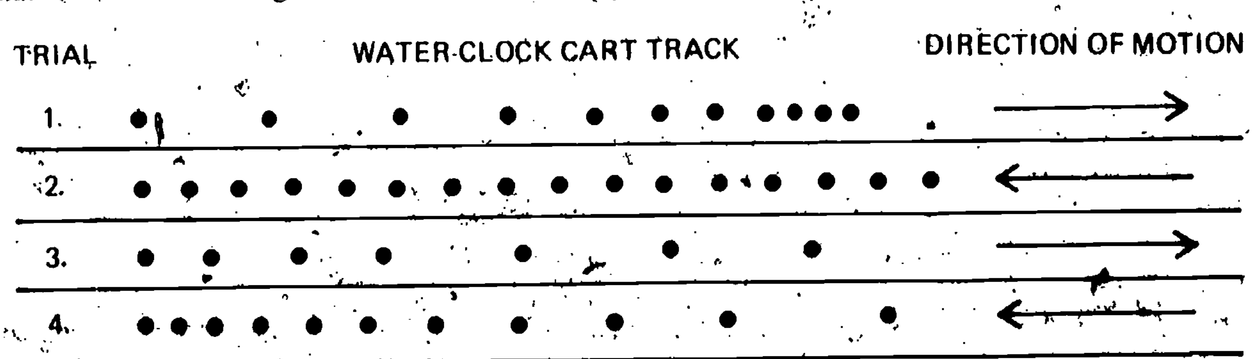
Interprets water-clock cart tracks.

The student classifies the speed of a water-clock cart as increasing if the drops become farther apart, as decreasing if the drops become closer together, or as constant if the drops are equally spaced.

Student Action: Stating whether the speed increases, decreases, or remains constant correctly for at least three of the four cases.

A: 1. decreases, 2. remains constant, 3. increases, 4. decreases
B: 1. remains constant, 2. decreases, 3. increases, 4. remains constant
C: 1. decreases, 2. increases, 3. increases, 4. remains constant

Performance Check A: The diagram below represents the water drops left by a moving water-clock cart during four trials. The arrow shows the direction of motion of the cart for each trial. Indicate whether the cart's speed increases, decreases, or remains constant during each of the four trials.



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Remediation: (1) Have the student read the paragraph above question 3-10 on page 27. (2) Review his answer to question 3-10 on page 27. (3) Review his answers to Self-Evaluation 3-3 a, b, and c.

WU O2 Core 4

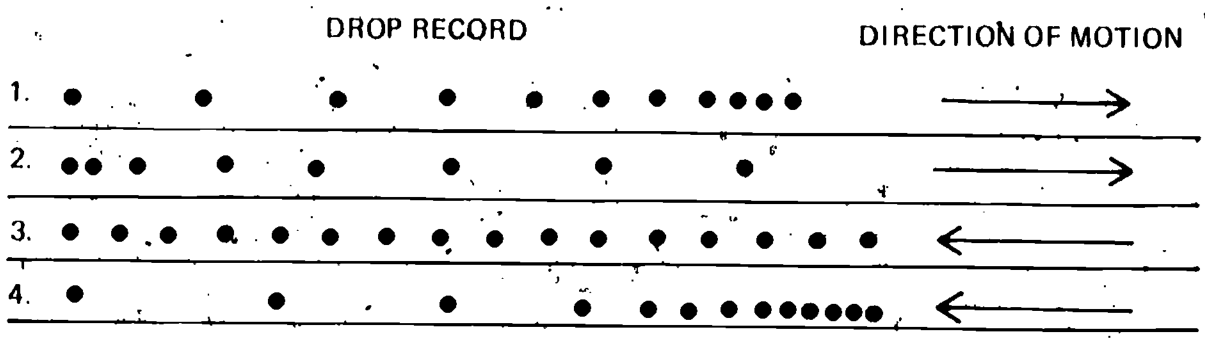
Matches graphs of speed vs water-drop intervals with water-clock cart drop records.

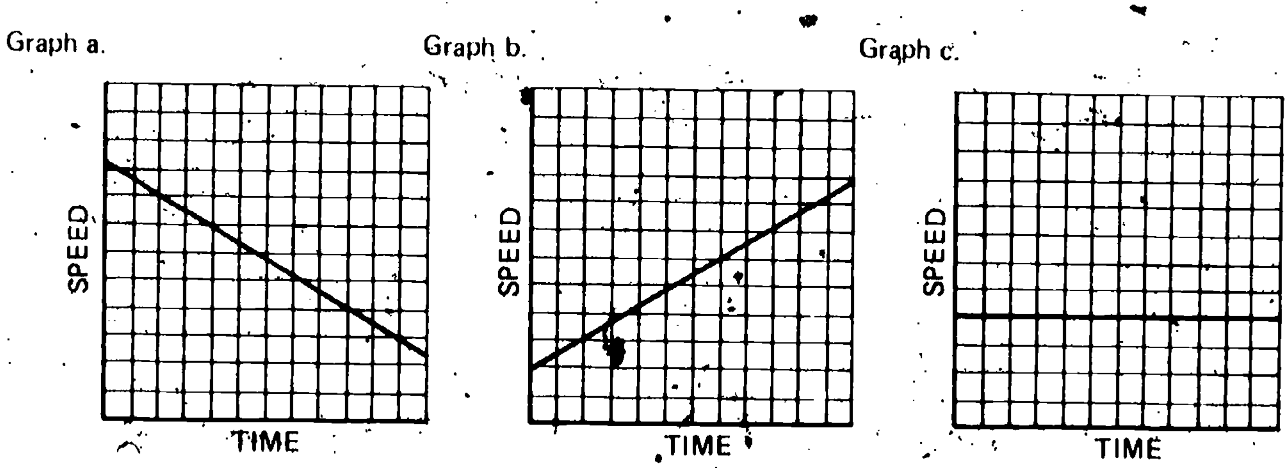
The student classifies water-clock cart records as showing the same relationships as corresponding graphs.

Student Action: Matching the water-clock cart drop record in which the drop separation increases in the direction of motion with the graph that slopes upward to the right, the record in which the drop separation decreases in the direction of motion with the graph that slopes downward to the right, and the record in which the drop separation is constant with the graph with the horizontal line.

A: 1. a, 2. b, 3. c, 4. b
B: 1. c, 2. a, 3. b, 4. b
C: 1. b, 2. a, 3. c, 4. c

Performance Check A: The graphs below show the change in speed, if any, of a water-clock cart. On your answer sheet after the number of each water-clock cart drop record shown below, write the letter of the graph that best represents the speed of the cart.





Remediation: (1) If the student simply overlooked some part of the item, have him do an alternate performance check. (2) Have the student do the following exercise. Look at Activity 3-6 and Table 3-1 on page 28. The distance between drops indicates the speed of the cart. Plot the interval numbers (1, 2, 3, and so on) versus the distance traveled between drops.

(a) What is the general shape of the graph?

(b) Is the speed decreasing, increasing, or constant?

(c) If you are not sure about the answer to b, above, look to see whether the space between intervals becomes larger, smaller, or remains the same. Remember that the time between the release of one drop and the next is the same.

(d) Now return to question b.

WU O2 Core 5

Relates masses of objects to their speed when equal forces are applied.

The student applies the concept that an object's speed varies inversely with its mass when equal forces are applied.

Student Action: Selecting the object with less mass and stating to the effect that the speed of the object with less mass will increase faster because its mass is less.

A: the blue cart
B: Bill's cart
C: Mark's cart

Performance Check A: Ed has two water-clock carts. The red one has a mass of 5 kg. The blue one has a mass of 2.5 kg. Using his force measurer, Ed applies the same force to each cart.

1. Which cart, the red or the blue, will speed up more quickly?
2. Explain your answer.

Remediation: (1) Review the student's answers to questions 3-13 through 3-15 on page 32. (2) Have him read item 7 at the bottom of page 32. (3) Review his answers to Self-Evaluation 3-5 a and b.

WU O2

Graphs data.

The student applies the procedures of graphing to data related to the change in distance traveled by a cart acted on by a constant force when the mass of the cart is changed.

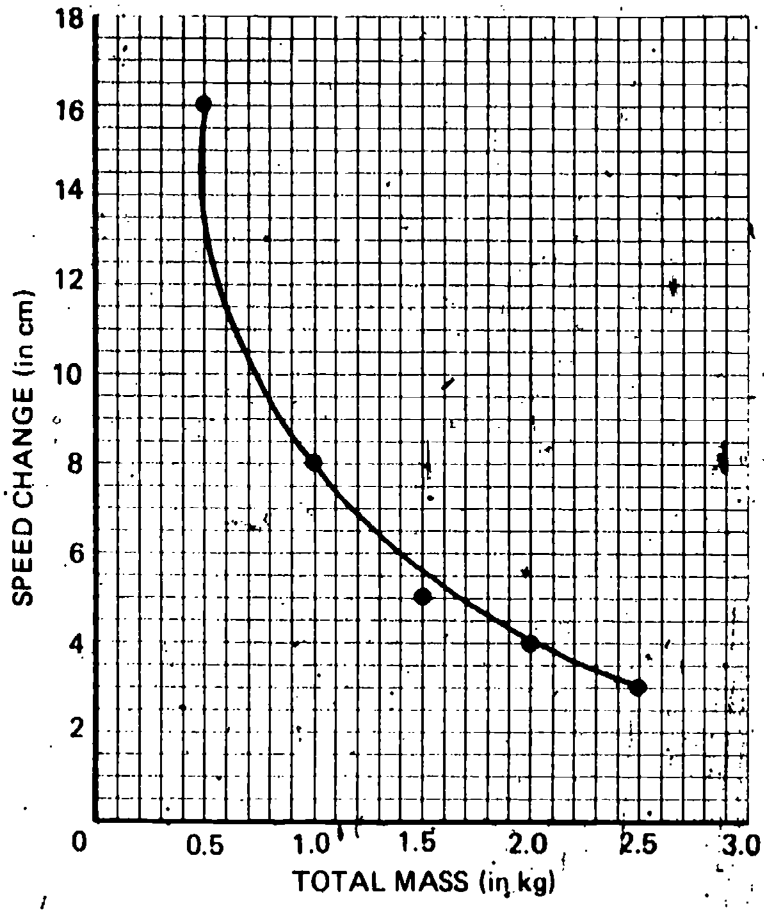
Special Preparations: Prepare a grid for the student or duplicate the appropriate grid from the back of this book.

ERIC

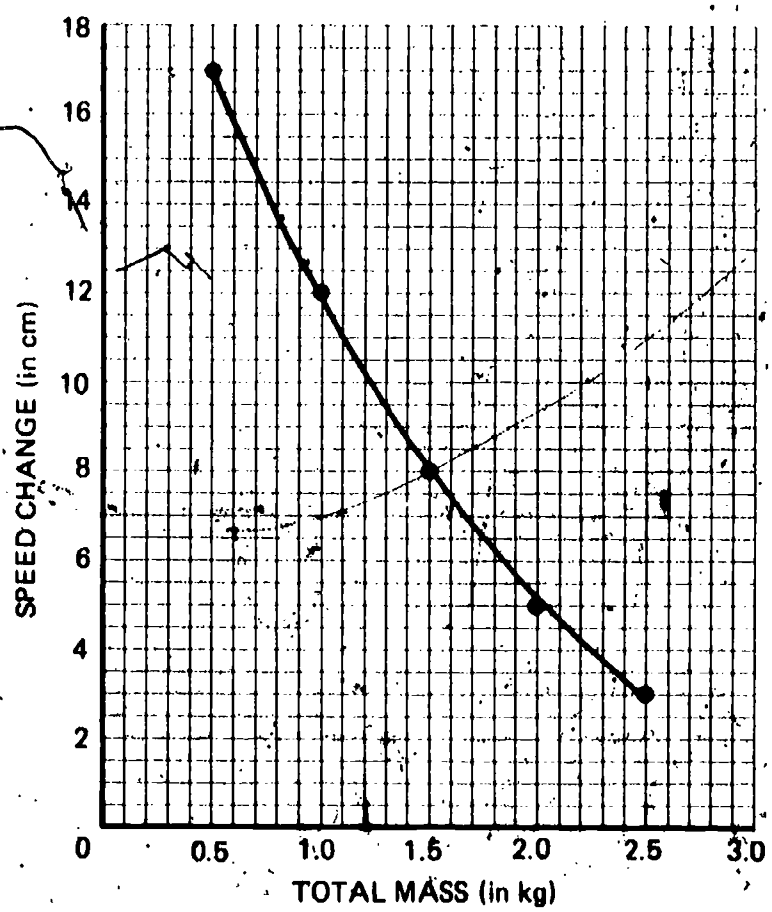
Core 6

Student Action: Constructing a graph, which includes plotting the points to ±0.2 scale divisions and drawing a best-fit line.

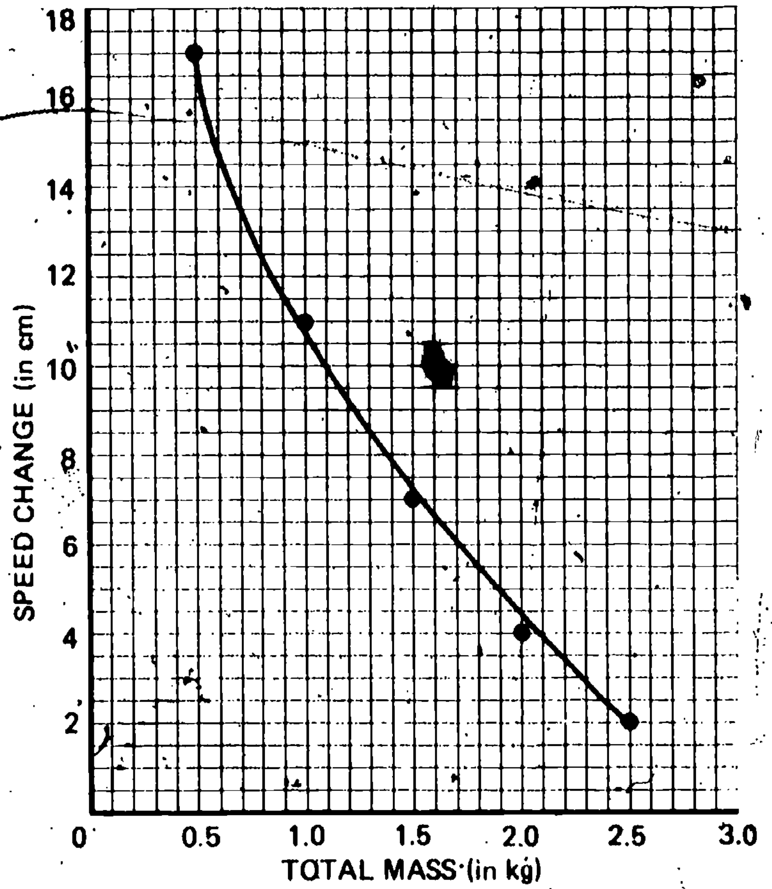
A:



B:



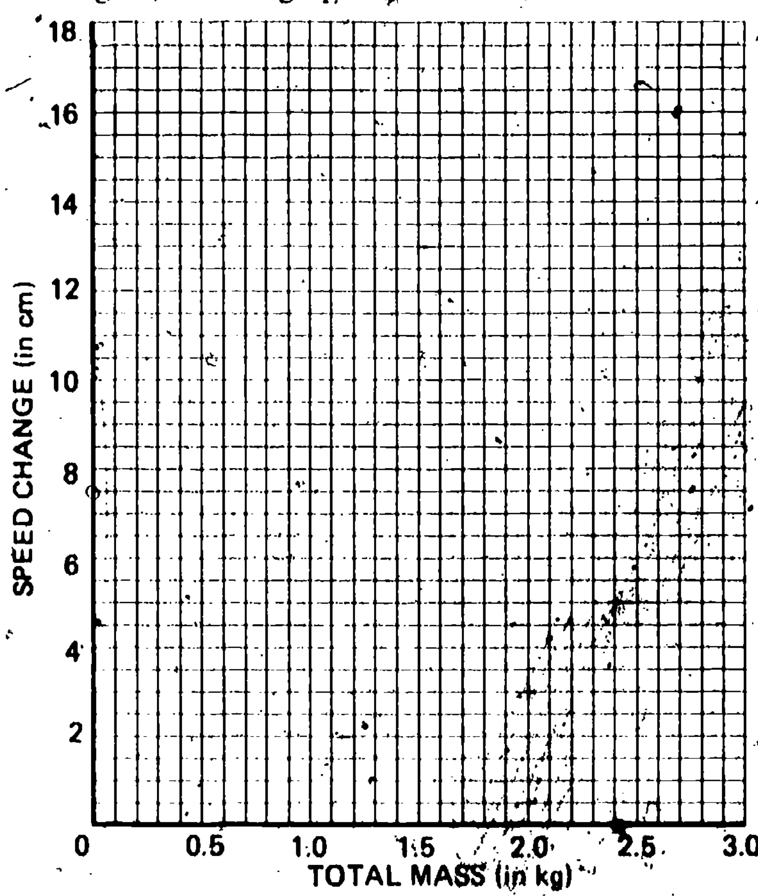
C:



Performance Check A: From your teacher, get a copy of the labeled grid below or a piece of grid paper and label the axes as shown.

Marion measured the distance traveled by her cart over five equal time intervals while she exerted a force of 0.2 N. She changed the mass of her cart for each of the five trials. Her data are shown below. On your labeled grid, draw a graph of her data.

TOTAL MASS (in kg)	DISTANCE CHANGE (in cm)
2.5	3
2.0	4
1.5	5
1.0	8
0.5	16



Remediation: (1) Review the student's answer to question 4-13 on page 45. (2) If a Level II text is available, have the student read Excursion 7-1, pages 425 through 434.

