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AUTHOR Hathway, James A., Ed.
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ABSTRACT

This is one form of three performance checks booklets (A, B, and C) for two texts of Level III of the Intermediate Science Curriculum Study (ISCS). These two texts are In Orbit (IO), and What's Up (WU). The 12 performance checks booklets for Level III are considered one of four major subdivisions of a set of individualized evaluation materials for level III of the ISCS. This booklet (form B), developed to assess the students' achievement of the objectives of IO and WU of Level III, contains a set of performance checks which are equivalent to the performance checks of the other two forms (A and C). Each performance check has its own code number and identifies whether it is based on core material or excursions. Directions for students' use of performance checks are also included. (HM)

INTERMEDIATE SCIENCE CURRICULUM STUDY

ISCS

INDIVIDUALIZED TESTING SYSTEM

Performance Checks

ISCS LEVEL III
IO-WU
FORM B

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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MATERIALS DEVELOPMENT CONTRIBUTORS

Betsy Conlon Balzano, State University of New York at Brockport
Gary Carroll, F.S.U.
Susan K. Castle, Norristown, Pa.
Robert L. Cocanougher, F.S.U.
Allan D. Dawson, F.S.U.
Linda Dubaldi, F.S.U.
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John Selgrath, Warminster, Pa.
Everett S. Stallings, F.S.U.

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.

The Co-Directors
Intermediate Science Curriculum Study
Rm 415, W.H. Johnston Building
415 North Monroe Street
Tallahassee, Florida 32301

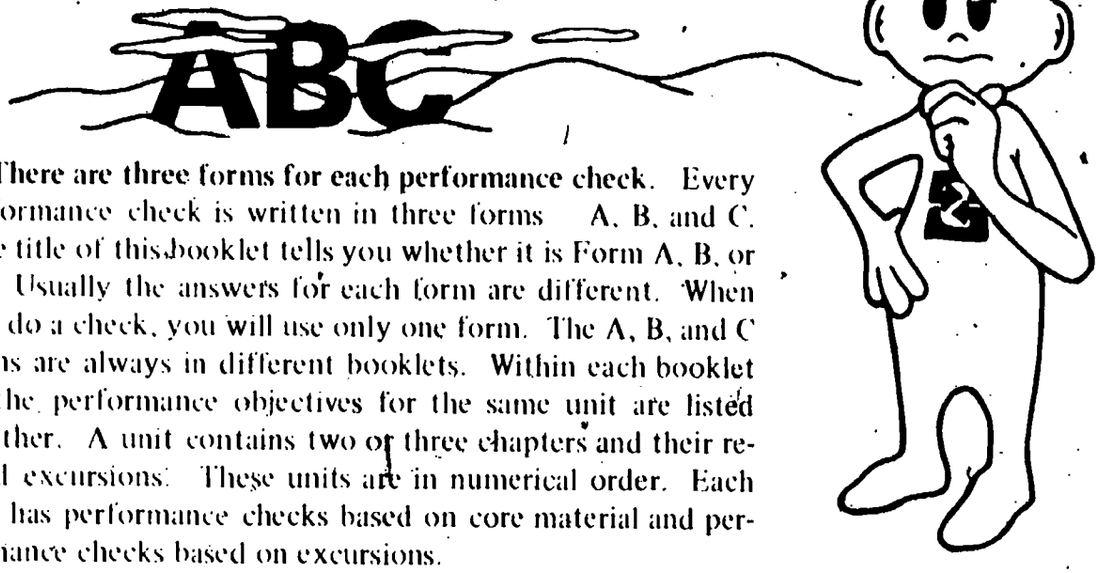
NOTES TO THE STUDENT

Now that you have completed several chapters, excursions, and self-evaluations, you are ready to help your teacher determine how well you are doing. The performance checks in this book will provide your teacher with this information. Then your teacher can help you with things you may not understand and can keep a record of your progress.

Read the next section carefully. It explains some important things about the performance checks in this book, and it gives you specific suggestions for using them.

What You Need To Know about Performance Checks

1. **You do performance checks when you are ready.** Performance checks are somewhat like the questions in the self-evaluations you do them when you are ready, not when the whole class is ready.
2. **Your teacher or both of you decide how many you do.** Your teacher or you and your teacher together will decide which ones you should do. You are not expected to do all of the performance checks.



3. **There are three forms for each performance check.** Every performance check is written in three forms A, B, and C. (The title of this booklet tells you whether it is Form A, B, or C.) Usually the answers for each form are different. When you do a check, you will use only one form. The A, B, and C forms are always in different booklets. Within each booklet all the performance objectives for the same unit are listed together. A unit contains two or three chapters and their related excursions. These units are in numerical order. Each unit has performance checks based on core material and performance checks based on excursions.
4. **Each performance check has its own number.** The number is in the outside margin of the page and will look like this: IO-03-Core-17A or WU-01-Exc 2-2-2A. These numbers mean

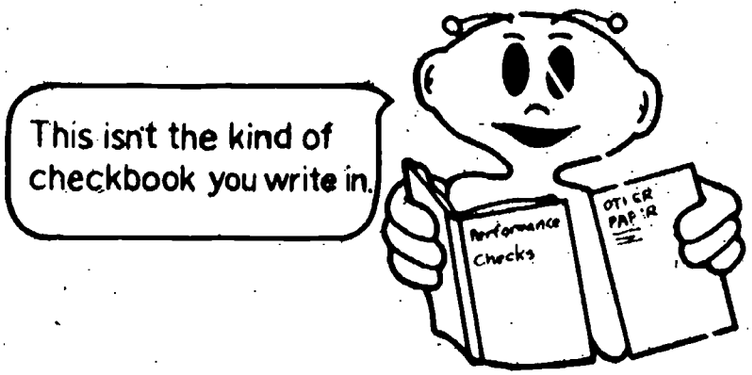
IO	-	03	-	Core	-	17	A	and	WU	-	01	-	Exc	2-2	-	2	A
text		unit		based on core material		check number	form of the check		text		unit		based on excursion material	excursion number		check number	form of the check

5. **Each performance check is separated from the other.** There is a line before each performance check and one after it. Some performance checks have several parts, so do everything called for between the lines. If there is no line at the bottom of a page, the check is continued onto the next page.

6. **Sometimes you will need to use equipment.** If special materials are needed, they will be in boxes labeled with the same number and sometimes the same letter too as the performance check for which you need them.

7. **Some performance checks have two or more answers.** If more than one answer is correct you must select all the correct choices. In such cases, selecting just one answer is not enough.

8. **Some performance checks have no answers.** Occasionally, you may be asked to do something that is impossible and to explain your answer. If so, say that the task is impossible and explain why.



9. **You share books of performance checks and YOU DO NOT WRITE IN THEM.** Write your answers on other paper. Give the number and form of the performance check for each answer you write. If you are to draw a graph, a chart, or a map, your teacher may provide you with grid paper or a copy of the map or chart.

10. **Your teacher or his assistant will collect and mark your checks.** And sometimes you must ask him to watch or assist you as you do a check.

11. **Sometimes a review procedure will be suggested.** If you can't do a performance check, you may be asked to review a part of the text or a self-evaluation question. You may then be checked on the same material, so be sure you understand the material you review. Get help if you need it.

In Orbit 10

Before you begin, tell your teacher that you are going to do this check. IO

Get an ISCS spectroscope, a sheet of white paper, and a 150-watt bulb and receptacle. Pretend that the 150-watt bulb is the sun. Determine whether the spectrum when observed with the left eye is different from the spectrum when observed with the right eye. 01-Core-1B

Get a 100-watt light bulb and a socket, and assemble them. Use a spectroscope to observe the spectrum of the light source. Look at the spectrum on the right side of the spectroscope. IO 01-Core-2B

1. What is the color on the right side of the green area of the right spectrum?
2. What is the color on the left side of the green area of the right spectrum?

Give a definition of the term *spectroscope*. IO 01-Core-3B

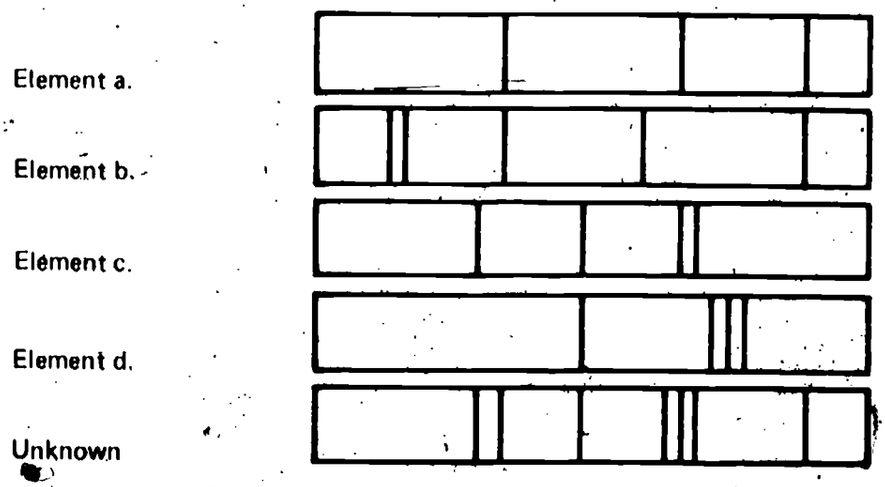
State what a diffraction grating in a spectroscope does to sunlight. IO 01-Core-4B

What does the term *spectrum* mean? IO 01-Core-5B

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: IO 01-Core-6B

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

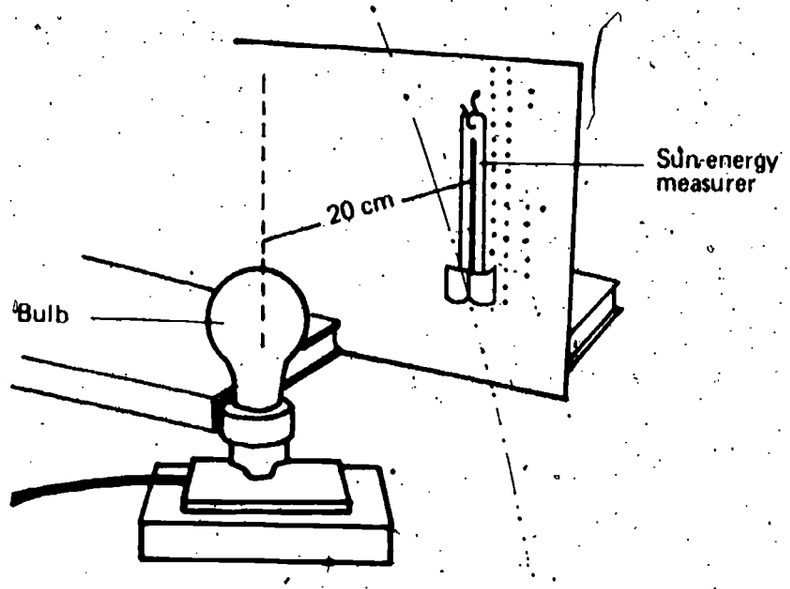
By heating crystals of four elements, a, b, c, and d, Vinnie obtained the first four spectra below. The last spectrum is the spectrum of a mixture of crystals containing some of the four elements. What elements (a, b, c, d) are in the unknown mixture? IO 01-Core-7B



IO 01-Core-8B	Suppose that just after completing an experiment in which you viewed the line spectra of several labeled salts, you ran out of burner fuel. 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.
IO 01-Core-9B	You observed the spectrum of the alcohol flame before you put the crystals of several chemicals into the flame to observe their spectra. Explain why this step was necessary.
IO 01-Core-10B	Archie has a 100-watt bulb in a heat lamp. He is using the lamp to heat a silver-colored box containing wax which he wants to use to make a sculpture. He finds that the wax remains too hard to change its shape. He has decided he will have to buy a larger light bulb. Suggest two ways that he could increase the heating effect of the lamp without buying a larger bulb.
IO 01-Core-11B	List the four variables which determine how much the temperature of an object changes when it is placed in direct sunlight.
IO 01-Core-12B	Suppose two men were in the bright sunlight in the summer. Both were wearing cotton suits which were identical except that one suit was dark blue and the other suit was white. 1. Which of the two men is probably warmer? 2. Explain your answer.
IO 01-Core-13B	Your sun-energy indicator contained a blackened copper strip. [illegible] the copper strip was blackened.

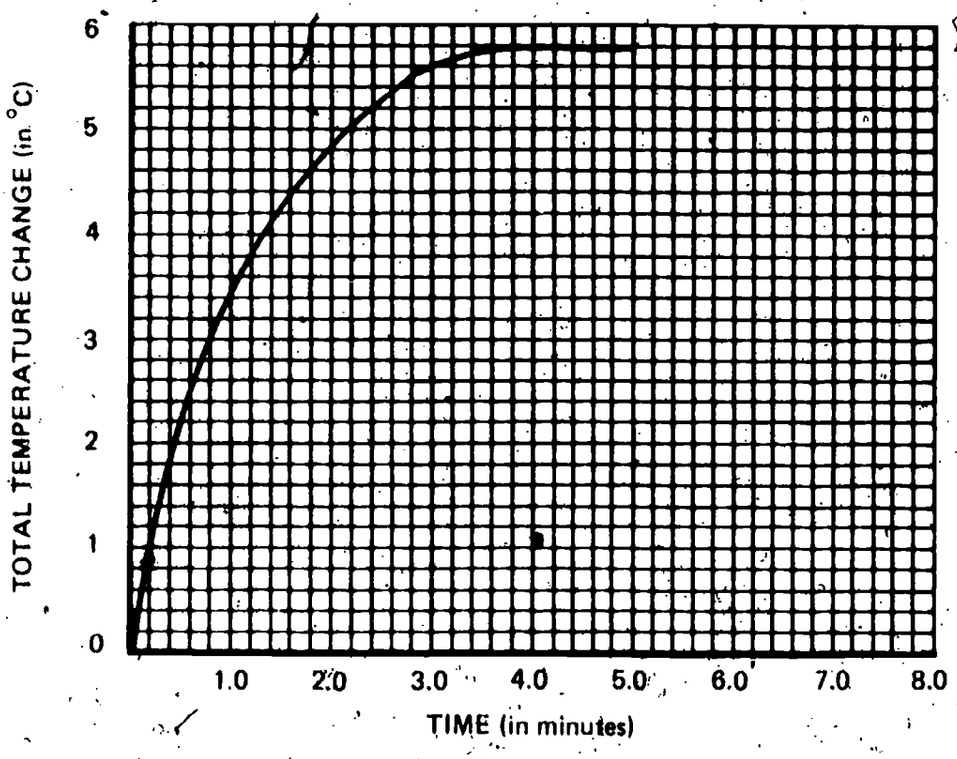
Sam measured the effect of different wattages of light bulbs on temperature change with his sun-energy measurer, as shown below. Why did Sam have to keep the following variables constant the distance of the light bulb from the measurer and the amount of time the bulb shone on the temperature measurer?