WU 02 Core 7

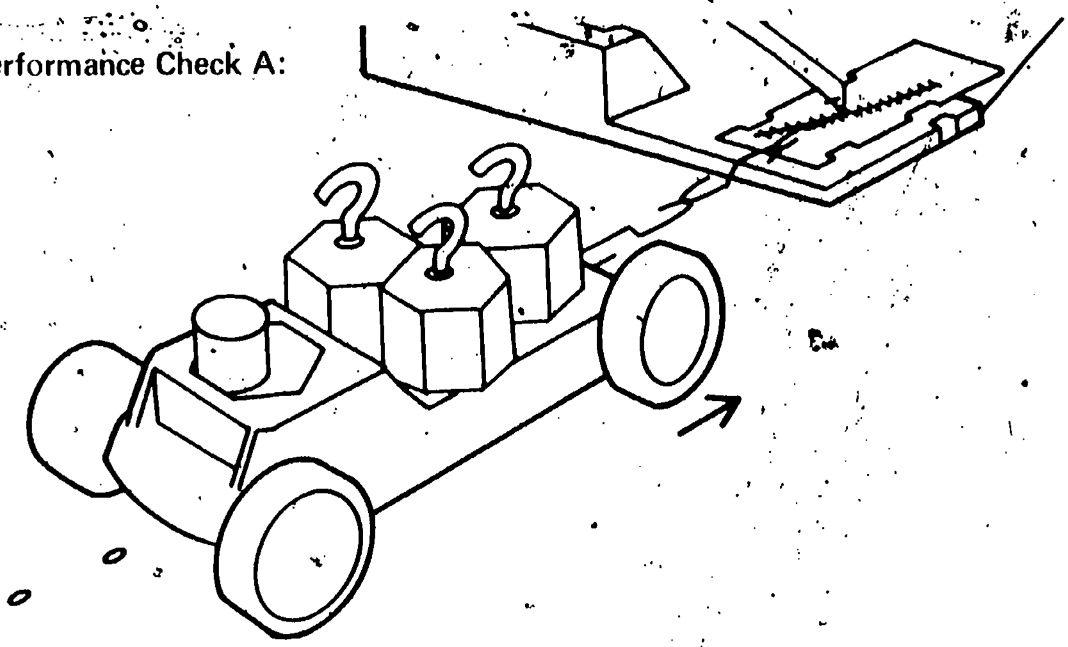
Selects a graph showing the relationship between mass and change of speed.

The student applies the concept that if an applied force is held constant while the mass of an object is varied, the object's rate of speed varies inversely with the variation in mass.

Student Action: Selecting the graph showing a curve sloping downward to the right.

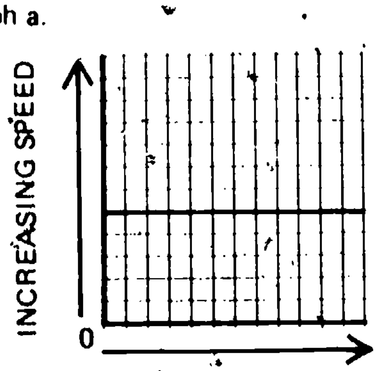
A: b
B: c
C: d

Performance Check A:

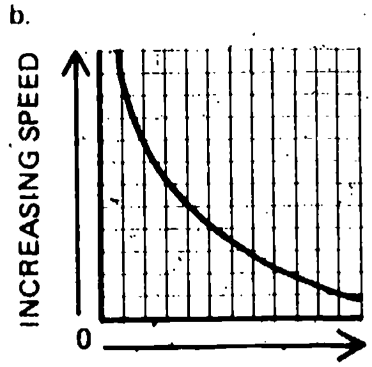


Suppose that the force acting on the water cart shown above was a constant 0.2 N for each trial and the mass on the cart was varied. Select the graph below which best shows the relationship between the mass of the cart and its load and the speed of the cart.

Graph a.



Graph b.



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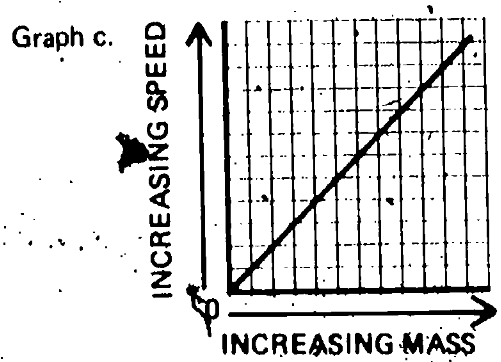
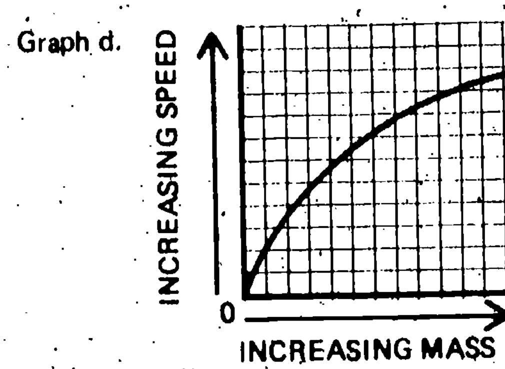




Remediation: (1) Have the student review Self-Evaluation 3-5. (2) Review together the data in Table 3-2, page 31, in terms of each of the graphs in the performance check to find the graph that fits the data. (3) If he can summarize the data but has difficulty with graph interpretation and if a Level II text is available, refer the student to Excursion 7-1, Part B, pages 428 through 434.

WU O2 Core 8

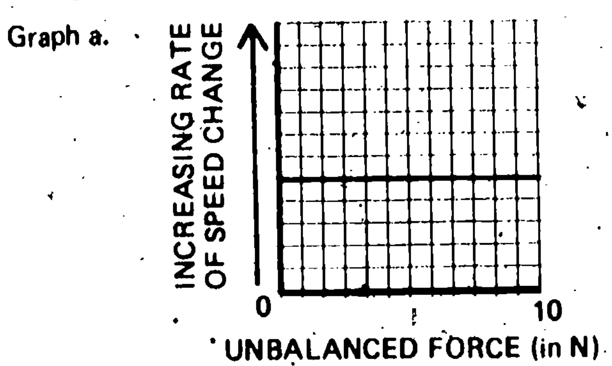
Selects the graph showing a change in an unbalanced force vs a speed change.

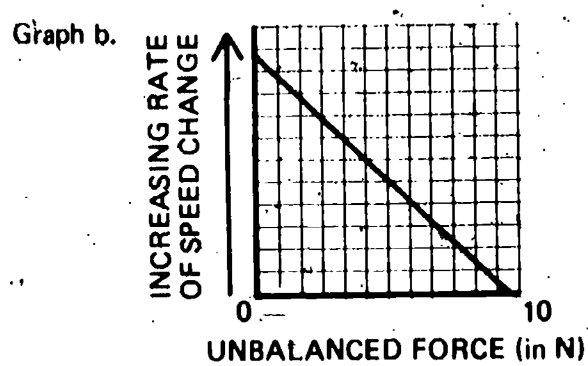
The student applies the concept that the speed of an object varies directly with the size of an unbalanced force applied to it.

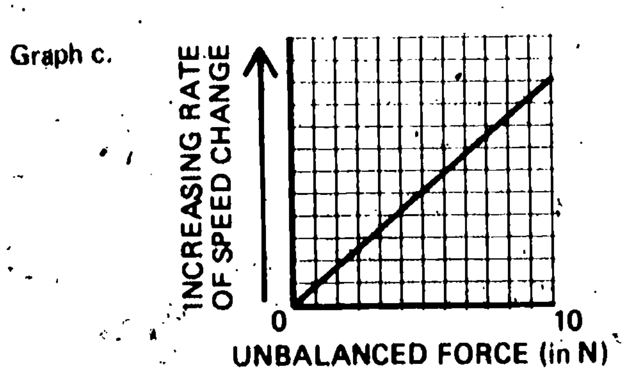
Student Action: Selecting the graph with the line sloping upward to the right.

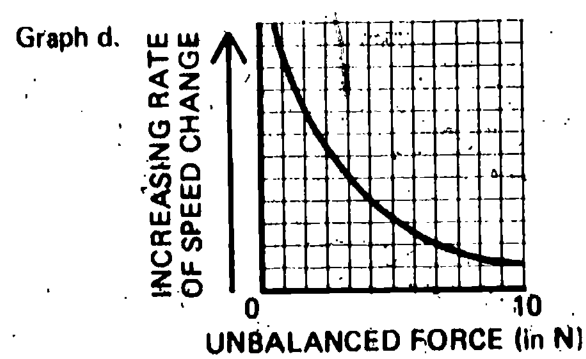
- **A:** c
- **B:** b
- **C:** a

Performance Check A: If you used your force measurer to apply different forces to a water-clock cart, the speed would change at different rates. Select the graph below that best shows how the rate at which speed changes varies as the force applied is changed.









Remediation: (1) Have the student review Figure 3-1 on page 26. (2) Have him read point 6 on page 32. (3) If graph interpretation is the problem and a Level II text is available, refer the student to Excursion 7-1, Part B, pages 428 through 434.

WU O2 Core 9

Relates the length of time an unbalanced force acts and the speed of an object.

The student applies the concept that the amount of change in the speed of a mass depends on the size of an unbalanced force applied to it and the amount of time the force is applied.

Student Action: Selecting the object which is in contact with the force longer and stating to the effect that the longer an unbalanced force is applied, the more the object will speed up.

A: Rocket a
B: Jim
C: Stone b

Performance Check A: Two identical rockets which exert the same launching force were fired from two identical launching pads. Rocket a was launched with a force that was exerted for 60 seconds. Rocket b was launched with the force exerted for only 30 seconds.

1. Will rocket a or rocket b reach the greater speed?
2. Explain your answer.

Remediation: (1) Have the student read the first three paragraphs on page 33. (2) Review his answer to question 3-16 on page 33. (3) Review his answer to Self-Evaluation 3-4.

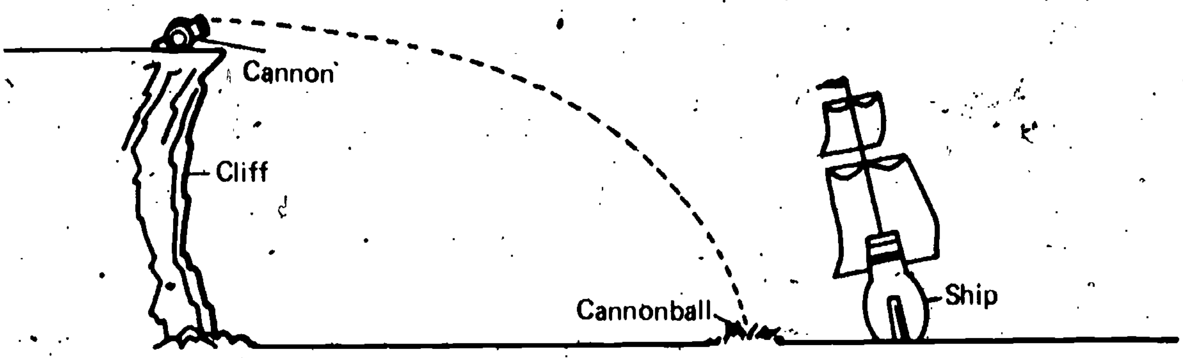
WU O2 Core

Relates unbalanced horizontal force and projectile range.

The student applies the concept that the greater the unbalanced horizontal force acting on the object when it is launched, the greater its range will be.

Student Action: Describing a way to increase the force to produce the desired change in range and explaining, in effect, that the greater the unbalanced horizontal force acting on an object, the greater its range will be.

Performance Check A: Suppose you were in command of a cannon at the edge of a cliff. The cannon cannot be moved or tilted up and down. It can only fire straight ahead. During an attack, you fire on an enemy ship. The first cannonball drops short of the ship, as shown below.



1. What can you do to increase the firing range of your cannon?
2. Explain why this would have the desired effect.

Remediation: (1) Refer the student to Figure 4-2 on page 37. (2) Review his answers to questions 4-1 and 4-2 on page 38.

WU O2 Core 11

Explains why the ball which fell straight down was used.

The student applies the concept that a control, a sample not exposed to the experimental variable, is used in an experiment as a standard with which changes are compared.

Student Action: Stating, in effect, that the object which fell straight down served as an experimental control or standard with which the other fall times were compared.

Performance Check A: In the activity in which you investigated the effect of the sideward force on the fall time of a ball, one of the balls always fell straight down. What was the purpose of using this ball that always fell straight down?

Remediation: Refer the student to Table 4-1 on page 37 and ask him the following questions:

(1) How did you measure each distance?
(2) Did you measure from a fixed point? How was this fixed point determined?
(3) What effect will changing this original point have on each subsequent measurement?

WU O2

Relates time of fall to the weight and horizontal speed of an object.

The student applies the concept that the time of fall of an object is independent of its weight and horizontal speed.

Student Action: Stating that both objects hit the ground at the same time because the time of fall of an object is independent of the object's weight and horizontal speed.

Core 12

Performance Check A: Frank clamped his BB gun to a tree so that it would not move. He sighted down the barrel to make sure the BB would start off level. At the same time as Frank fired his gun, Jim dropped a stone from the same height as the gun barrel.

1. If the ground was flat, would the BB or the stone hit the ground first?
2. Explain your answer.

Remediation: (1.) Have the student study Figure 4-3 on page 39. (2) Then review his answer to question 4-10 on page 40. (3) Review his answer to Self-Evaluation 4-1 a and b.

WU O2 Core 13

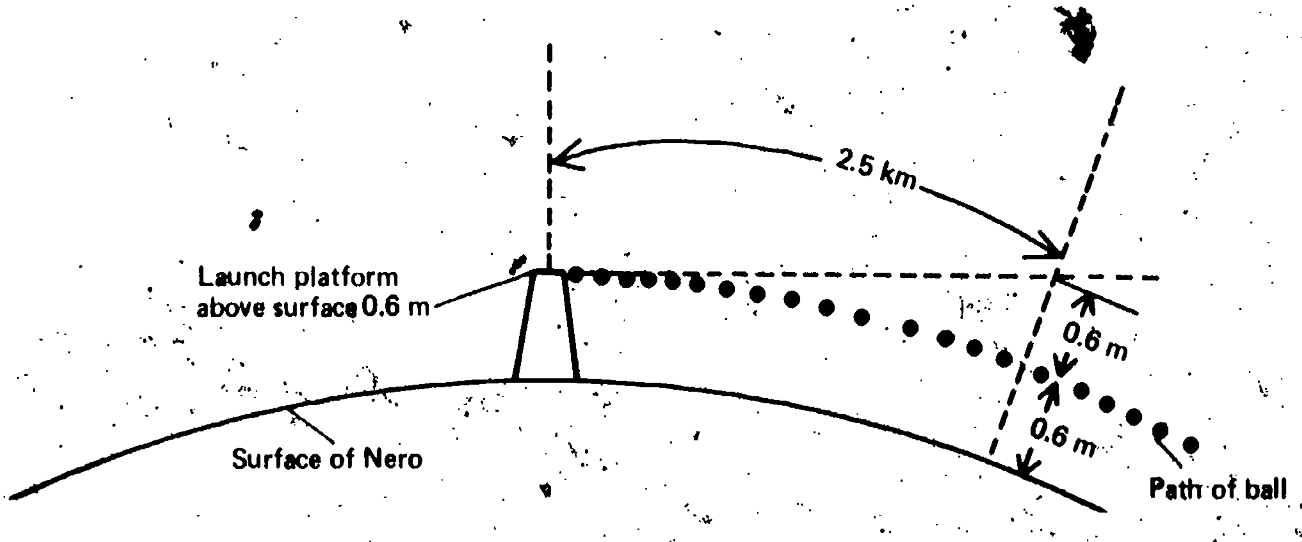
Determines the orbiting speed of a satellite.

The student applies the rule for determining the orbiting speed (distance per unit of time) of a satellite near the surface of a planet.

Student Action: Stating the orbiting speed which is numerically equal to the distance an object must travel in a curving path parallel to the surface in one second so that its rate of fall per second is numerically equal to the amount of curvature of the surface.

A: 2.5 km per sec
B: 3.7 km per sec
C: 7.5 km per sec

Performance Check A: An object dropped near the surface of the planet Nero falls 0.6 meters in 1.0 second. Use this information and the diagram below to determine the orbiting speed of a satellite near Nero's surface.



Remediation: (1) Have the student read Problem Break 4-1 on pages 40 and 41. (2) Review his answer to Self-Evaluation 4-10 a.

WU O2 Core 14

Selects a graph which shows the period of a satellite vs its distance from the earth.

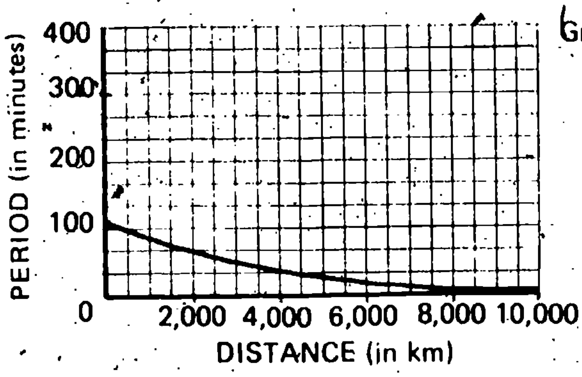
The student identifies the graph which shows the relationship between the period of a satellite and its distance from the earth.

Student Action: Selecting the graph which illustrates the period of a satellite increasing as the radius of its orbit increases.

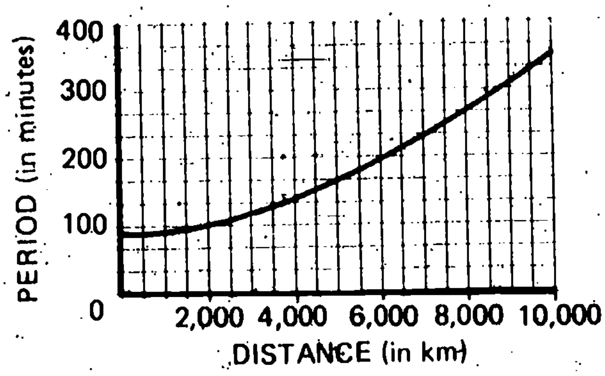
- **A:** b
- **B:** d
- **C:** a

Performance Check A: Select the graph below that best shows how the period of a satellite changes as its distance from the earth increases.