IO
01-Core-14B



Bob and Frank set up their sun-energy indicator, using a 100-watt bulb. They measured the temperature change for 5 minutes. Then, without turning off the bulb, Bob drew the following graph of their data. What do you predict will be the total temperature change of the sun-energy measurer 8 minutes after the beginning of the experiment?

IO
01-Core-15B

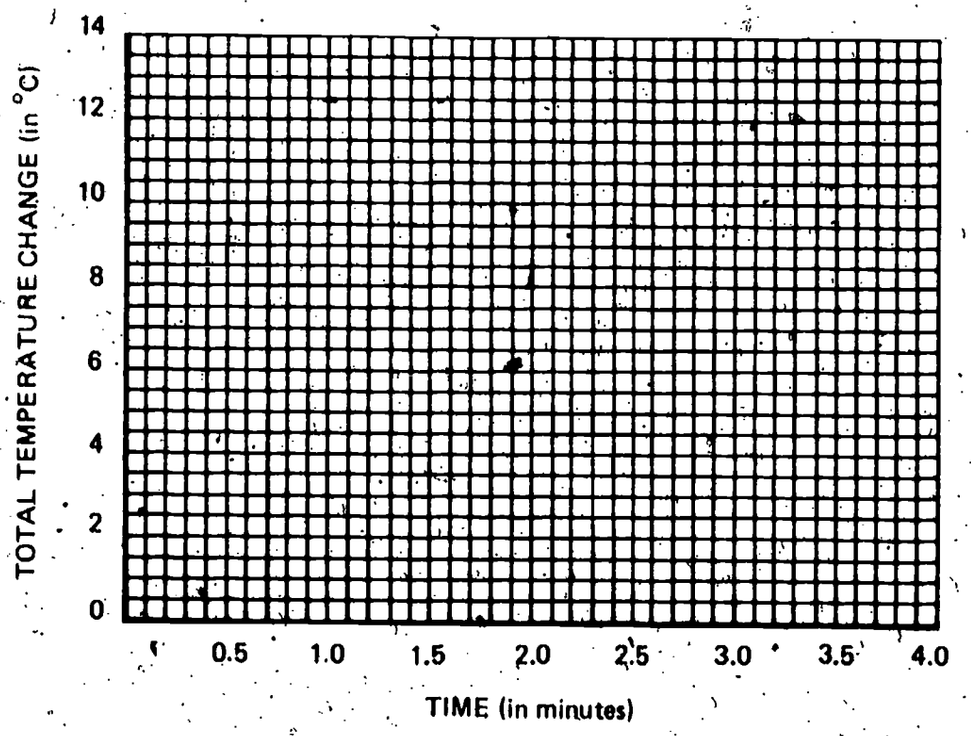


Before you begin this check ask your teacher for graph paper or a labeled grid like the one shown below.

Anne placed her sun-energy measurer near a light source and recorded its temperature every 30 seconds. Anne's data are shown below.

TIME (in min)	TEMPERATURE (in °C)	TOTAL TEMP. CHANGE (in °C)
0.0	21.8	0.0
0.5	23.6	1.8
1.0	25.5	3.7
1.5	27.6	5.8
2.0	28.8	7.0
2.5	30.0	8.2
3.0	30.7	8.9
3.5	31.0	9.2
4.0	31.1	9.3

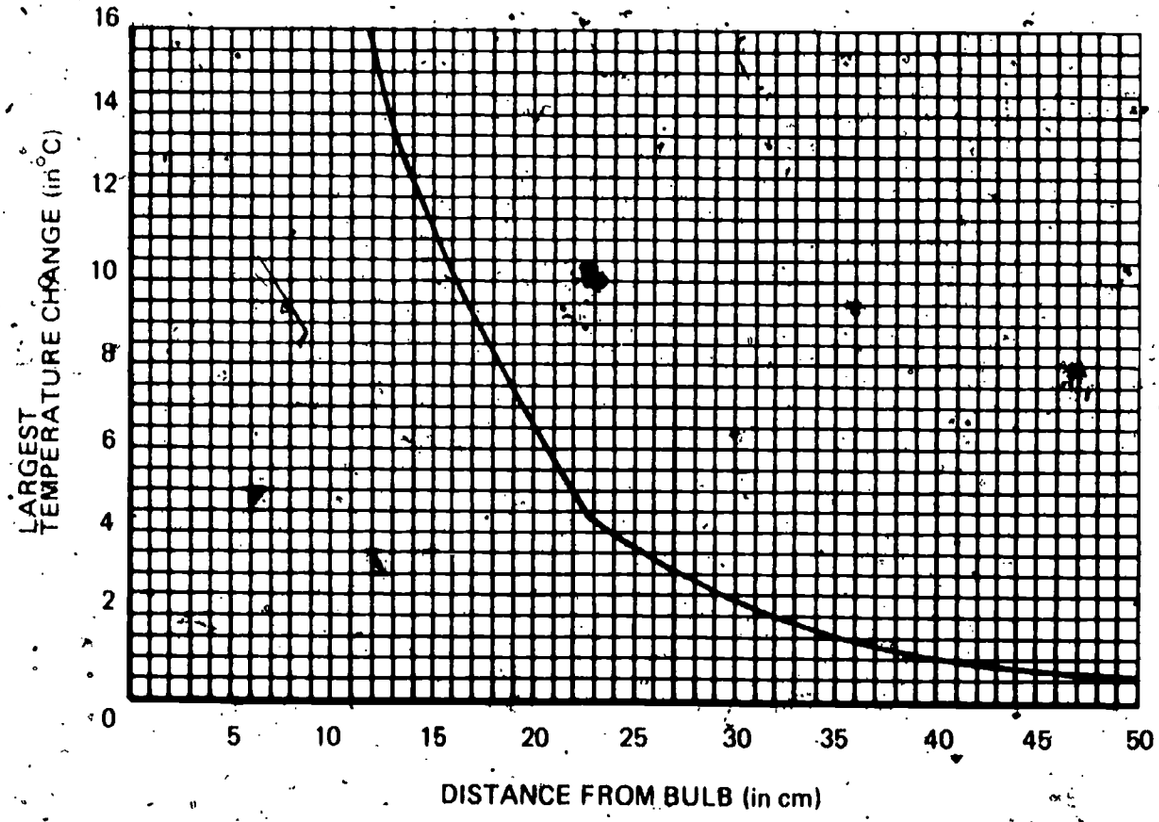
Graph Anne's measurements of the temperature change and the time on the grid.



A plastic lamp has the following sticker on its base. "WARNING: BULBS OF MORE THAN 60 WATTS ARE NOT TO BE USED IN THIS LAMP." IO 01-Core-17B

1. Explain why the warning sticker is on the lamp.
2. What might happen if you were to use a 100-watt bulb in the lamp?

Jim put a sun-energy measurer in direct sunlight. He found that the largest temperature change for his sun-energy measurer was 7.5°C. He then measured the largest temperature changes for his measurer at different distances from a 150-watt bulb. He used his data to plot the graph shown below. IO 01-Core-18B



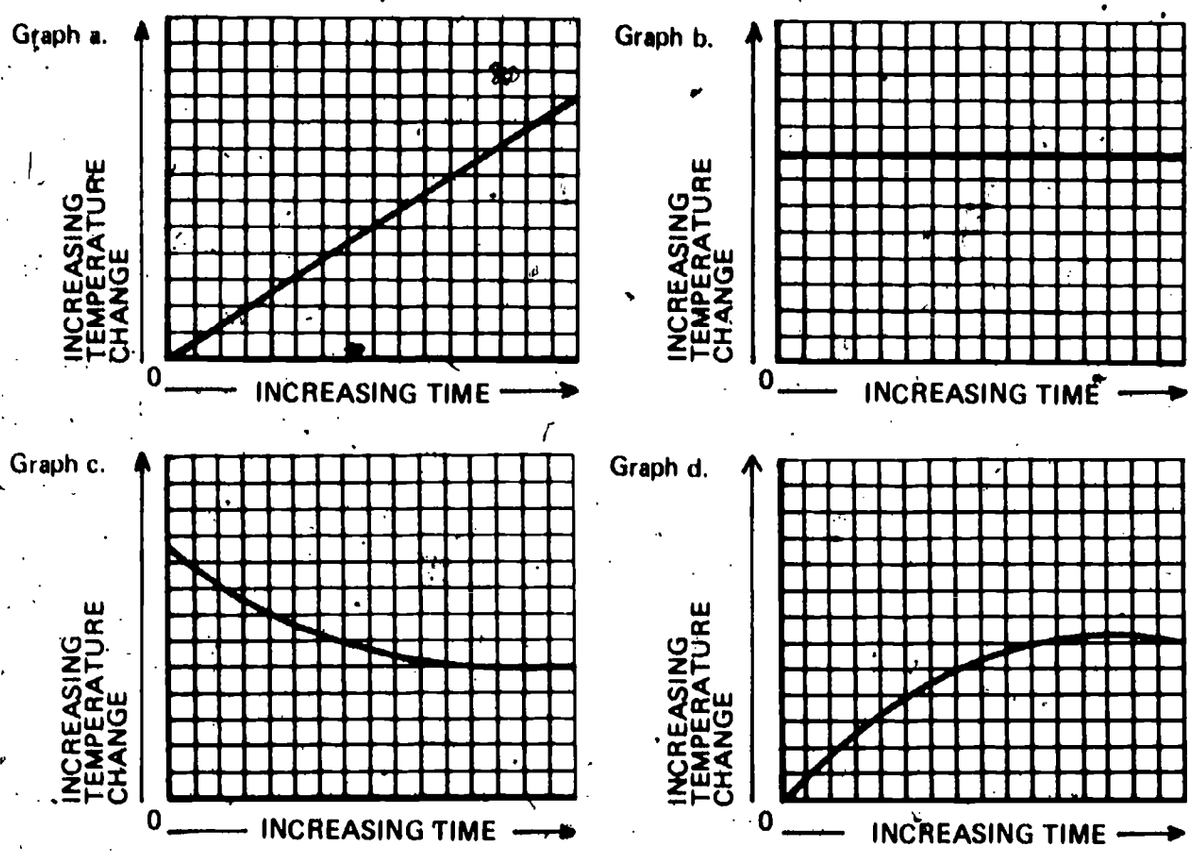
At what distance from the 150-watt bulb did his sun-energy measurer receive the same amount of energy as it did from the sun when it was placed in direct sunlight?

Some students decided to build a chicken brooder for keeping baby chicks warm. They doubled the dimensions shown in the plans. Thus in their brooder the light bulb which keeps the baby chicks warm is about twice as far from the baby chicks as the 25-watt bulb shown in the plans. Select the wattage of the light bulb that would produce nearly the same heating effect in the larger brooder as the 25-watt bulb produces in the smaller one. IO 01-Core-19B

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

10
01-Core-20B

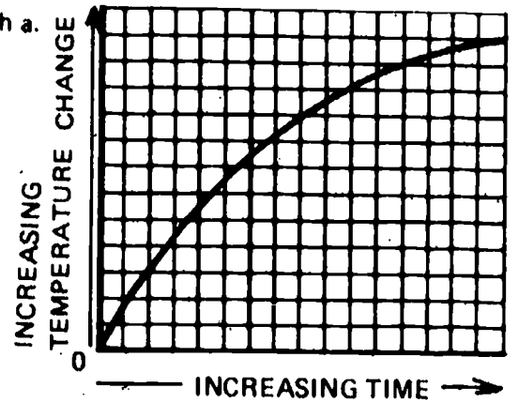
Judy recorded the temperature of her sun-energy measurer at room temperature and then put the measurer in front of a 100-watt bulb. Every 30 seconds, she read the temperature. Later she drew a graph showing the temperature rise of her sun-energy measurer over time. Which of the graphs below best shows what her graph might look like?



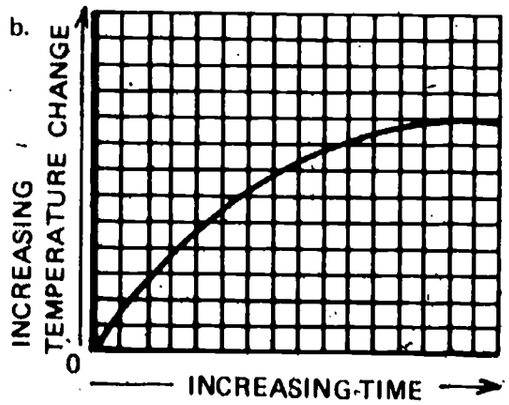
George measured the temperature changes in his sun-energy measurer when he placed it 20 cm from a 25-watt light bulb. He then changed to a 50-watt bulb and measured the temperature changes again. He also made measurements, using 75-watt and 100-watt bulbs. On your answer sheet, match the letters of the graphs he drew with the numbers of the light bulbs he used.

Bulbs	Graphs
1. 25 watt	
2. 50 watt	
3. 75 watt	
4. 100 watt	

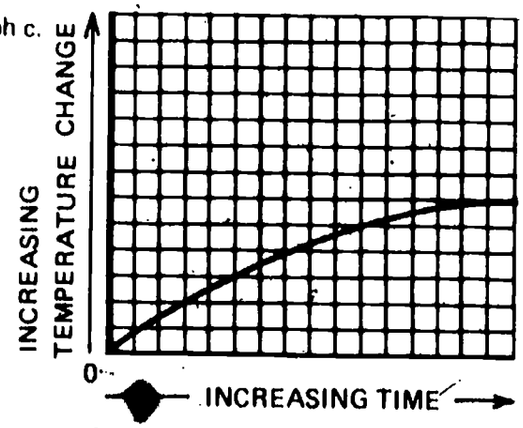
Graph a.



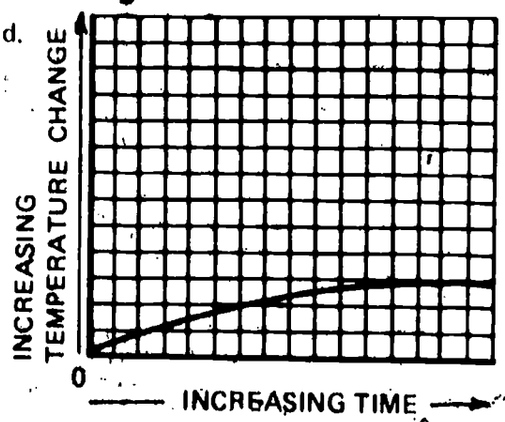
Graph b.



Graph c.