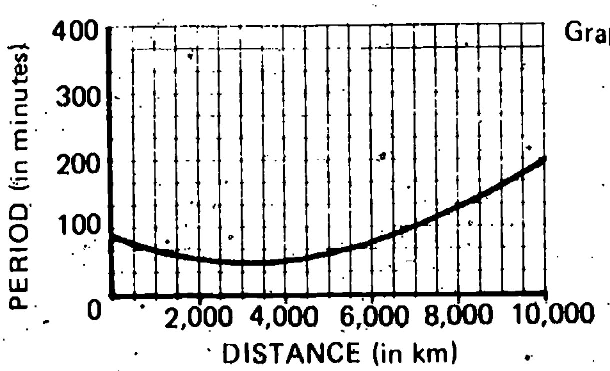
Graph a.



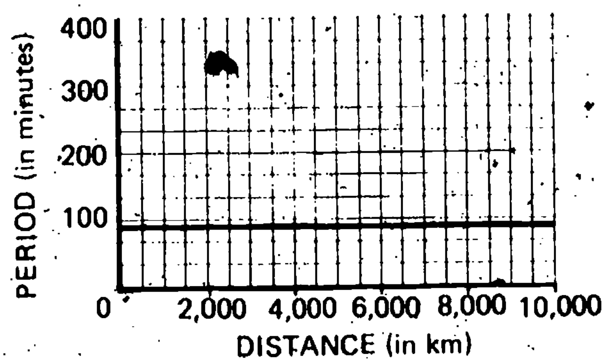
Graph b.



Graph c.



Graph d.



Remediation: (1) If the student doesn't know what is meant by *period*, see the Remediation for WU-02-Core-19. (2) Review his answer to question 4-24 on page 48. (3) Have him read the paragraph at the top of page 49. (4) Review his answer to Self-Evaluation 4-8 a.

WU O2

Selects the graph showing the minimum orbiting speed vs height.

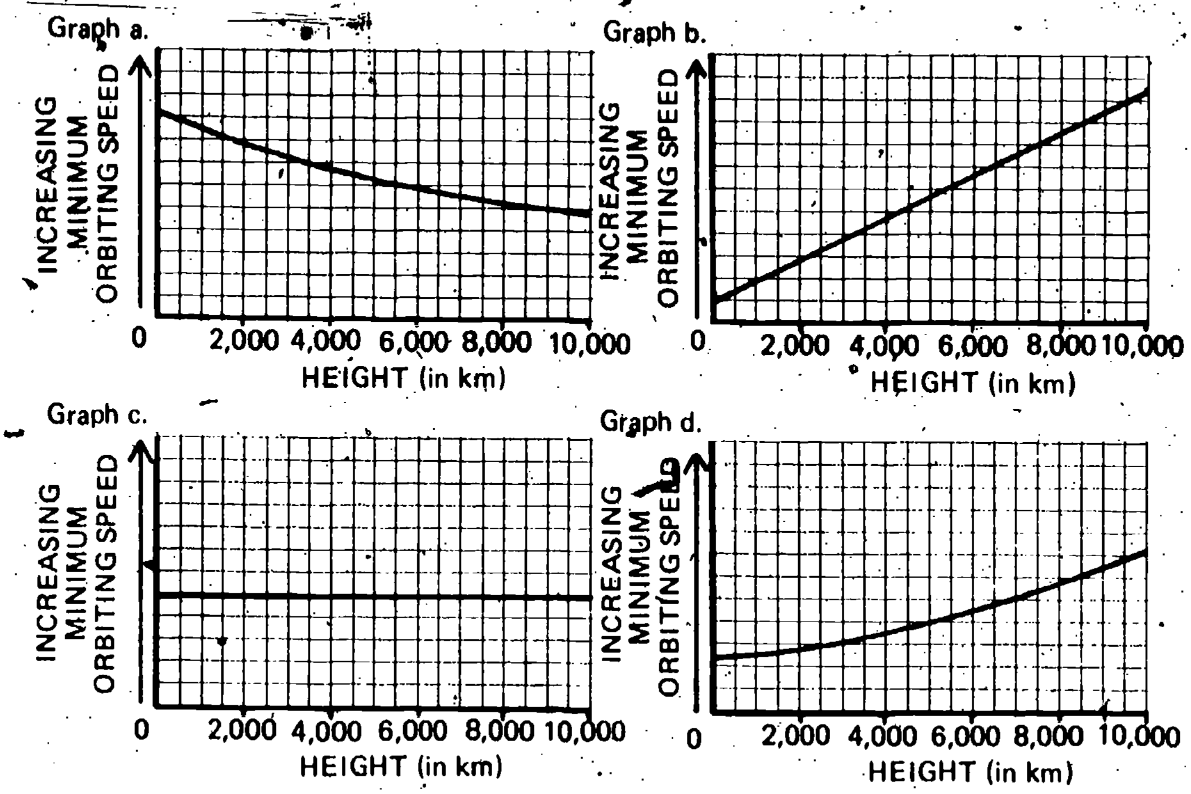
The student identifies the graph which shows best how minimum orbiting speed varies with height.

Student Action: Selecting the graph which curves downward to the right.

- **A:** a
- **B:** c
- **C:** b

Core 15

Performance Check A: Select the graph below that best shows how the minimum orbiting speed of a satellite changes as the satellite gets farther from the earth's surface.



Remediation: (1) Have the student review the data in Table 4-2 on page 42. (2) Review his answer to Self-Evaluation 4-10 b. (3) If a Level II text is available and the student has trouble interpreting graphs, refer him to Excursion 7-1, Part B, pages 428 through 434.

WU O2 Core 16

States two forces that slow down rockets leaving the earth.

The student recalls two forces that slow down rockets leaving the earth.

Student Action: Naming friction with the atmosphere and the force of gravity.

Performance Check A: What are two forces that slow down a rocket that is leaving the earth?

Remediation: (1) Refer the student to Figures 4-7 and 4-8 on page 44 and have him explain the effects of gravity and friction, represented by the arrows on the rocket. (2) Have him read items 2 and 3 on page 44. (3) Review his answers to Self-Evaluations 4-2 a and 4-8 b.

WU O2

Selects the graph showing the relationship between the weight of an object and its distance from the earth.

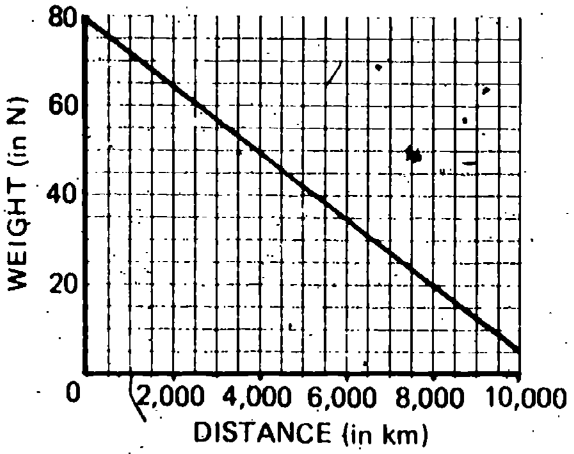
The student identifies the graph that best shows the relationship between the weight of an object and its distance from the earth's surface.

Core 17

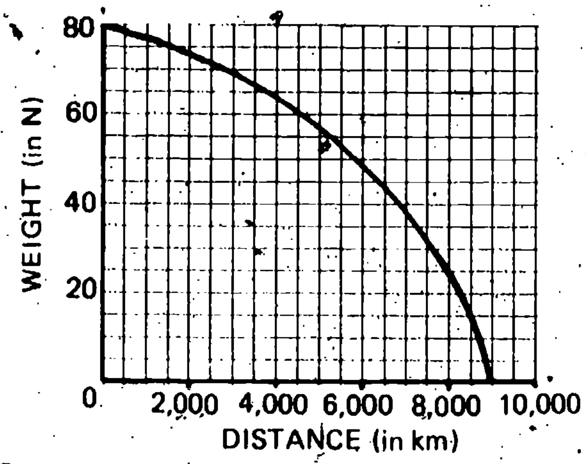
Student Action: Selecting the graph with a negative slope that is concave upwards.
- **A:** d
- **B:** a
- **C:** c

Performance Check A: Select the graph below that best shows how the weight of an object changes with its distance above the earth's surface.

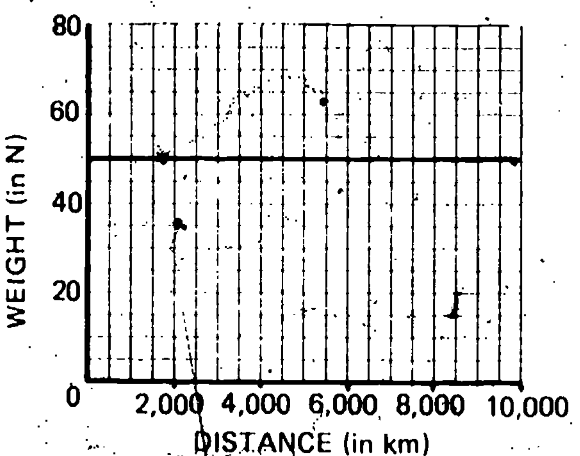
Graph a.



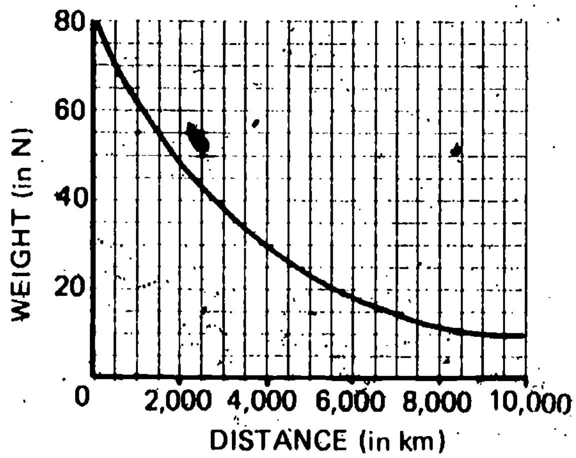
Graph b.



Graph c.



Graph d.



Remediation: (1) Review the student's graph of the data in question 4-13 on page 45. (2) Review his answer to Self-Evaluation 4-5.

WU 02

States whether gravity reaches zero at some distance from the earth.

The student recalls that the force of the earth's gravity, though it decreases with increased distance from the earth, never reaches zero.

Student Action: Stating, in effect, that there is no such distance and that although the force of gravity decreases with increased distance from the earth's surface, gravity never reaches zero.

Core 18

Performance Check A: Suppose that a gravity-measuring satellite was launched two months ago from the Space Center.

1. At what distance from the earth should the satellite signal that the earth's force of gravity is zero?
2. Explain your answer.

Remediation: (1) Have the student read the two paragraphs following question 4-16 on page 47. (2) If he brings up the matter of the weightless conditions that astronauts experience, discuss with him the material found in the teacher's note in the margin of page 44 of the Teacher's Edition of the text.

WU 02 Core 19

Defines the term *period* of a satellite.

The student recalls the definition of *period* of a satellite.

Student Action: Responding with the essence of the definition that the period of a satellite is the amount of time required for the satellite to make one complete orbit.

Performance Check A: What is meant by the term *period* of a satellite?

Remediation: (1) Review the student's answer to Self-Evaluation 4-4. (2) Direct him to question 4-22, page 48, which states the definition.

WU 02 Core 20

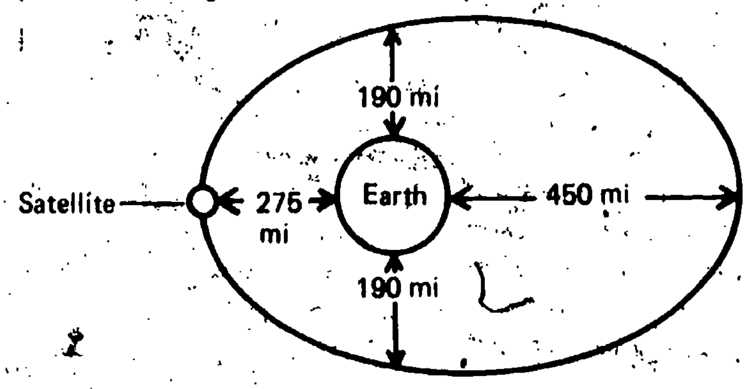
Selects a numerical value for the period of a satellite.

The student classifies the time required to complete one revolution as the period of a satellite.

Student Action: Selecting the time required to complete one revolution as the period of a satellite.

A: e
B: c
C: d

Performance Check A: A satellite eight feet in diameter rotates on its axis once every 45 minutes and orbits the earth once every 100 minutes as shown below.



What is its period?

a. 45 minutes
b. 275 miles
c. 450 miles
d. 190 miles
e. 100 minutes

Remediation: (1) Review the student's answer to Self-Evaluation 4-4. (2) Have him review his answer to question 4-22 on page 48.

WU 02 Core 21

Characterizes the speed of satellites by the shape of their paths.

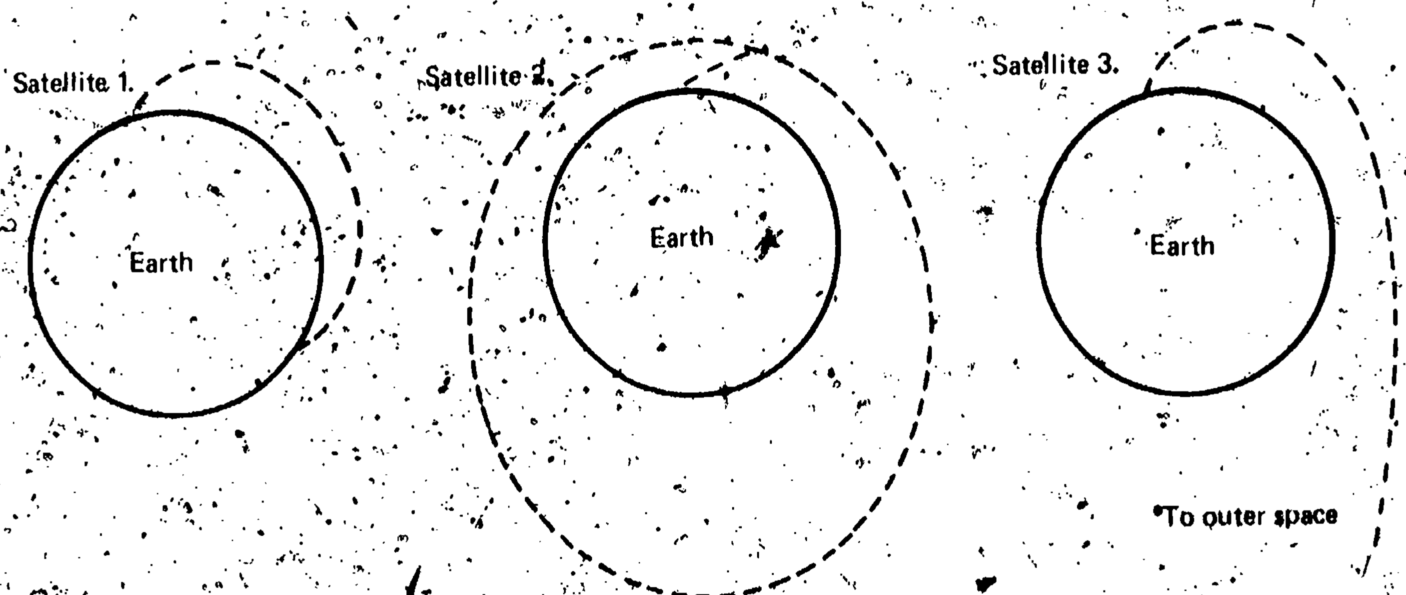
The student classifies the speed of satellites according to the shape of their paths.

Student Action: Matching the diagrams with appropriate statements correctly in at least two of the three cases according to the following characteristics: (1) the speed of a satellite is less than that necessary for a circular orbit if its path returns it to the earth's surface, (2) its speed is equal to the speed necessary for a circular orbit if its path is a circular orbit, (3) its speed is slightly greater than that necessary for a circular orbit if its path is an elliptical orbit, and (4) its speed is much greater than that necessary for a circular orbit if its path leads away from the earth indicating the escape of the satellite.

A: 1. b, 2. a, 3. d
B: 1. c, 2. b, 3. d
C: 1. a, 2. d, 3. b

Performance Check A: For each of the satellites whose paths are shown below, select the statement that best describes its speed. Write the number of the satellite on your paper and after it the letter of the matching statement.

a. Slightly greater than the speed necessary for a circular orbit
b. Less than the speed necessary for a circular orbit
c. Equal to the speed necessary for a circular orbit
d. Much greater than the speed necessary for a circular orbit



Remediation: (1) Review the student's answer to Self-Evaluation 4-9. (2) Refer him to Figures 4-12, 4-14, and 4-15 on pages 50 and 51. (3) Have him read pages 50 and 51.

WU O2 Core 22

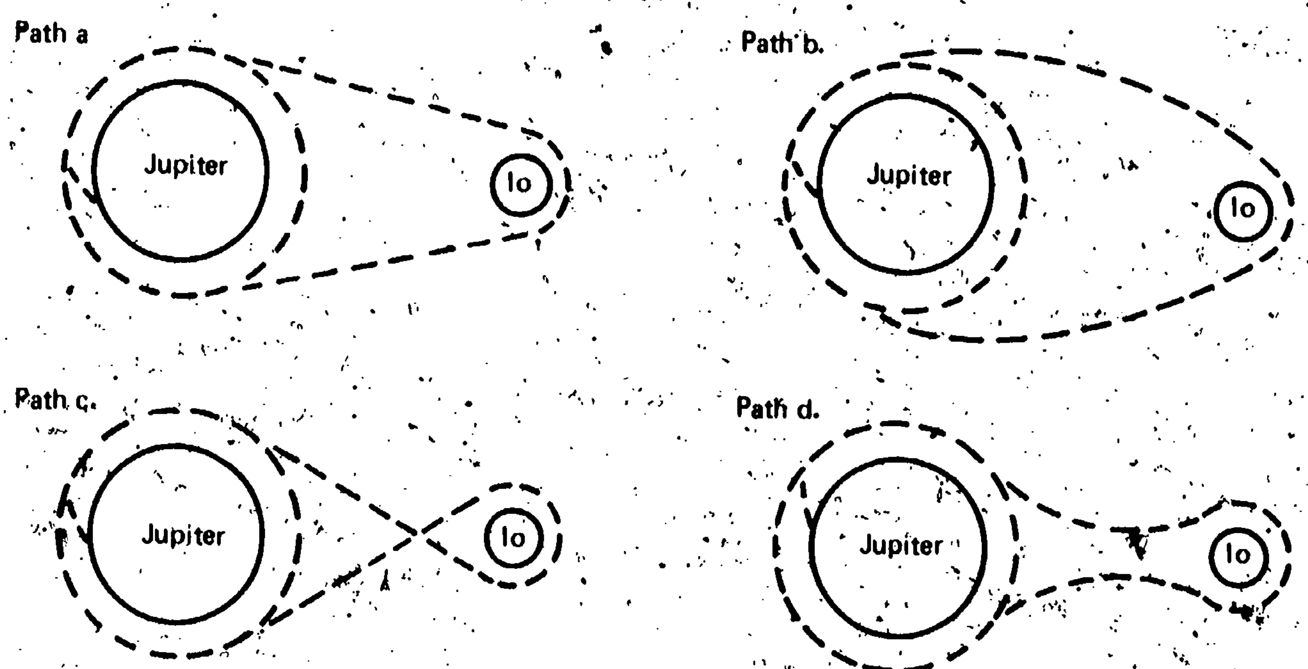
Selects a diagram of a free-return path.