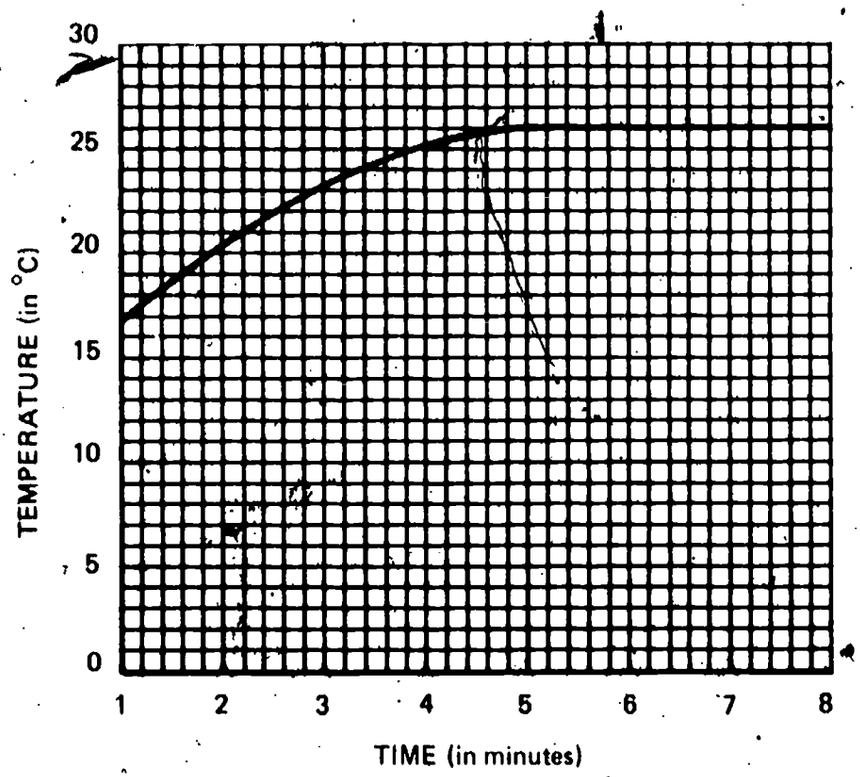


Graph d.



10
01-Core-22B

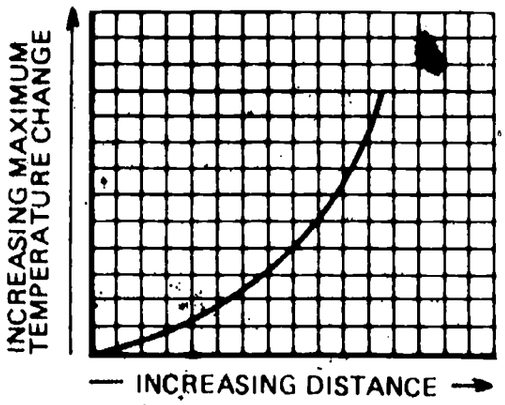
Damon placed his sun-energy measurer 30 cm from a light bulb and read its temperature. He then read it every 30 seconds. He plotted his temperature data on the graph shown below.



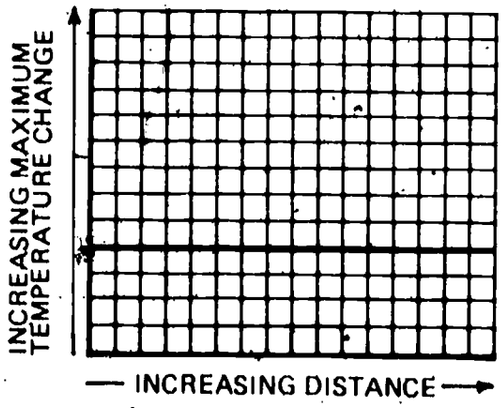
What was the total temperature change of Damon's sun-energy measurer?

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. IO 01-Core-23B

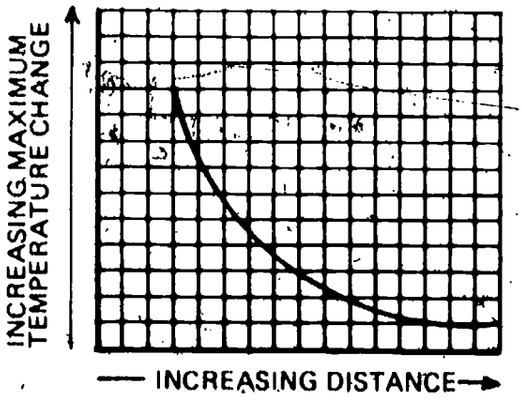
Graph a.



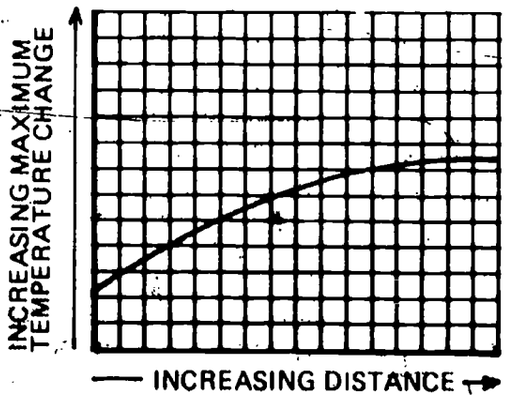
Graph b.



Graph c.



Graph d.



Your teacher will observe you for this check when he can. IO 01-Core-24B

Your teacher will observe you for this check when he can. IO 01-Core-25B

Your teacher will observe you for this check when he can. IO 01-Core-26B

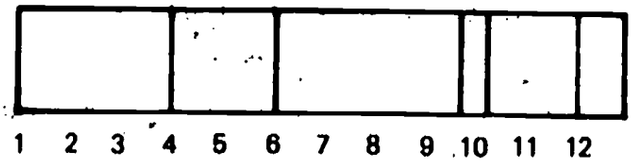
Your teacher will observe you for this check when he can. IO 01-Core-27B

Your teacher will observe you for this check when he can. IO 01-Core-28B

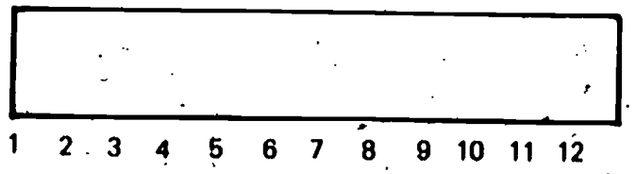
IO
01-Exc 1-1-1B

After doing an activity with his spectroscope, Joe drew the diagram below of the bright-line spectrum of element Y.

Element Y
Bright-line spectrum



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



IO
01-Exc 2-1-1B

Tim made a device that he called an "energy producer." He sealed it in a metal box, so there is no way to get to it. But there are two wires leading from the box. Sol, Tim's lab partner, decided to connect the two wires to his light bulb. The bulb has been burning brightly for ten days.

1. Describe what is happening inside the box to operate the bulb.
2. Can this device keep the bulb burning forever?
3. Explain your answer to part 2.

IO
01-Exc 2-1-2B

How would you calculate the amount of work done to move a piano across a room?

IO
01-Exc 2-1-3B

Explain what scientists mean by the term *conservation of energy*.

IO
01-Exc 2-1-4B

There are many forms of energy. List three of them.

You have probably used a ruler or a meterstick to measure the distance between objects directly. But sometimes you cannot measure distances directly. You can then use a range finder, which measures angles that can then be changed into distance measurements. Describe two different situations each of which illustrates a different condition under which distances should be measured indirectly.