The student identifies the free-return path of a rocket from a planet to a moon of the planet and back to the planet.

Student Action: Selecting the diagram with a figure-8 path.

A: c
B: a
C: d

Performance Check A: Several possible paths for a rocket flight from Jupiter to its moon Io and back to Jupiter are shown below. Select the diagram which shows the free-return path.



Remediation: (1) Refer the student to Figure 4-16 on page 51. (2) Have him read the paragraphs immediately preceding and following Figure 4-16.

WU O2

States the relative rocket speed necessary for lunar orbit.

The student recalls that in order to achieve lunar orbit, a rocket from the earth must slow down so that it can be captured by the moon's gravity.

Student Action: Responding that the rocket from the earth must slow down and, in effect, that it must do so in order to be captured by the moon's gravity.

Performance Check A: Suppose that a rocket is traveling from the earth to the moon.

1. Will the rocket have to speed up, slow down, or maintain the same speed if it is going to orbit the moon?
2. Explain your answer.

Remediation: Review the student's answer to question 4-25 on page 52.

Core 23

States the purpose of a spacecraft's heat shield.

The student recalls the reason for putting a heat shield on a spacecraft.

Student Action: Stating, in effect, that a heat shield on a spacecraft protects the spacecraft from the heat generated by friction with the atmosphere upon reentry.

Performance Check A: Why does a spacecraft require a heat shield?

Remediation: (1) Review the student's answers to questions 4-27 and 4-28. (2) Have him read the first paragraph on page 53.

WU O2 Core 24

States a way that a returning spacecraft is slowed down.

The student recalls that a spacecraft returning to the earth is slowed down by the atmosphere, which it pushes out of its way and with which there is friction.

Student Action: Responding, in effect, that a spacecraft is slowed down by the atmosphere because of the friction created when the spacecraft pushes the atmosphere out of its way.

Performance Check A: Spacecraft returning to the earth can be slowed down by firing retro-rockets.

1. What else causes a spacecraft to slow down when it nears the earth but before the parachutes open?
2. Explain how this causes the spacecraft to slow down.

Remediation: (1) Refer the student to the paragraphs following question 4-28 on page 52. (2) Have him redo the performance check.

WU O2 Core 25

Explains recoil in a launching device.

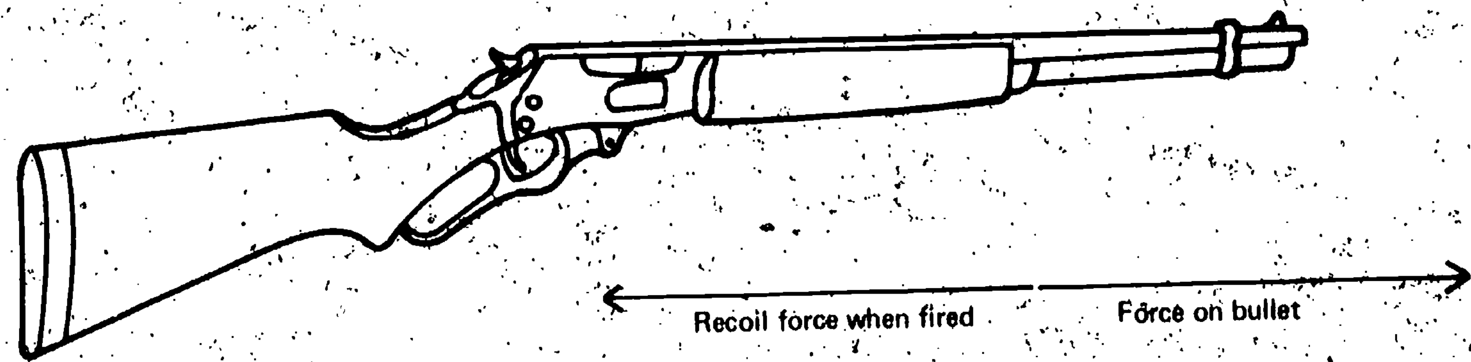
The student generates an explanation for the recoil of an object when matter is expelled.

Student Action: Responding in effect that recoiling occurs when the explosion produces equal forces on the launching mechanism and the projectile, the force on the projectile accelerating and ejecting it and the force on the launching mechanism causing the mechanism to recoil in the opposite direction.

WU O2 Exc

3-1
1

Performance Check A: If you have ever fired a large gun, you know that the gun kicks backward when it is fired. Explain why there is this backward force on the gun when the explosion produces equal forces forward and backward.



Remediation: (1) Have the student read from the last paragraph on page 109 to the end of page 110 in Excursion 3-1. (2) Have him study Figure 1 on page 107. (3) If he replies "For every action there is an equal and opposite reaction," make certain that he can identify the fact that there is a force acting on the bullet in one direction and on the gun in the opposite direction.

WU
O2
Exc
3-1
2

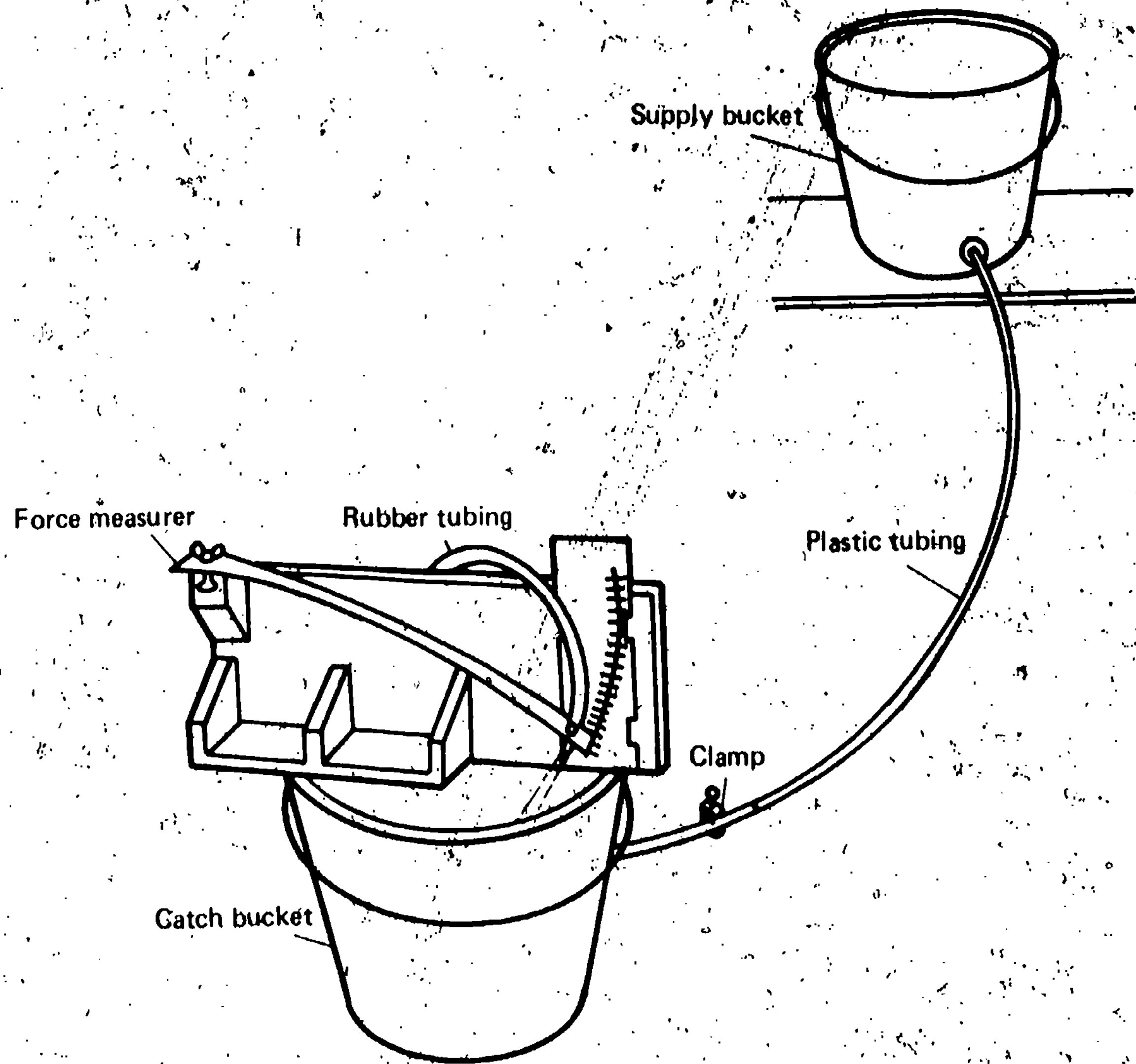
States the effect on force of a change in the masses being ejected.

The student applies the concept that when the mass of matter per second which rushes out of an opening in a container varies, the unbalanced force on the force measurer varies in the same direction.

Student Action: Stating, in effect, that it would be less than the specified number of units because of the reduction in the mass of the matter leaving the container.

Performance Check A: Jim set up the equipment shown below. He found that when he used water and a flow rate of 10 ml per second, the force from the jet was 6 units. Suppose he now repeated the experiment, using alcohol and the same flow rate of 10 ml per second.

1. When Jim used alcohol, would his force measurement be more than 6 units, less than 6 units, or exactly 6 units? (Note that 10 ml of alcohol weighs less than the 10 ml of water.)
2. Explain your answer.



Remediation: (1) Refer the student to the paragraph below Figure 1 on page 107 to reinforce the idea that the greater the mass, the greater the force. (2) Discuss with him the notion that it is the mass not the volume of ejected material that is critical.

Calculates the thrust of a rocket.

WU 02 Exc

The student applies the formula for calculating the thrust of a rocket.

Student Action: Calculating the thrust of the rocket, using the formula that the thrust of a rocket equals the mass thrown out per second multiplied by the speed at which the mass is ejected.

A: 45 kg·m per sec or N per sec
B: 50 kg·m per sec or N per sec
C: 4 kg·m per sec or N per sec

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3-2
1

Performance Check A: A small rocket engine ejects 0.05 kg of mass each second. This mass is thrown out from the rocket at 900 m per sec. What is the thrust (force) produced by this engine?

Remediation: (1) Have the student read the paragraphs following question 13 on page 117, Excursion 3-2. (2) Have him study Figure 5 on page 119. (3) Have him read the paragraph following Figure 5 on page 119.

WU
O2
Exc
3-2
2

Lists two ways to increase the thrust of a rocket.

The student recalls two ways to increase the thrust of a rocket.

Student Action: Responding to the effect that the thrust (force) of a rocket can be increased by increasing the mass of the exhaust gases thrown out of the rocket and by increasing the speed at which the mass is thrown out.

Performance Check A: What are two ways that a rocket engineer can increase the thrust (force) produced by a rocket engine?

Remediation: Have the student read the material on pages 119 and 120 of Excursion 3-2.

WU
O2
Exc
3-2
3

States why rockets are built so that they burn their fuel in stages.

The student recalls why rockets are built so that they burn their fuel in stages.

Student Action: Stating, in effect, that rockets are built to burn their fuel in stages so that as the rocket fuel from one stage is used, the empty tanks making up that stage can be discarded, thus decreasing the mass of the rocket and making the transportation of the useless mass unnecessary.

Performance Check A: Many rockets burn their fuel in two or three stages. Why are rockets built to burn their fuel in several stages?

Remediation: (1) Have the student review page 120 in Excursion 3-2. (2) Have him reattempt the performance check. (3) Discuss the cart-bricks analogy with him if necessary.

WU

Selects a reason incorrect ideas about nature tended to be accepted for a long time.

The student applies the concept that incorrect scientific ideas tend to persist if they are not tested.

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Student Action: Selecting the response to the effect that old ideas were not tested by performing controlled experiments.

A: c
B: d
C: b

O2 Exc 4-1 1

Performance Check A: In the past, many incorrect ideas were accepted for long periods of time. For example, it was believed for hundreds of years that diseases spread from one person to another by foul air. In the last 200 years or so, many of our ideas about how diseases spread have changed. Select the best reason why incorrect ideas such as this one were able to last so long.

a. People are smarter now than they were then.
b. The first schools started about 200 years ago.
c. The old ideas were not tested by performing controlled experiments.
d. The greatest thinkers are alive today.
e. The old ideas explained the experimental observations just as well as the modern ones.

Remediation: Have the student read the first paragraph on page 121.

Selects the variable or variables which affect the period of a pendulum.

WU O2 Exc 4-1 2

The student identifies the variable that affects the period of a simple pendulum.

Student Action: Selecting the length of the pendulum as the variable.

A: b
B: a
C: d

Performance Check A: Select any of the following variables that affect the period of a pendulum.

a. Weight of the ball
b. Length of the pendulum
c. Timing device used
d. Time of day

Remediation: (1) Review the student's answer to question 9 on page 124. (2) Have him redo Activity 6 and review his answers to questions 6 through 8 on page 124.

Explains why scientists prefer mathematical models.

WU O2 Exc

The student generates an explanation for why a quantitative model is often more useful than a qualitative model.

Student Action: Stating an explanation which includes the essence of the idea that a quantitative model can be used to make predictions which can be used to test the model and may lead to further discoveries.

4-2
1

Performance Check A: Scientists often devise models to describe what they see. Many of these models use mathematics. Why is a model which is stated in terms of mathematical formulas or equations likely to be more helpful to a scientist than a model which describes the same things in words?

Remediation: (1) Have the student review pages 127 and 128. (2) Have him look at Figure 4 on page 128. Ask him what advantage there is in having the quantitative data given in that figure.

WU
O2
Exc
4-3
1

Selects the period necessary for a fixed-position satellite.

The student applies the concept that the period of revolution of a satellite and its fixed position in relation to a point on the surface of the planet are directly related.

Student Action: Selecting the period for the satellite that equals the time required for a rotation of the planet.

A: c
B: b
C: d

Performance Check A: Suppose that several NASA engineers are planning to put a satellite into orbit around Mars. They want this satellite to remain directly over the same spot on Mars's surface at all times. They have the following information about Mars.

Time for Mars to revolve around the sun	1.88 earth years
Time for Mars to make one complete rotation on its axis	24.6 earth hours
Diameter of Mars	0.54 of earth's diameter
Force of gravity at Mars's surface	0.40 of earth's gravity

Which of the following is the correct period for this satellite?

a. 0.40 earth gravity units
b. 0.54 earth diameters
c. 24.6 earth hours
d. 1.88 earth years

Remediation: (1) Have the student review page 129. (2) Review his answer to ~~question 1 on page 129.~~

WU

Reads a graph which has two curves on it.

The student applies the procedure for reading the values of two variables from a graph involving three variables which correspond to a stated value of a variable.

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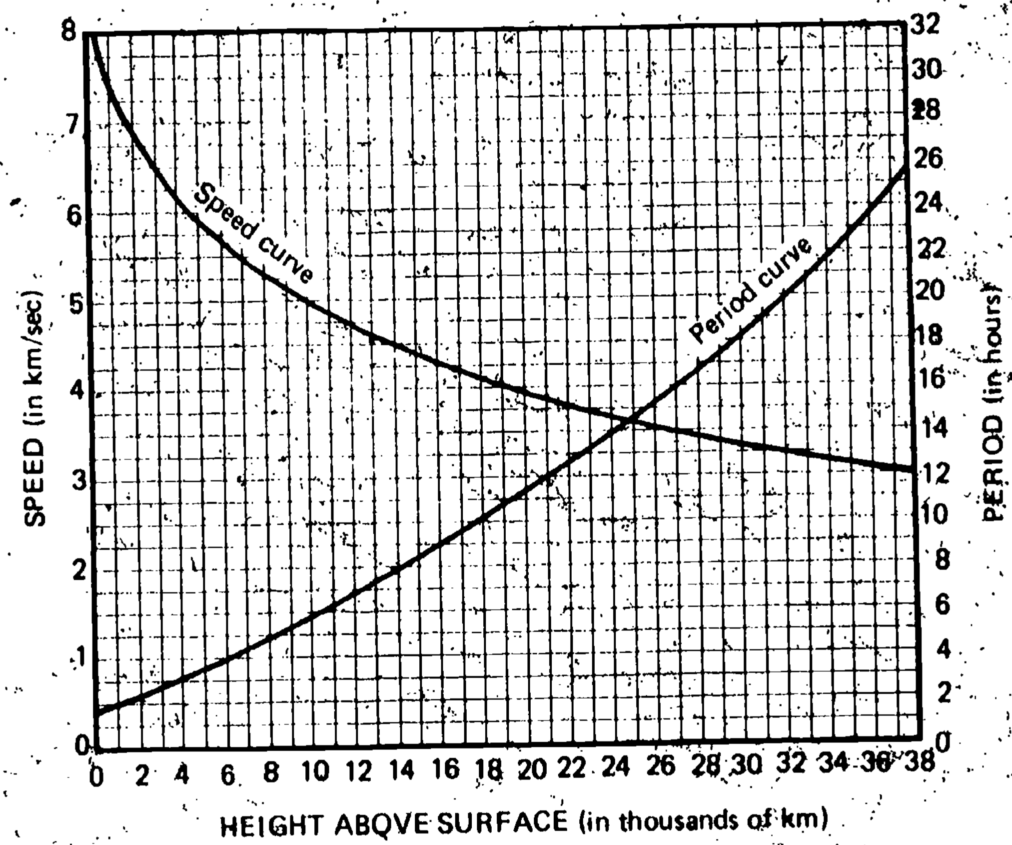
O2 Exc 4-3 2

Student Action: Reporting the height that corresponds to the period within ±500 km and then moving vertically from that point until he intersects the speed curve and reporting the speed that corresponds to that height within ±0.2 km per sec.

A: 1. 24,000 ±500 km. 2. 3.7 ±0.2 km/sec.
B: 1. 27,000 ±500 km. 2. 3.6 ±0.2 km/sec
C: 1. 14,000 ±500 km. 2. 4.5 ±0.2 km/sec

Performance Check A: Use the graph below to determine the following information for a space vehicle with a period of 14 hours.

1. Height above the surface
2. Orbital speed



Remediation: (1) Have the student read the information following Figure 1 in Excursion 4-3, page 130. (2) Review his answers to questions 2 and 3 on page 130.

WU O2

Selects a graph showing the heating of a substance from solid to gaseous form.

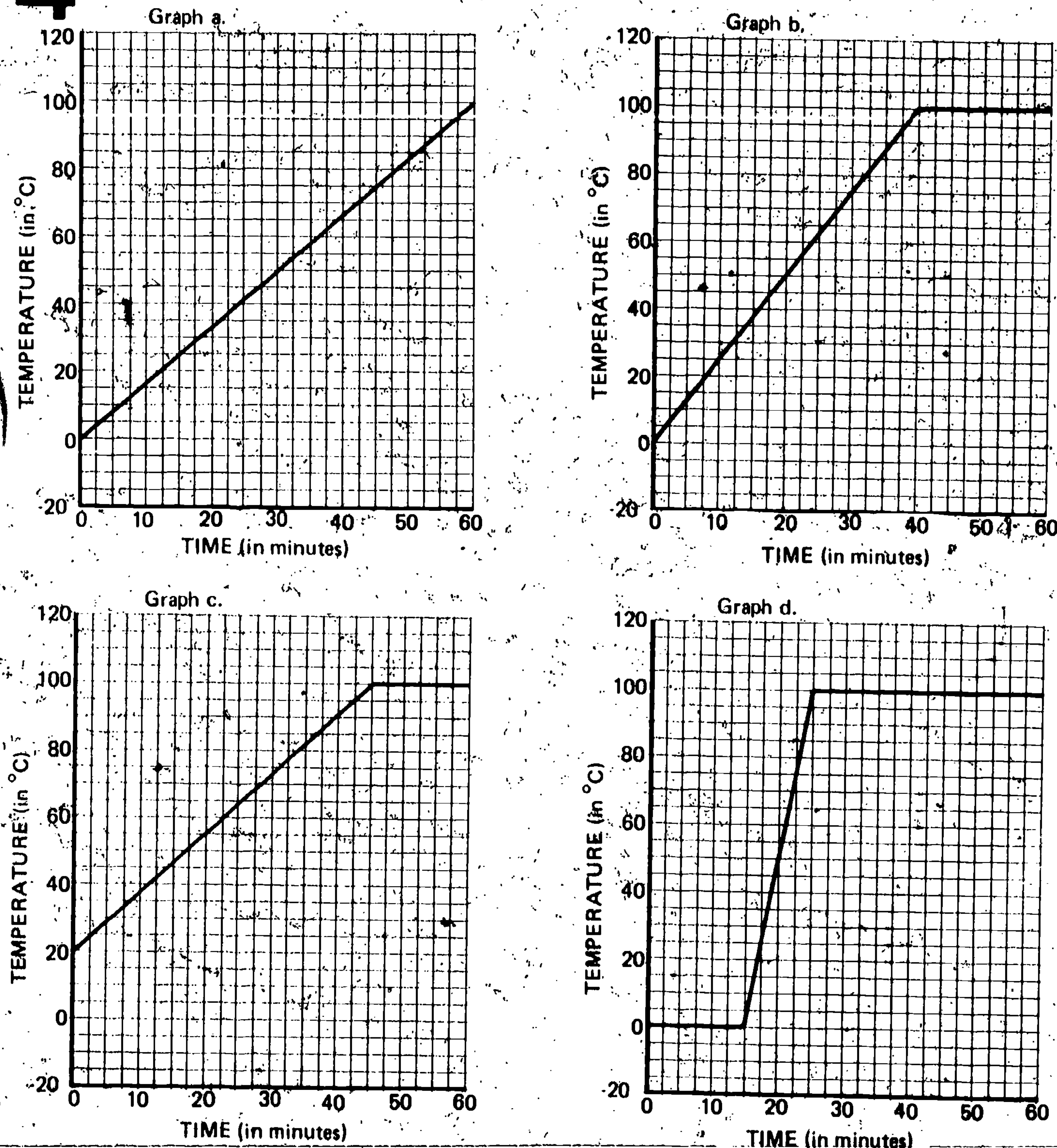
The student applies the concept that it takes heat without temperature change to convert a substance from a solid to a liquid and a liquid to a gas.

Student Action: Selecting the graph with two constant temperature sections.

A: d
B: b
C: c

Exc 4-4 1

Performance Check A: Suppose that you put a flame under an open container containing ice and continue heating it until all the water has boiled away. Select the graph below that best shows how the temperature would change during the entire heating process. The freezing point of water is 0°C and the boiling point is 100°C.



Remediation: (1) Review the student's answers to questions 1, 2, and 3 on page 135. (2) Discuss together the importance that the two horizontal parts of the graph have for spacecraft upon reentry.

States why a spacecraft does not burn up on reentry.

The student recalls the reason a spacecraft does not burn up during its reentry.

Student Action: Responding to the effect that the heat shield melts and boils, absorbing and taking away much of the heat caused by friction and thus protects the rest of the spacecraft.

Performance Check A: A great deal of heat is produced by friction when a spacecraft reenters the atmosphere. Explain why the spacecraft does not burn up from the heat generated during its reentry.

Remediation: (1) Have the student read the last paragraph on page 133 and the last paragraph on page 135. (2) Review the concept of melting as a heat removing process. (For example, a soft drink cools as it melts the ice in it.) (3) Also review boiling-vaporization-evaporation as a heat-removing process. A drop of alcohol placed on the student's arm might help clarify the concept.

WU O2 Exc 4-4 2

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WU 03

Chapters 5 thru 7

Excursions 5-1 and 7-1

Performance Check

Summary Table

Objective Number	Objective Description
WU-03-Core-1	Recognizes a mare on the lunar surface
WU-03-Core-2	Selects a ray on the lunar surface
WU-03-Core-3	Explains scientific interest in the moon's origin
WU-03-Core-4	Describes the origins of craters from illustrations
WU-03-Core-5	Lists variables that affect the size of impact craters
WU-03-Core-6	States the relationship between the mass of an object and the speed of its fall
WU-03-Core-7	Relates graphically the mass of a falling ball vs the crater size produced
WU-03-Core-8	States the reason for changing only one variable at a time
WU-03-Core-9	States a plan to find the effect of a falling object's diameter on crater size
WU-03-Core-10	Selects the position of a light source for the maximum surface detail of a rough
	surface
WU-03-Core-11	States the cause of erosion on the moon
WU-03-Core-12	Indicates the relative age of overlapping craters
WU-03-Core-13	States why the model for the surface material of the moon was changed
WU-03-Core-14	Predicts color change in rock as the moon's surface is drilled
WU-03-Core-15	Selects the relationship between the darkening of paper and of the moon's surface
WU-03-Core-16	Compares the effects of a force applied to an object on the moon and on the earth
WU-03-Core-17	States the reason for the formation of central peaks in craters

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
				Q		√				identifies	
				Q		√				identifies	
						√				recalls	
				Q		√				classifies	
						√				recalls	
						√				applies	
				Q						classifies	
						√				applies	
										generates	
										applies	
						√				recalls	
										applies	
						√				applies	
										applies	
				Q		√				applies	
										applies	
										recalls	

WU 03

Objective Number	Objective Description
WU-03-Core-18	States the conditions which determine the size of the central peak during a crater's
	formation
WU-03-Core-19	States the probable cause of cinder cones on the moon
WU-03-Core-20	States a possible cause for the dome-shaped mountains on the moon
WU-03-Core-21	Matches features of the moon with their probable causes
WU-03-Core-22	Recognizes the effect of variables in a model
WU-03-Core-23	States the cause of and the evidence for a certain cone
WU-03-Core-24	States things that cause changes in the moon's surface
WU-03-Core-25	Predicts the relative ages of moon features
WU-03-Core-26	Estimates the fraction of the earth seen from the moon during different time periods
WU-03-Core-27	Matches the moon's position in relation to the earth with the moon's appearance
WU-03-Core-28	Matches the moon's position with diagrams of the earth's appearance from the moon
WU-03-Core-29	Predicts the position of the earth as seen from the moon
WU-03-Core-30	Explains why the new moon is not completely dark
WU-03-Core-31	Explains why only one side of the moon is seen from earth
WU-03-Core-32	States the moon's period in days
WU-03-Core-33	States the earth's period in days
WU-03-Exc 5-1-1	Estimates weight on the moon's surface relative to the earth

Materials	Observer	Special Preparations	Quick Score	3 Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
									recalls	
					√				recalls	
					√				recalls	
			Q		√				identifies	
								√	applies	
					√				applies	
									recalls	
					√				applies	
M								√	applies	
			Q		√				applies	
			Q		√				applies	
			Q						applies	
									recalls	
					√				recalls	
			Q						recalls	
			Q						recalls	
			Q		√				recalls	

WU 03

Objective Number	Objective Description
WU-03-Exc 5-1-2	Calculates weight on the moon's surface
WU-03-Exc 7-1-1	States any differences between the near and far sides of the moon
WU-01-Core-7R	States why only one experimental variable is changed at a time
WU-02-Core-5R	Relates masses of objects to their speed when equal forces are applied
WU-02-Core-8R	Selects the graph showing a change in an unbalanced force vs a speed change

ERIC Full Text Provided by ERIC

	Materials	Observer	Special Preparations	Quick Score	3 + Minutes	Basal	Math	Reading	Concept	Action Verbs	Notes
				Q						applies	
						√				recalls	
						√				applies	
						√				applies	
				Q						applies	

WU
O3
Core
1

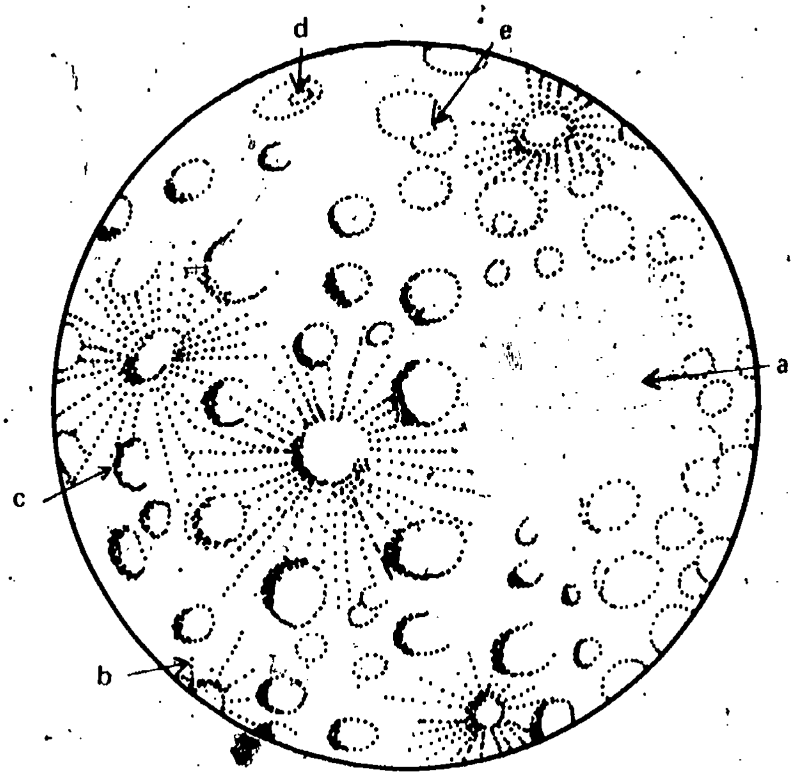
Recognizes a mare on the lunar surface.

The student identifies a mare in an illustration of the lunar surface.

Student Action: Selecting the broad, flat area on the lunar surface as the mare.

A: a
B: d
C: c

Performance Check A: The diagram below shows part of the lunar surface. Identify the mare by writing the letter of the arrow which points to it.



Remediation: Have the student read page 55 and the first paragraph on page 56.

WU
O3
Core

Selects a ray on the lunar surface.

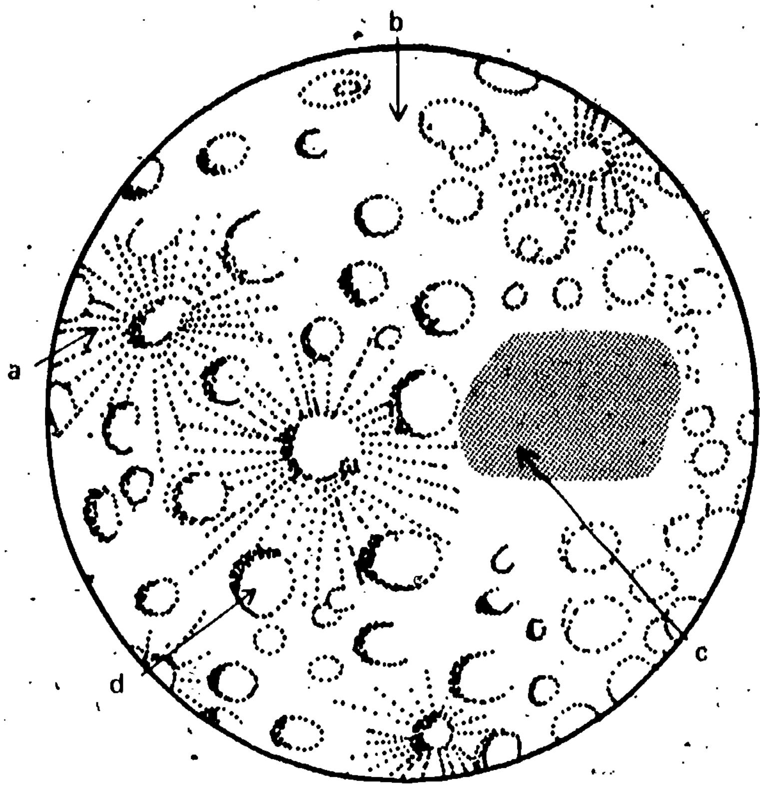
The student identifies a ray in a picture of the lunar surface.

Student Action: Selecting the arrow indicating the streaks across the surface of the moon that seem to originate in craters.

A: a
B: d
C: c

Performance Check A: The diagram below shows part of the moon's surface. Select the letter of the arrow on the illustration which indicates a ray.

2



Remediation: (1) Have the student review the second paragraph on page 56 and identify the rays shown in the picture below the paragraph. (2) Have him refer to Figures 5-18 and 5-19 on pages 72 and 73. (3) Have him read pages 72 and 73.

WU 03 Core 3

Explains scientific interest in the moon's origin.

The student recalls the reason that scientists are particularly interested in the origin of the moon's surface.

Student Action: Responding, in effect, that the reason for the scientific interest is that scientists believe that such information may help to explain the age and origin of the earth.

Performance Check A: Geologists are scientists who study the history and formation of rocks and minerals. They are very much interested in the origin of the moon's rocks. Why are these scientists particularly interested in the origin of rocks on the moon?

Remediation: (1) Have the student read page 58. (2) Have him read the first paragraph on page 63. (3) Review his answer to question 6-11 on page 86. Then discuss with him how the lack of weathering may result in lunar rocks remaining relatively unchanged over long periods of time. (4) Have him read Problem Break 6-1 on page 87.

WU 03 Core 4

Describes the origins of craters from illustrations.

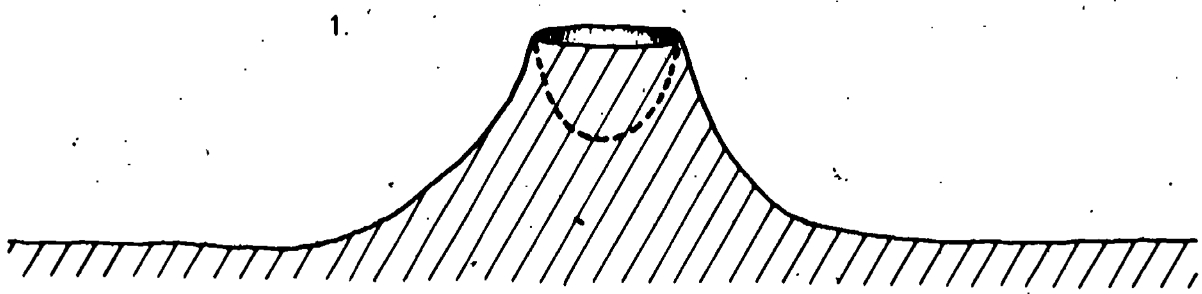
The student classifies (1) craters whose floors are above the surrounding area as caused by volcanic activity, (2) the circular craters with raised rims, steep walls, and floors below the surrounding area as caused by meteor impact, and (3) the circular craters with sloping walls extending below the surrounding surface as caused by an underground atomic blast.

Student Action: Naming the correct cause as determined by shape for at least two of the three following craters: volcanic craters, meteor craters, and craters caused by underground atomic blasts.