10
02-Core-1B

State the principle on which a range finder works when you use it to measure the distance to an object.

10
02-Core-2B

Scientists use calibrated measuring devices (measuring devices with scales) when making an investigation. Why is it necessary to use calibrated rather than uncalibrated measuring devices?

10
02-Core-3B

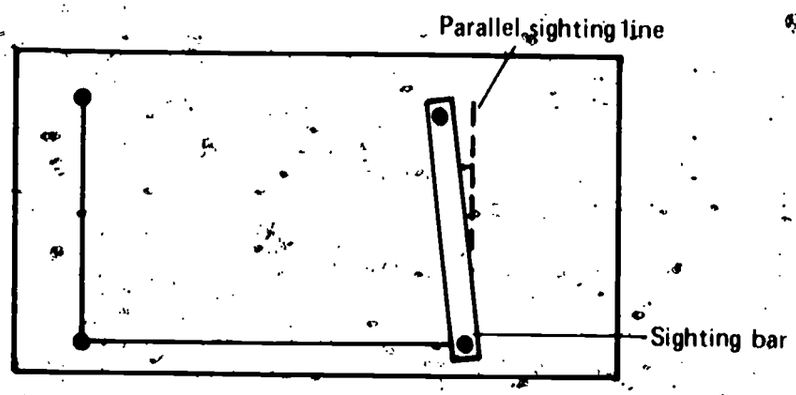
Get the ISCS range finder labeled 10-02-Core-4, and find the distance between the two points which your teacher names for you.

10
02-Core-4B

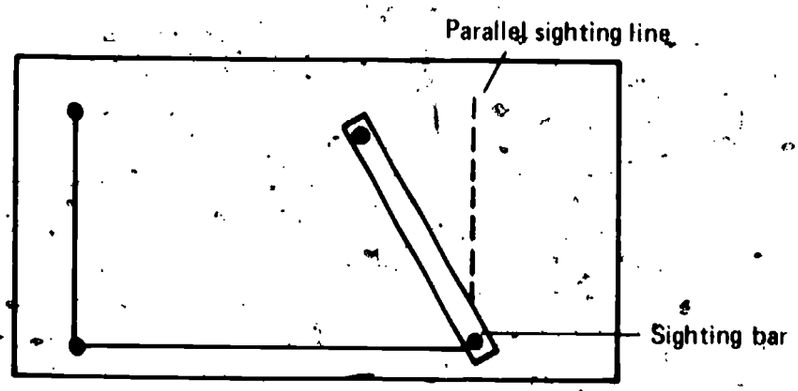
1. In the diagrams of the two range finders below, which one is being used to measure the larger distance?
2. Explain the reason for your choice.

10
02-Core-5B

Range finder a.



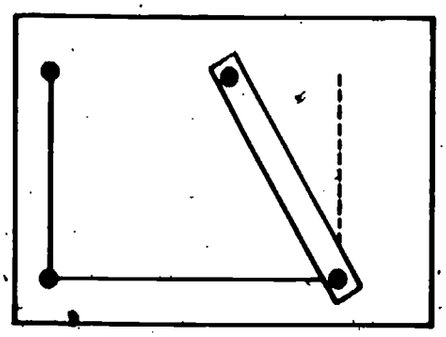
Range finder b.



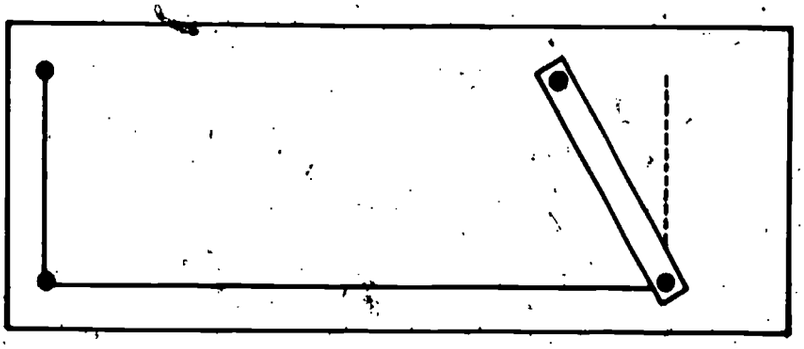
10
02-Core-6B

Suppose you are asked to measure the distance to a telephone pole that is about 80 meters away. You are to use one of the range finders shown below.

Range finder a.



Range finder b.



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

10
02-Core-7B

The greatest distance that you can measure accurately with a range finder depends upon two variables. What are they?

10
02-Core-8B

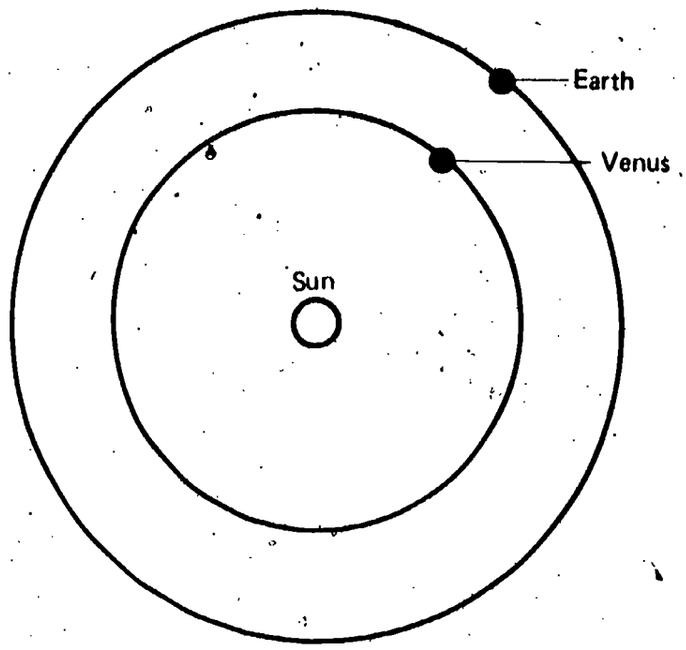
Ask your teacher to watch you do this check. Place a 150-watt bulb on one side of your work area. Get a range finder from the supply area, and place it on the other side of your work area. Read the instructions for Activities 3-7 and 3-8 on page 28 of *In Orbit*. Pretend the bright light is the sun. Have your teacher watch you as you measure the distance to the sun (the bulb).

10
02-Core-9B

The distance from the earth to a star in the Big Dipper cannot be measured with a range finder like the one you made in class. Why can this distance not be measured with a range finder like yours?