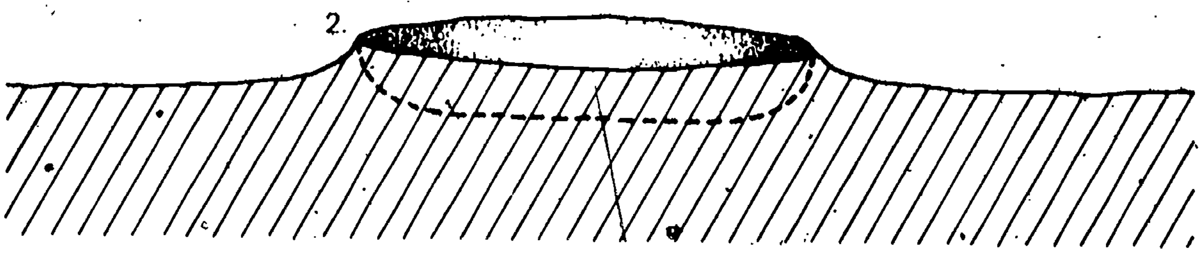
A: 1. volcano, 2. meteor impact, 3. atomic blast
B: 1. atomic blast, 2. volcano, 3. meteor impact
C: 1. meteor impact, 2. atomic blast, 3. volcano

Performance Check A: The diagrams below show craters that were formed on the earth's surface. The dashed lines show the interiors of the craters. On your answer sheet, write the most probable cause of each of these craters.

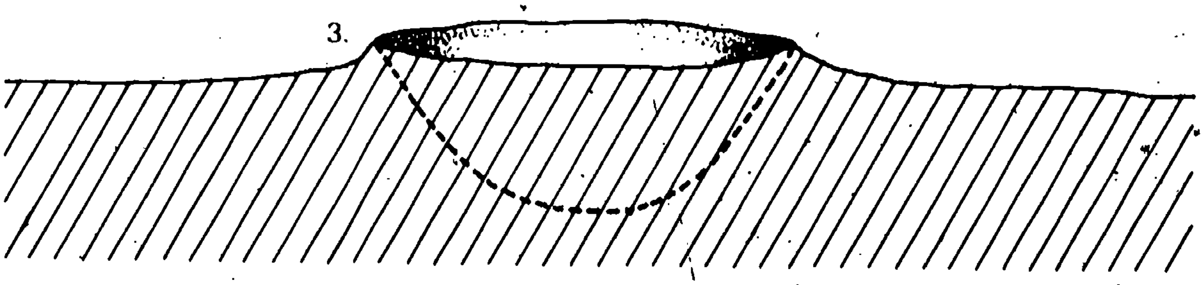
1.



2.



3.



Remediation: (1) Have the student review Figures 5-7 through 5-12 on pages 60, 61, and 62. (2) Have him read pages 60 through 62. (3) Review his answer to Self-Evaluation 6-2. (4) Reassess the student's knowledge of crater formation by assigning him one or more of the following checks: WU-03-Core-19, WU-03-Core-21, or WU-03-Core-23.

ERIC

Lists variables that affect the size of impact craters.

The student recalls the two variables that affect the size of a crater formed by the impact of falling objects.

Student Action: Stating the essence of the two variables: (1) the mass of the falling object and (2) its speed when it hits.

Performance Check A: What are two variables that determine the size of the crater that is formed by a falling body?

Remediation: Have the student read from the last paragraph on page 65 through page 67.

WU 03 Core 5

States the relationship between the mass of an object and the speed of its fall.

The student applies the concept governing the speed at which objects of different mass fall when dropped from the same height, ignoring the effects of air friction.

Student Action: Stating, in effect, that both objects were traveling at the same speed because they were dropped from the same height and therefore fell at the same speed.

Performance Check A: Simon, Tina, and their teacher were on the roof of the school. Simon dropped a steel shotput (ball) and Tina dropped a wooden ball of exactly the same size from exactly the same height to the ground.

1. Which object was traveling faster when it struck the ground?
2. Explain your answer.

Remediation: (1) Have the student read rules 1 and 2 on page 66. (2) Have him do Excursion 4-1, pages 121 through 124.

WU 03 Core 6

Relates graphically the mass of a falling ball vs the crater size produced.

The student classifies the graph showing an increase in crater size with an increase in mass as the one best representing the relationship between the mass of a ball and the crater size.

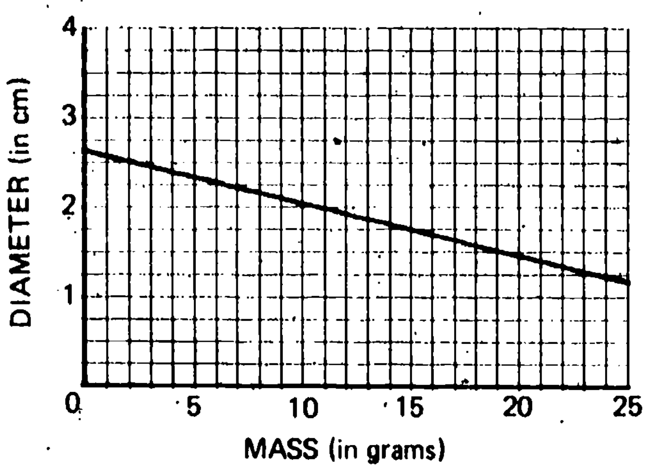
Student Action: Selecting the graph with the line slanting upward from the lower left to the upper right corner.

A: d
B: b
C: a

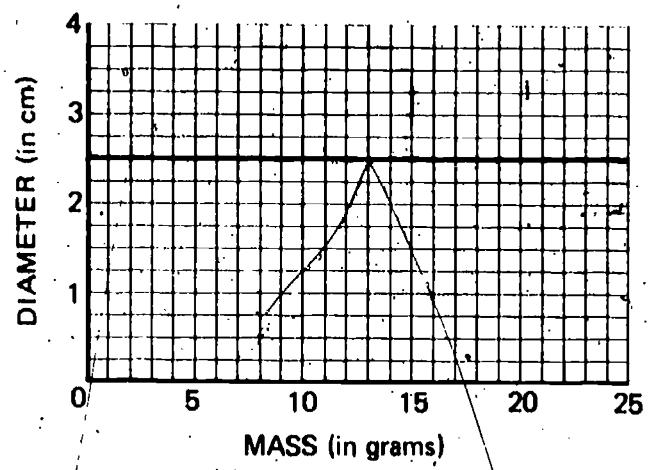
WU 03 Core 7

Performance Check A: Select the graph that best shows how the diameter of a crater changes when balls of different masses but the same diameter are dropped into sand.

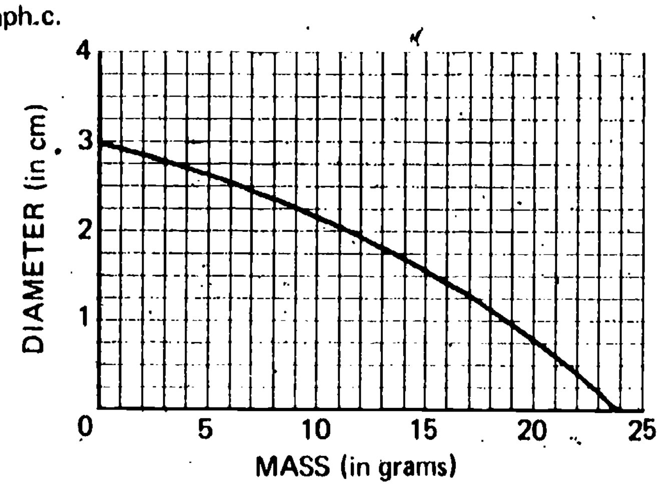
Graph a.



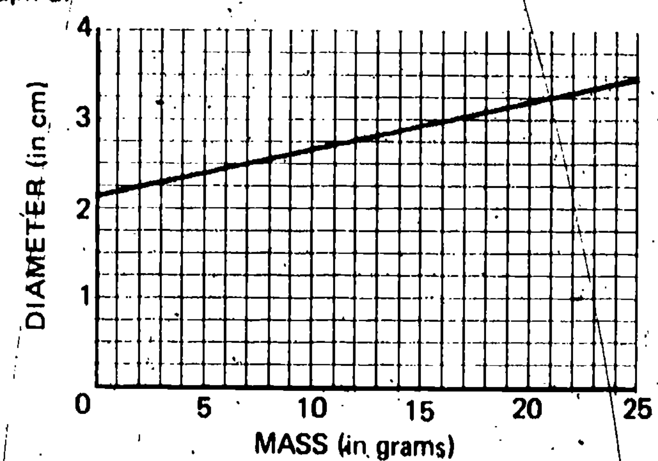
Graph b.



Graph c.



Graph d.



Remediation: (1) Review the student's answer to question 5-10 on page 66. (2) Review his answer to Self-Evaluation 5-3 b.

WU O3 Core 8

States the reason for changing only one variable at a time.

The student applies the concept that during an investigation, only one variable is changed at a time.

Student Action: Stating, in effect, that only one variable is changed at a time so that the effects of the changes in that variable cannot be confused with the effects of changes in other variables.

Performance Check A: When you dropped balls into sand to form craters, you changed the mass by using different balls. You also changed the distance of fall to give a different impact speed. Why did you change only one of these variables at a time?

Remediation: (1) If a Level II text is available, have the student review Excursion 4-1. (2) Have the student work through the following exercise.

In the question you were told that when you formed craters, using sand and balls, you changed the mass by using different balls. You also changed the distance of fall to give a different impact speed. What are the variables that you were changing?

Suppose you change the size of the ball used and at the same time change the distance of fall. Which of the variables will be responsible for the change in the size of the crater?

Are you having trouble with the last question? Suppose you changed only the size of the ball but hold the distance of fall constant. Which variable is now responsible for the change? Now that you have all the answers, why do you change only one variable at a time?

WU 03 Core 9

States a plan to find the effect of a falling object's diameter on crater size.

The student generates a description of a plan to investigate the effect on the size of the crater formed of varying the diameter of a falling body.

Student Action: Stating a plan which includes the idea of holding the mass of the ball and the distance of fall constant while systematically varying the size of the ball.

Performance Check A: Suppose you wanted to investigate the effect of changing the diameter of a falling body on the size of the crater it makes. Describe a plan you could perform to investigate this effect, using a ball and sand. Be sure to include in your description the variables you would vary and those which you would keep the same throughout the investigation.

Remediation: Have the student review Activity 5-5 on page 66 to be reminded about which variables should be kept constant.

WU 03 Core 10

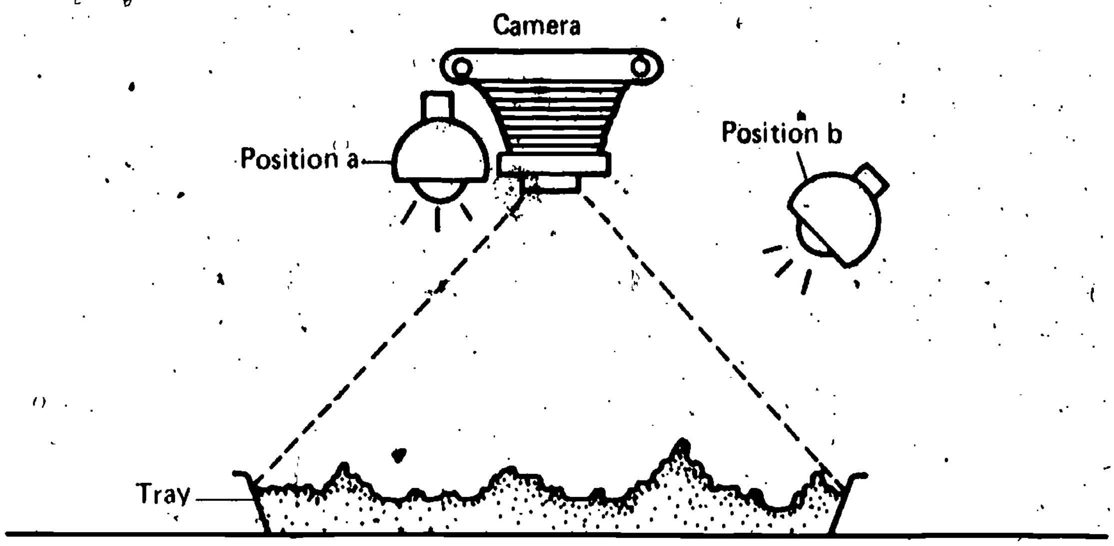
Selects the position of a light source for the maximum surface detail of a rough surface.

The student applies the concept that low level lighting of a rough surface produces the sharpest shadows.

Student Action: Selecting the light source at the side and stating to the effect that more detail is seen in a photograph of a rough surface when the light source is positioned at the side rather than overhead because the shadows reveal the surface irregularities.

A: b
B: a
C: b

Performance Check A: Henry wants to take a photograph of some of the moon craters he has made. He sets up the equipment as shown below.



1. If he wants to get the most detail, should he put the light at position a or position b?
2. Explain your answer.

Remediation: Have the student study Figures 5-14 and 5-15 and the paragraph following on page 69.

WU O3 Core 11

States the cause of erosion on the moon.

The student recalls why erosion occurs on the moon's surface even though there is no wind or rain.

Student Action: Stating that erosion on the moon is the result of bombardment by particles (meteors) from space.

Performance Check A: There is no rain or wind to cause erosion on the surface of the moon. However, erosion does occur. What causes craters and cones on the moon's surface to erode?

Remediation: (1) Review the student's answer to question 5-17 on page 70. (2) Have the student read the two paragraphs on page 70.

WU

Indicates the relative age of overlapping craters.

The student applies the concept that the relative age of two overlapping craters can be determined by their shapes.

Student Action: Selecting the crater with the incomplete rim and stating the effect of the concept that when crater rims intersect, the rim of the younger crater will tend to be complete and the rim of the older will be interrupted by the younger.

A: b

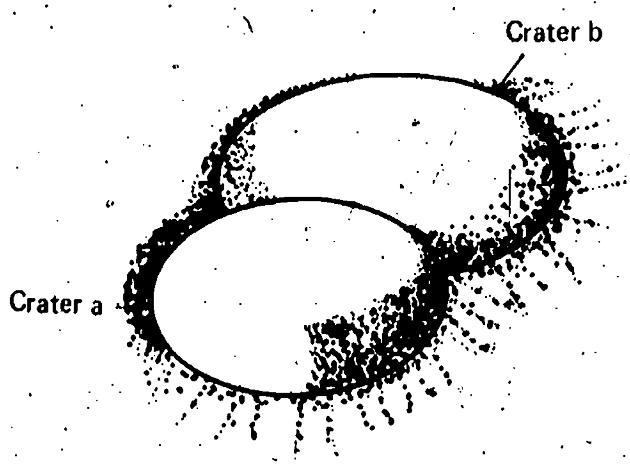
B: a

C: x

O3 Core 12

Performance Check A:

1. Which of the moon craters in the diagram below was formed first?
2. Explain the reason for your choice.



Remediation: (1) Have the student read Activity 5-10. (2) Review together his answers to questions 5-20 and 5-21 on page 71 and have him redo Activity 5-10 if necessary. (3) Review his answer to Self-Evaluation 5-5.

States why the model for the surface material of the moon was changed.

WU O3 Core 13

The student applies the concept that models are modified when they no longer agree with observations.

Student Action: Stating, in effect, that the model was changed because the old sand model could not explain the light-colored rays on the surface of the moon.

Performance Check A: The sand model of the moon's surface explained the shape and size of craters. Why was this model of the moon's surface changed to a rotten-stone-on-top-of-bentonite model?

Remediation: (1) Have the student review Activity 5-13 on page 75. (2) Review his answers to questions 5-27 and 5-28 on page 76.

Predicts color change in rock as the moon's surface is drilled.

WU

The student applies the concept that the light-colored material of the rays may come from beneath the moon's surface.

O3 Core 14

Student Action: Predicting, in effect, either that the rock will be lighter or that the sequence will be light-dark-light beneath the moon's surface.

Performance Check A: Suppose you were on the moon near a crater that had rays coming from it. You drilled into the surface and examined the rock that you hauled up. Predict how the color of the rock will change as you drill deeper.

Remediation: (1) Have the student read Activities 5-11 and 5-12 on pages 74 and 75. (2) Review his answers to questions 5-24 through 5-28 on pages 74 through 76. (3) Review his answer to Self-Evaluation 5-7.

WU O3 Core 15

Selects the relationship between the darkening of paper and of the moon's surface.

The student applies the concept that the fact that a model may act in the same way as a real object does not mean that the two are the same.

Student Action: Selecting the response to the effect that since sunlight causes some substances to darken, sunlight is a possible cause of the darkening of the moon's surface.

A: b
B: a
C: c

Performance Check A: In Activity 5-12, you found that sunlight darkens a piece of light-sensitive paper. Which statement below is the best conclusion about the effect of sunlight on the moon's surface which you can draw from that activity?

a. Since sunlight darkens the moon's surface, that surface is made of the same chemicals as the light-sensitive paper.
b. Since sunlight causes some substances to darken, this might explain the moon's surface material being darker than that underneath the surface.
c. Sunlight causes the surface of the moon to darken.
d. Sunlight darkens the surface material on the moon but does not affect the material thrown out from below the surface.

Remediation: (1) Have the student read the paragraph following question 5-26 on page 75. (2) If he needs to be reminded of the light-sensitive test, refer him to Activity 5-12 on page 75.

WU O3 Core

Compares the effects of a force applied to an object on the moon and on the earth.

The student applies the concepts that on the moon's surface the force of gravity is less than on the earth's surface and that there is no air friction on the moon's surface.

Student Action: Responding that the object would travel a greater distance and with the effect of both concepts.

A: greater
B: greater
C: higher

Performance Check A: Suppose you were on the surface of the moon and hit a baseball.

1. Would it travel a greater or smaller distance than it would on earth?
2. State two reasons for the difference.

Remediation: (1) Review the student's answers to questions 5-29 and 5-30 on page 76. (2) Refer him to Excursion 5-1, page 137.

16

WU 03 Core 17

States the reason for the formation of central peaks in craters.

The student recalls a model for the formation of a moon crater which has a central peak.

Student Action: Responding that the meteor which formed the crater with the central peak must have been traveling more rapidly and, in effect, that the heat produced by the impact had to be great enough to melt both the meteor and the moon's surface so that they became liquids.

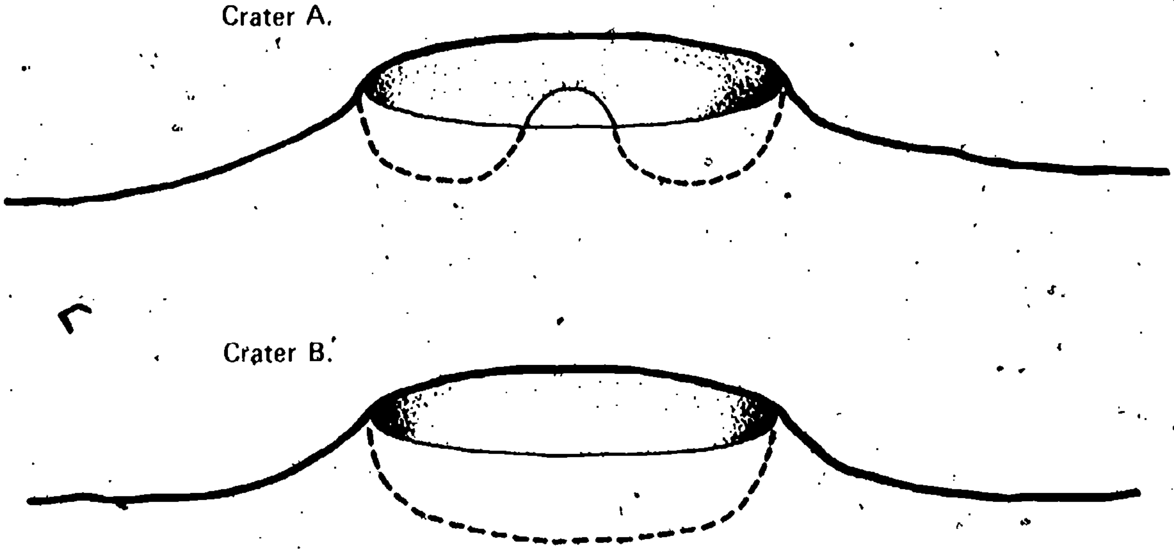
A: more rapidly
B: more slowly
C: more rapidly

Performance Check A: The diagrams below show craters that were formed by the impact of meteors on two places on the moon where the surfaces were identical. The dashed lines show the interiors of the craters.

1. Was the meteor that caused crater A traveling more slowly or more rapidly than the meteor that caused crater B?
2. What evidence do you have for your answer?

Crater A.

Crater B.



Remediation: (1) Have the student read the last paragraph on page 79. (2) Review his answer to question 6-4 on page 82. (3) Review his answer to Self-Evaluation 6-1.

WU 03 Core 18

States the conditions which determine the size of the central peak during a crater's formation.

The student recalls the conditions which will increase the size of the central peak during the formation of an impact crater.

Student Action: Stating the effect of at least two of the following: there must be (1) an increase in the depth of the loose surface material, (2) an increase in the size of the drops of water, or (3) an increase in the height from which the water is dropped.

Performance Check A: You found that when you dropped a drop of water on a layer of bentonite, it formed a crater with a central peak. State three ways in which you can increase the size of your model's central peak during the crater's formation.

Remediation: Review the student's answers to questions 6-2 and 6-3 on page 82.

WU 03 Core 19

States the probable cause of cinder cones on the moon.

The student recalls that cinder cones on the moon whose crater bottoms are above the moon's surface may be of volcanic origin.

Student Action: Responding, in effect, that the origin of the lunar cones is probably volcanic.

Performance Check A: The sketch below shows a cinder cone on the surface of the moon. What is the most likely cause of this cinder cone?

Remediation: (1) Refer the student to Figure 5-7 on page 60. (2) Refer him to Figure 6-4 on page 83. (3) Review his answer to question 6-8 on page 84. (4) Other objectives related to this are 03-Core-4, 03-Core-21, and 03-Core-23.

WU

States a possible cause for the dome-shaped mountains on the moon.

The student recalls that underground magma flows are thought to have caused the dome-shaped mountains on the moon.

Student Action: Responding to the effect that underground flows of molten rock, or magma, are thought to be the cause of the dome-shaped mountains on the moon.

Performance Check A: There are dome-shaped mountains on the surface of the moon. State a possible cause for these mountains.

Remediation: (1) Have the ~~student~~ review Activity 6-8 on page 85 and question 6-10 and the paragraph that follows on page 86. (2) Review his answer to Self-Evaluation 6-3.

O3 Core 20

WU O3 Core 21

Matches features of the moon with their probable causes.

The student identifies features of the moon's surface according to their origins.

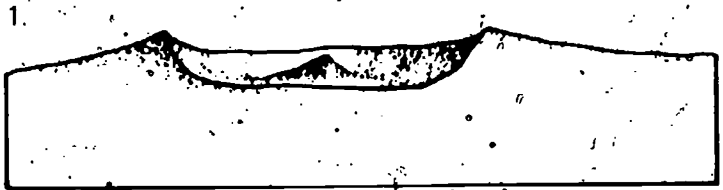
Student Action: Matching the diagrams with the probable causes as follows: the meteor crater with a central peak as having been caused by a fast-moving meteor, the meteor crater without a central peak as having been caused by a slow-moving meteor, the cinder cone crater as having been caused by volcanic eruption, and the dome-shaped mountain as having been caused by an underground magma flow.

A: 1. b, 2. a, 3. e, 4. c
B: 1. d, 2. c, 3. b, 4. a
C: 1. a, 2. e, 3. d, 4. b

Performance Check A: The diagrams below show four different features which occur on the moon's surface. After the number of each feature, write the letter of the probable cause of that feature.

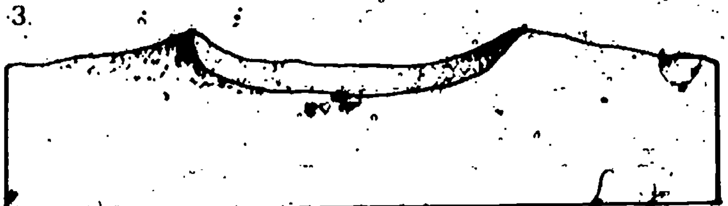
Feature

1.



2.

3.



4.

Probable Cause

a. Volcanic eruption
b. High-speed meteor impact
c. Underground magma flow
d. Explosion below the surface
e. Low-speed meteor impact

Remediation: (1) Review the student's answer to question 6-4 on page 82. (2) Review his answers to Self-Evaluations 6-2 and 6-3. (3) Have him read the paragraph following question 6-10 on page 86. (4) Have him do an alternate performance check or one of the related objectives - 03-Core-4, 03-Core-19, and 03-Core-23.

WU 03 Core 22

Recognizes the effect of variables in a model.

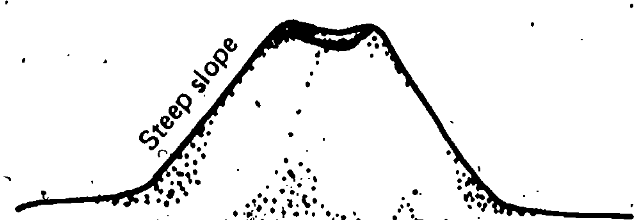
The student applies the concept that a model may not be directly interchangeable from one system to another because of the effect of other variables.

Student Action: Responding to the effect that the one difference is not sufficient reason to discard the model because other variables may be influencing the formation of the cone but the essential features of the basic model may still be pertinent.

Performance Check A: Suppose a scientist discovered a cinder cone on the moon's surface. Many of its features indicate that the cone was caused by volcanic activity. However, all cinder cones on earth which the scientists have observed have fairly gentle slopes, whereas the cones on the moon have steep slopes, as shown in the diagram below.

1. Is this sufficient evidence to throw out the model that volcanic action is responsible for the cones on the moon?
2. Explain your answer.

Cinder cone on earth



Cinder cone on moon

Remediation: Have the student consider the following problem.

Suppose you had a photograph showing surface features on earth which were definitely caused by the impact of a meteorite. You also have a photograph of surface features on the moon in which similar features are shown. There are some differences in the features, but some scientists strongly believe that the features on the moon were also caused by meteor impact. This first group of scientists argues that other variables may be influencing the formation of the moon's features. A second group of scientists believes that the same model cannot apply to both the earth and the moon.

1. Which group of scientists do you agree with?
2. Why?

If the student agrees with the second group, ask him whether different conditions on the moon from those on earth might explain the dissimilarities. Mention that the moon does not have weather as we experience it on earth and that the moon's gravity is weaker.

From considerations such as these, work with the student to develop the concept involved in the check.

WU 03 Core 23

States the cause of and the evidence for a certain cone.

The student applies the concept for determining the cause of lunar cone formation from pictorial evidence.

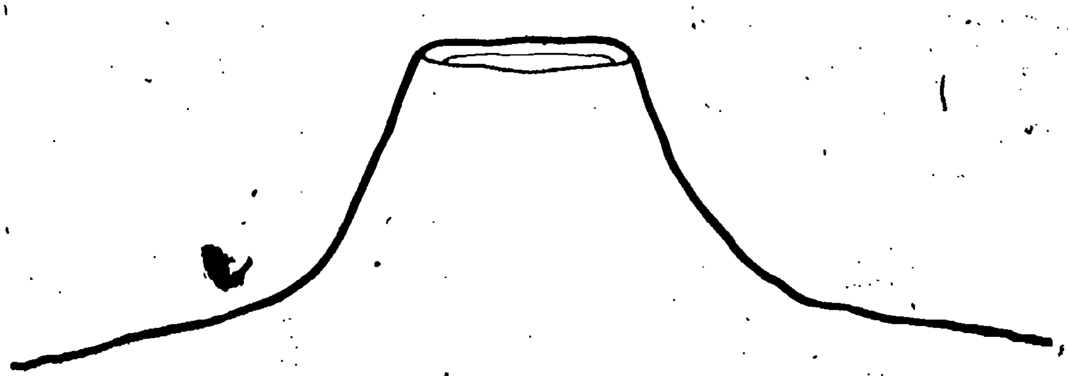
Student Action: Stating that the cone is of volcanic origin and the two pieces of pictorial evidence from the following list: (1) the cone has steeply sloping sides (cinder cone), (2) the surface of the central crater is above the level of the surrounding surface, (3) the crater is surrounded by rock debris, or (4) the crater is surrounded by a lava flow with a rippled surface.

A: 1. volcanic origin, 2. steeply sloping sides and floor above surface of surrounding surface.

B: 1. volcanic origin, 2. steeply sloping sides and rock debris surrounding it.

C: 1. volcanic origin, 2. steeply sloping sides and lava flow with a rippled surface.

Performance Check A: Use the diagram below to answer the questions that follow.



1. What is the most likely cause for the formation of this cone?
2. What two pieces of evidence from the diagram do you have to support your answer?

Remediation: (1) Have the student read page 86. (2) Have him review Figure 6-4 on page 83. (3) Have him read the first and second paragraphs on page 60. (4) Refer him to Figure 5-7 on page 60. (5) Review his answer to Self-Evaluation 6-2. (6) Have him select the feature in WU-03-Core-4 which is of volcanic origin.

WU 03

States things that cause changes in the moon's surface.

The student recalls three of the things that cause a change in the moon's features over a period of time.

Student Action: Responding to the effect of three of the following things which may cause changes on the moon's surface: (1) meteor impacts, (2) covering with dust, (3) gravity, (4) sunlight, (5) volcanic action, and (6) the settling and cracking of the crust.

ERIC

Core 24

Performance Check A: Features on the earth's surface change because of the weathering effects of wind and water. What are three things that may cause the surface of the moon to change?

Remediation: Have the student read (1) the paragraph prior to question 6-11 on page 86, (2) the paragraph above Figure 6-3 on page 82, (3) the paragraph above Figure 6-6 on page 86, and (4) the last paragraph on page 84.

WU 03 Core 25

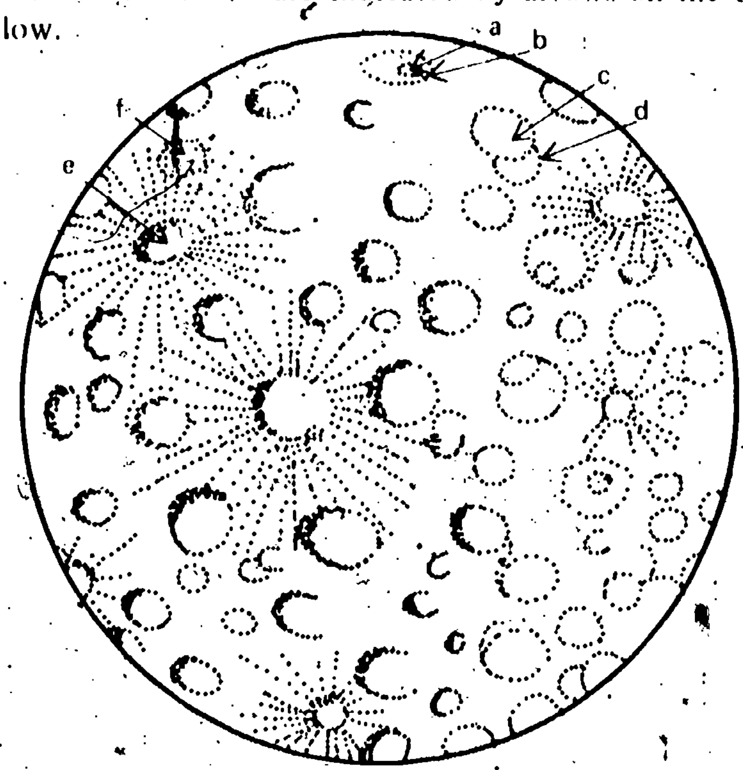
Predicts the relative ages of moon features.

The student applies the rules for predicting the relative ages of surface features on the moon seen in a diagram.

Student Action: Predicting the relative ages in agreement with the following rules: (1) circumscribing craters are older than smaller craters on their floors, (2) in a pair of overlapping craters, the one with the incomplete rim is the older, and (3) craters covered by light material from another crater (rays) are older than the crater that produced the rays, and stating the supporting evidence.

A: (1) b, (2) d, (3) f
B: (1) a, (2) d, (3) f
C: (1) b, (2) d, (3) e

Performance Check A: Several features are indicated by arrows on the diagram of the moon's surface below.



1. Indicate which of the two features in each of the following pairs is probably the older of the two features.
   (1) a or b
   (2) c or d
   (3) e or f
2. For each pair, state why you think the feature you selected is the older feature.

Remediation: Review with the student Problem Break 6-1 on pages 87 through 89.

Estimates the fraction of the earth seen from the moon during different time periods.

WU O3 Core 26

The student applies the model of the moon-earth-sun system to determine how much of the surface of a full earth can be seen by an observer on the moon in a twelve-hour interval and in a six-hour interval.

Student Action: Stating that the entire surface can be seen in 12 hours and that three-fourths of the surface can be seen in 6 hours.

Performance Check A: Get the materials you need to set up the sun-moon-earth model used in Activity 7-2. Arrange the model so that an observer on the moon sees a full earth.

1. What fraction of the earth's surface would an observer on the moon see in a 12-hour period?
2. What fraction of the earth's surface would an observer on the moon see in a 6-hour period?

Remediation: (1) Review the student's answer to question 7-3 on page 93. (2) If necessary, have the student repeat Activity 7-2 on page 93.

Matches the moon's position in relation to the earth with the moon's appearance.

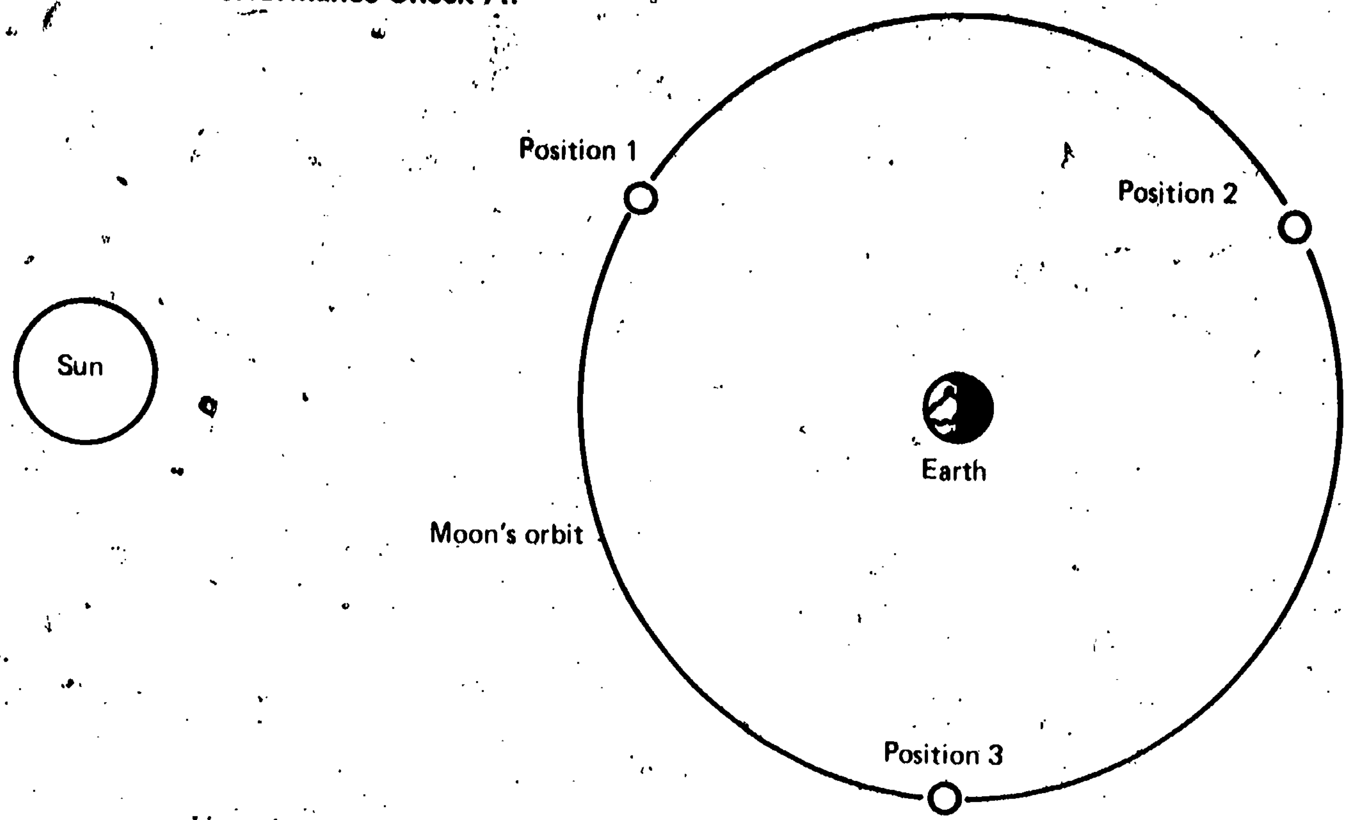
WU O3 Core 27

The student applies the sun-earth-moon model, in which the moon is orbiting the earth and the sun is the center of the earth's orbit.