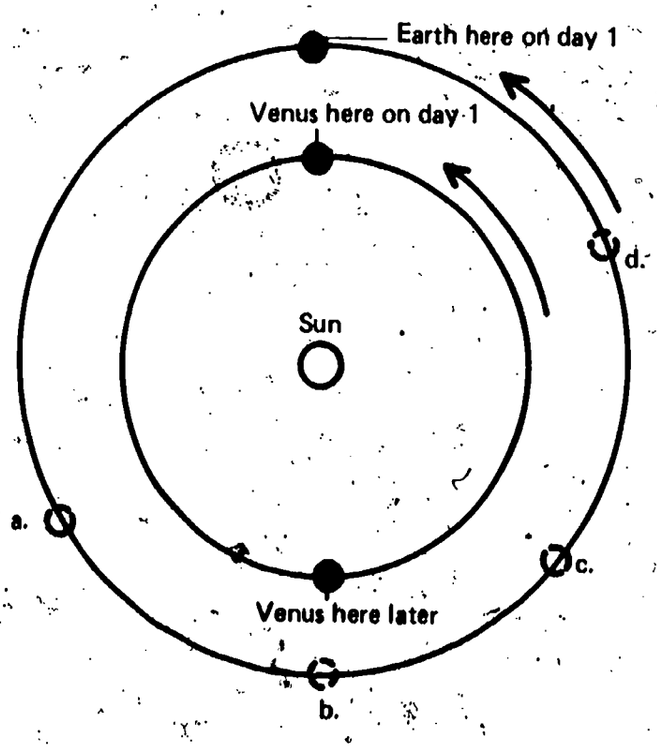
Whenever a scientist builds a model, he makes assumptions that will allow him to explain observed phenomena. A model of the Earth-sun-Venus system like the one you drew is shown below. List four assumptions that you made in drawing this model.

IO
02-Core-10B



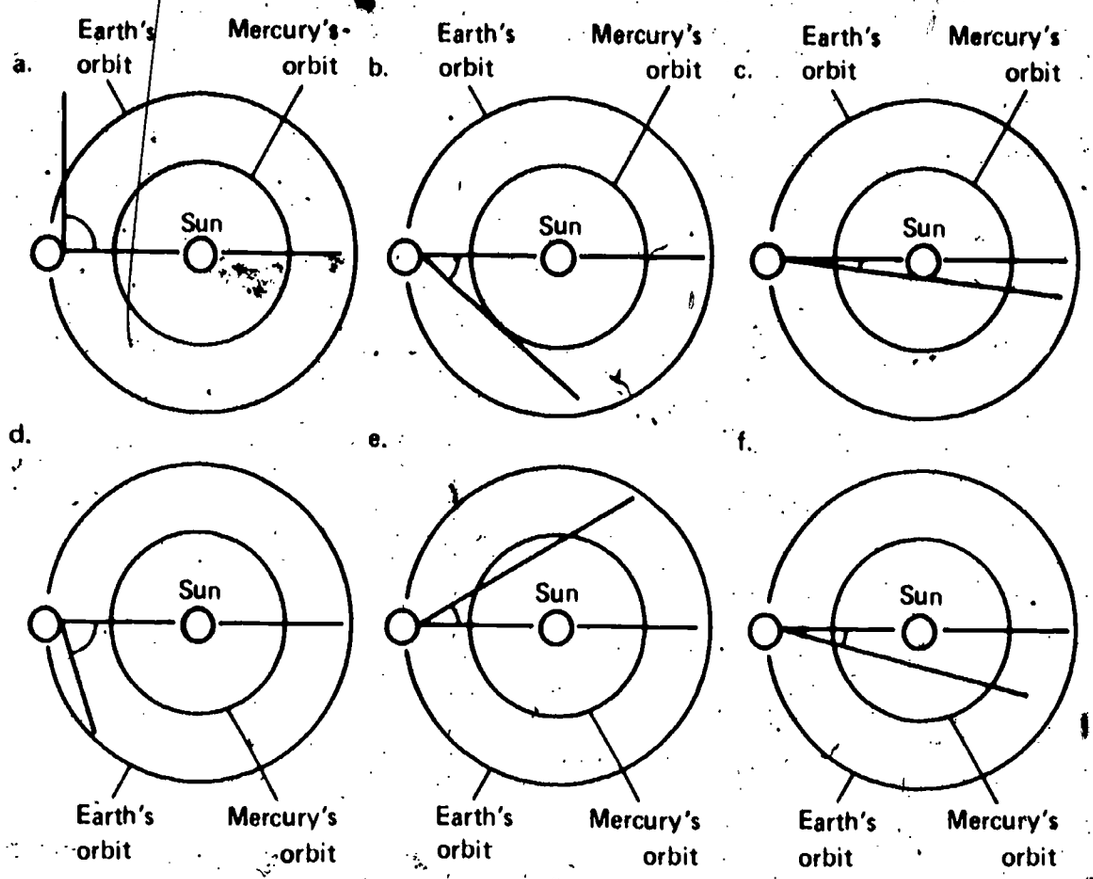
The diagram below shows the positions of Venus and Earth on the same day. It also shows the position of Venus a few months later. Select the letter of the approximate location of Earth with respect to Venus at that later time.

IO
02-Core-11B



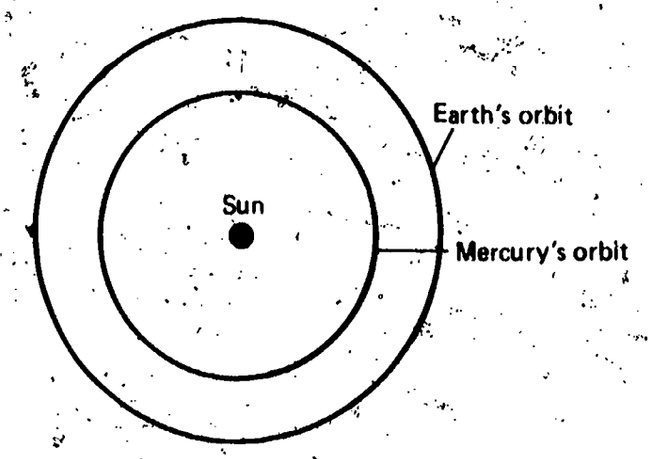
10
02-Core-12B

Select the diagram below that shows the greatest possible EM-ES angle.



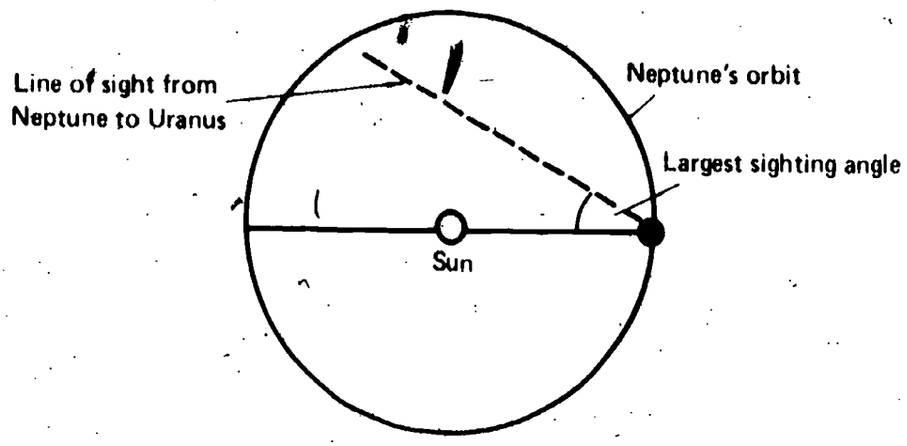
10
02-Core-13B

Get a drawing compass and a ruler, and copy the diagram of the Earth-sun-Mercury system shown below.