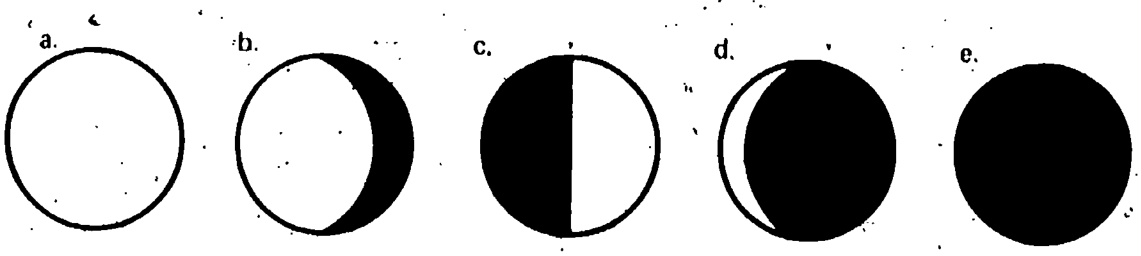
Student Action: Matching the diagram of a full moon with the position in which the earth is between the moon and the sun, a three-quarter moon with the position in which the sun-earth-moon angle is approximately 135°, a half-moon with the position in which the sun-earth-moon angle is about 90°, a one-quarter moon with position in which the sun-earth-moon angle is about 45°, and a new moon with the position in which the moon is between the sun and the earth.

A: 1. d, 2. b, 3. c
B: 1. c, 2. d, 3. b
C: 1. c, 2. e, 3. b

Performance Check A:



Use the sun-earth-moon model shown above to determine how the moon would appear to an observer on the earth who is facing the moon when the moon is in each of the three positions shown in the model. Write the number of the position and after it the letter of the diagram which shows the most likely appearance of the moon in that position.



Remediation: (1) Refer the student to Activities 7-2 through 7-5 on pages 93 through 95. (2) Review together his answers to questions 7-6, 7-7, 7-9, and 7-11 on pages 93 through 95. (3) Review his answer to Self-Evaluation 7-1. (4) Have him do an alternate performance check.

WU O3

Matches the moon's position with diagrams of the earth's appearance from the moon.

The student applies the sun-earth-moon model in which the sun is the center of the earth's orbit and the moon is orbiting around the earth.

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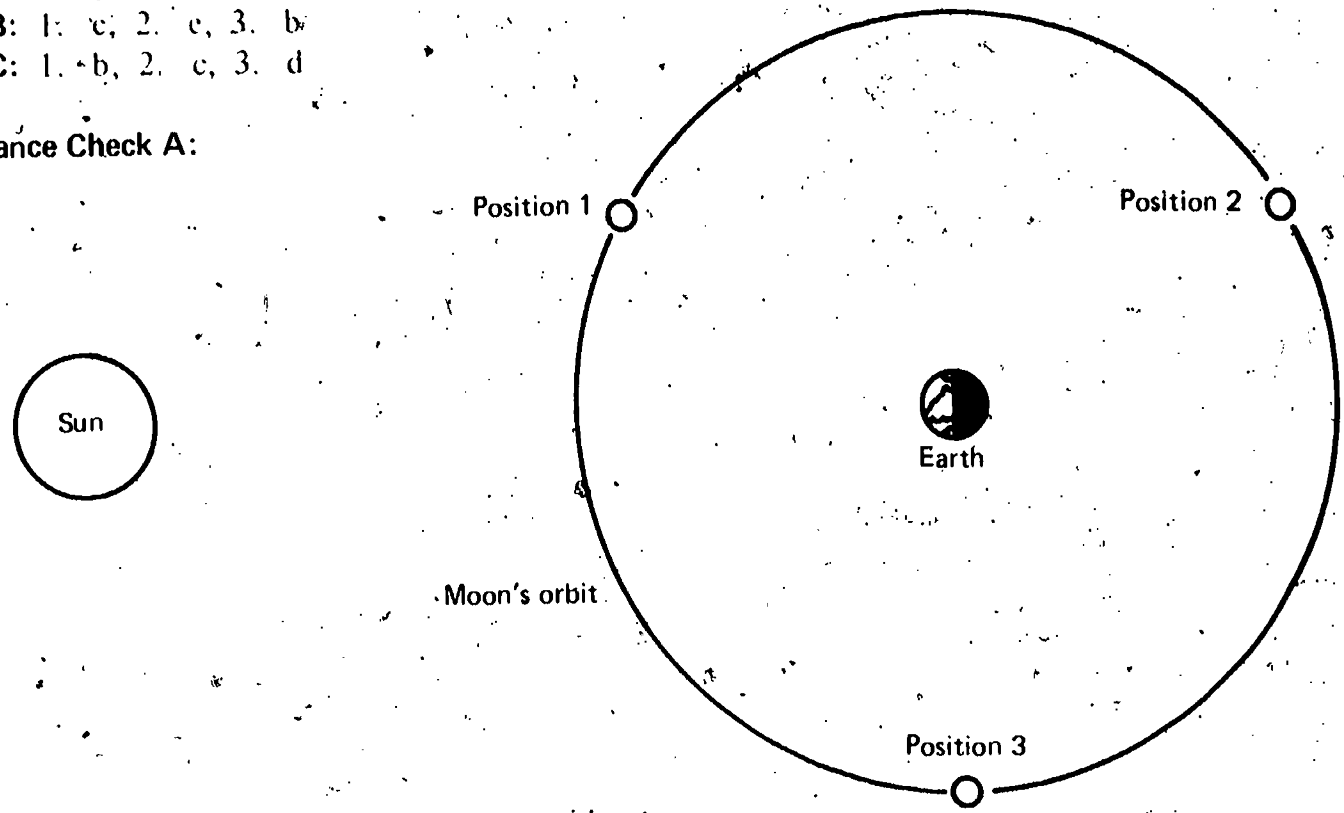
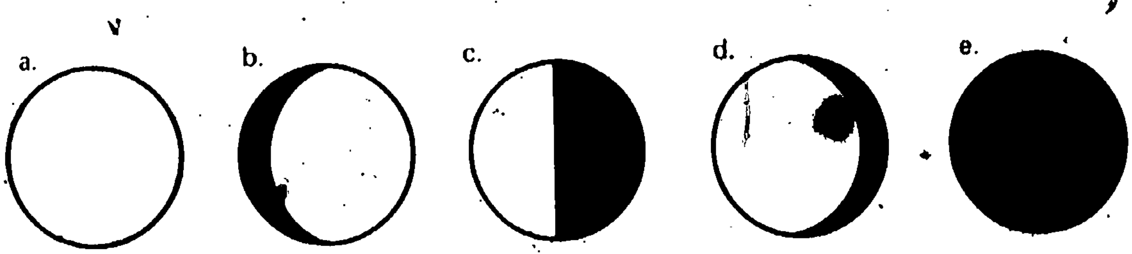
Student Action: Matching the diagram of the full earth with the position of the moon between the earth and the sun, the three-quarter earth with the sun-earth-moon angle of approximately 45°, the half earth with the sun-earth-moon angle of about 90°, the one-quarter earth with the sun-earth-moon angle of approximately 135°, and the new earth with the earth between the moon and the sun.

A: 1. b, 2. d, 3. c
B: 1. c, 2. e, 3. b
C: 1. b, 2. c, 3. d

Performance Check A:



Study the sun-earth-moon model shown above. Match each of the three positions of the moon with the diagram below which best shows how the earth would appear to an observer on the moon. Write the number of the moon's position and after it the letter of the earth diagram.



Remediation: (1) Refer the student to Activities 7-2 through 7-5 on pages 93 through 95. (2) Review his answers to questions 7-5, 7-8, and 7-12 on pages 93 through 95.

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WU O3 Core 29

Predicts the position of the earth as seen from the moon.

The student applies the concept that the same side of the moon always faces the earth.

Student Action: Selecting the response to the effect that the astronaut would still have to look directly overhead.

A: a
B: c
C: d

Performance Check A: An astronaut on the surface of the moon notices that the earth appears directly overhead. One week later, he returns to the same location on the moon's surface. Select the answer that best indicates where the astronaut will have to look to see the earth.

a. Directly overhead
b. About halfway between the horizon and overhead
c. Near the horizon
d. Impossible for him to see the earth

Remediation: (1) Refer the student to the wording of Activity 7-2 on page 93. (2) Review his answer to Self-Evaluation 7-3. (3) If the student has trouble visualizing the relationship, have him use the sun-earth-moon model from Chapter 7 to illustrate the concept.

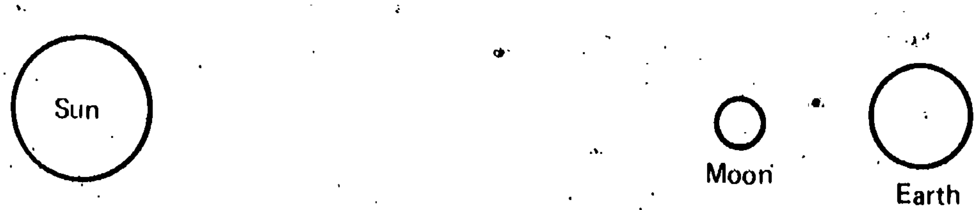
WU O3 Core 30

Explains why the new moon is not completely dark.

The student recalls why a new moon does not appear completely dark when viewed from the earth.

Student Action: Responding that the new moon is dimly lighted by light reflected from the earth.

Performance Check A: The diagram below shows the positions of the sun, the moon, and the earth when there is a new moon. Explain why an observer on the earth sees the surface of the moon as dimly lighted rather than completely dark.



Remediation: (1) Review the student's answer to question 7-10 on page 95. (2) Have him read the sentences preceding and following question 7-10 on page 95.

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Explains why only one side of the moon is seen from earth.

The student recalls why only one side of the moon is visible from the earth.

Student Action: Responding that only one side of the moon is visible from the earth because the moon makes one complete rotation on its axis in the same amount of time it makes one complete revolution around the earth.

Performance Check A: Since the moon revolves around the earth, why is only one side of the moon ever visible from the earth?

Remediation: (1) Refer the student to summary items 2 and 4 on page 96. (2) If he does not grasp the summary items, refer him to Activities 7-2 through 7-6 on pages 93 through 96. (3) Review his answer to Self-Evaluation 7-3.

WU O3 Core 31

States the moon's period in days.

The student recalls that the moon's period is 29½ days.

Student Action: Stating that the moon's period is 29½ days.

Performance Check A: What is the period in days of the moon's revolution around the earth?

Remediation: (1) Have the student review the text of question 4-22 on page 48, in which the term *period* is defined. (2) Review his answer to question 7-14 on page 97. (3) Have him review item 2 on page 96.

WU O3 Core 32

States the earth's period in days.

The student recalls that the earth has a period of 365¼ days.

Student Action: Stating that the period of the earth is 365¼ days.

Performance Check A: What is the period in days of the earth's revolution around the sun?

Remediation: Refer the student to question 4-22 on page 48 and to item 1 at the bottom of page 96.

WU O3 Core 33

Estimates weight on the moon's surface relative to the earth.

The student recalls that the weight of an object at the moon's surface is 1/6 of its weight at the earth's surface.

WU O3

Exc 5-1 1

Student Action: Responding that the weight is less at the moon's surface and that it would be 1/6 its weight on earth.

A, B, and C: 1. less, 2. 1/6

Performance Check A: Suppose you weighed an object at the earth's surface and then weighed the same object at the moon's surface.

1. Would the object's weight on the moon's surface be more, less, or about the same as its weight on the earth's surface?
2. If it would be more or less, how much more or less would it be? ______

Remediation: (1) Have the student read the first two paragraphs on page 137. (2) Review the student's answers to questions 1 and 2 on page 137.

WU O3 Exc 5-1 2

Calculates weight on the moon's surface.

The student applies the fact that an object weighs 1/6 as much on the moon as on the earth's surface.

Student Action: Multiplying its weight on the earth by the fraction 1/6. The exact results are unimportant, but if the multiplication is carried out, the results should be

A: 55 lbs
B: 80 lbs
C: 15 lbs

Performance Check A: A life-support system weighs 330 lbs when weighed at the earth's surface. What is its weight on the surface of the moon? Show your work.

Remediation: (1) Have the student read the first and second paragraphs on page 137. (2) Review his answers to questions 1 and 2 on page 137.

WU O3 Exc 7-1 1

States any differences between the near and far sides of the moon.

The student recalls that there are no important differences between the surface features of the near and far sides of the moon.

Student Action: Responding that there are no important differences in surface features between the near and far sides of the moon.

Performance Check A:

1. Do the surface features of the far side of the moon differ very much from the surface features of the side of the moon that is visible from the earth?
2. If so, describe the differences.

Remediation: Have the student read the last paragraph of Excursion 7-1, page 143.

Grids

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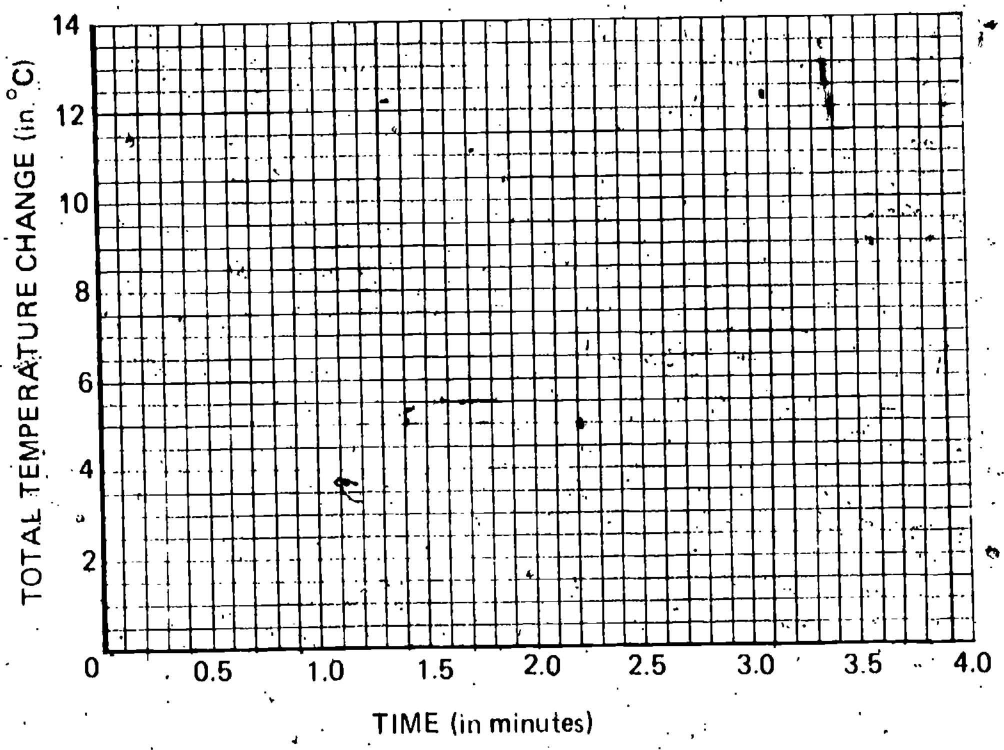
01-Core-16A, B, C



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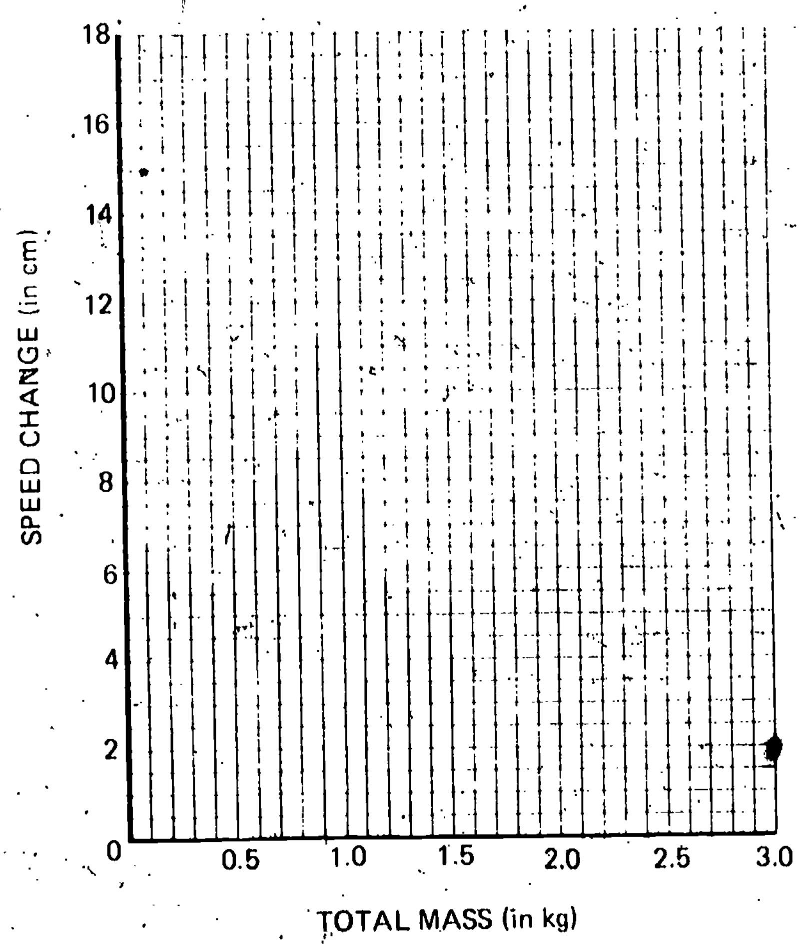
02-Core-6A, B, C



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