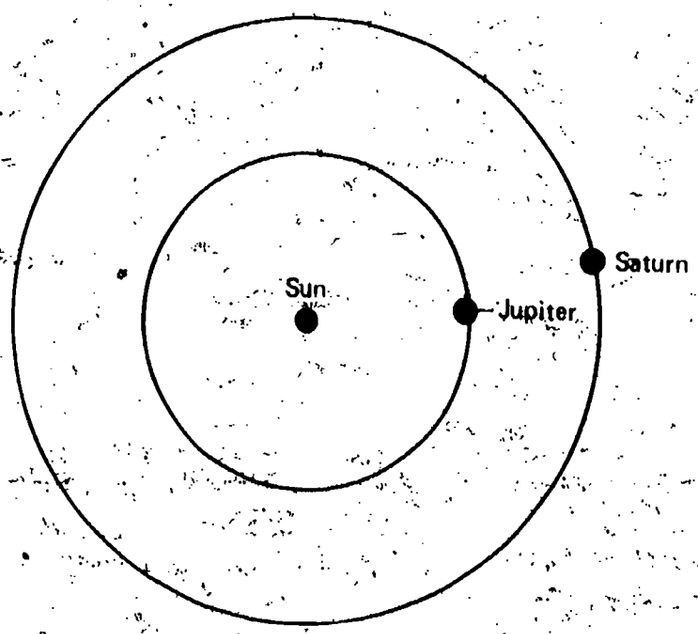
On your copy of the diagram, draw the lines of sight from Earth to Mercury and from Earth to the sun that would give the largest ES-EM angle.

Get a drawing compass. Suppose you were an ISCS student on the planet Neptune. You have just drawn a model of the sun-Neptune-Uranus system. The sighting line from Neptune to Uranus, which is shown below, is the line which makes the largest NS-NU angle. Copy the model below onto your answer sheet, and complete the model by drawing a circle to represent the orbit of Uranus. **IO 02-Core-14B**



Mercury is the closest planet to the sun. The largest angle from the sun at which we observe Mercury is 28°. Draw a circle with a radius of 9 cm to represent the orbit of Earth. Then draw a second circle to scale to represent the orbit of Mercury. You may use a metric ruler, a drawing compass, and a protractor. **IO 02-Core-15B**

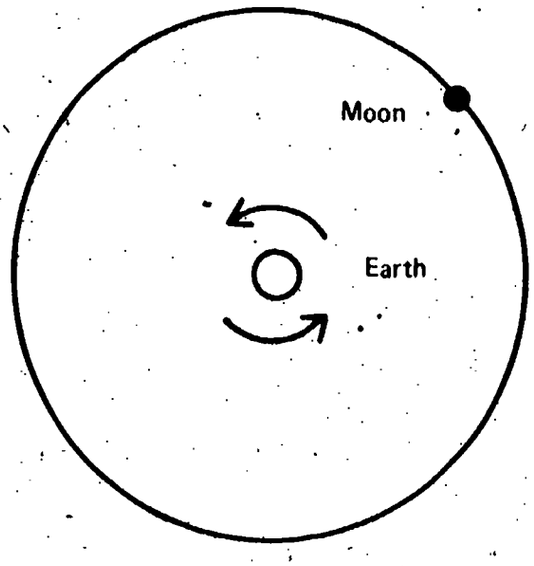
The scale diagram shown below represents the orbits of Saturn and Jupiter. The minimum distance between Jupiter and Saturn is 404 million miles. **IO 02-Core-16B**



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

IO
02-Exc 3-1-1B

To find the moon's diameter, you had to make certain assumptions about the earth-moon system shown below. What were two of these assumptions?

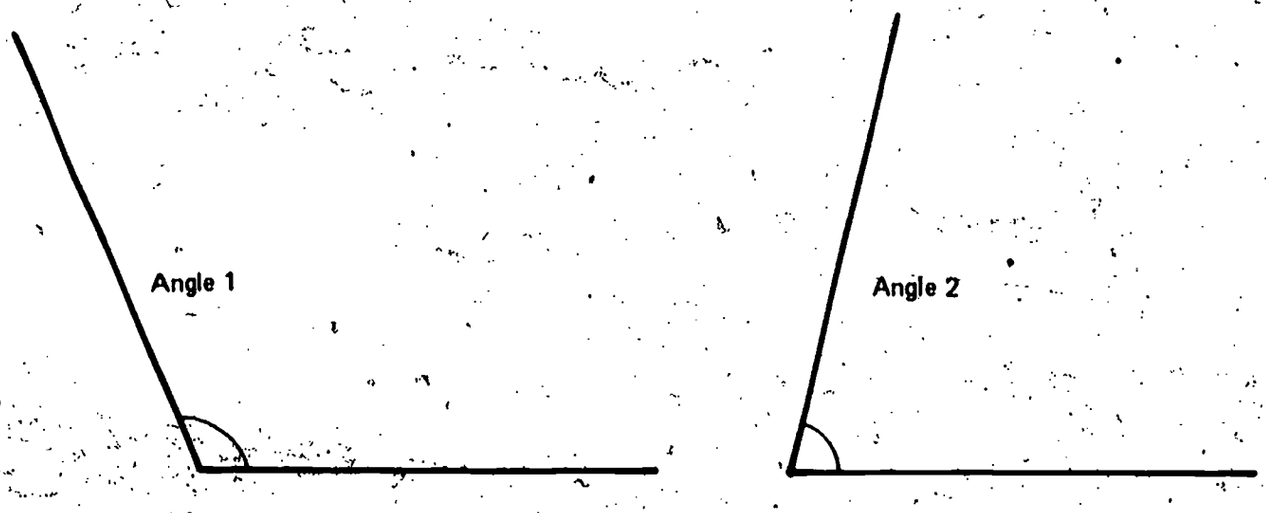


IO
02-Exc 4-1-1B

State briefly the process by which radar measures the distance to an object.

IO
02-Exc 4-2-1B

Use a protractor to measure each of the angles shown below.

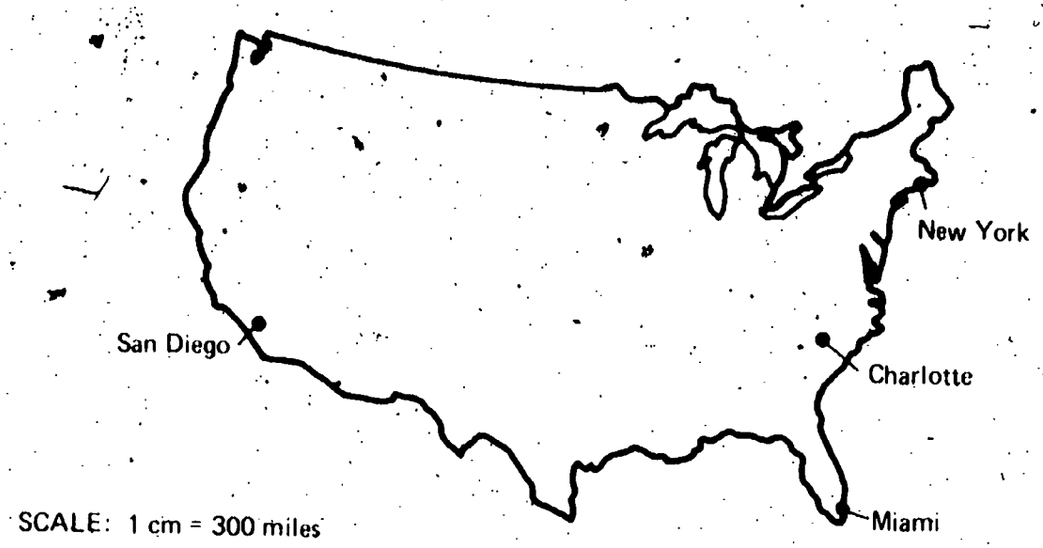


IO
02-Exc 4-2-2B

Use your protractor to construct angles of 28° and 126°.

Using the scale drawing below, answer the questions that follow.

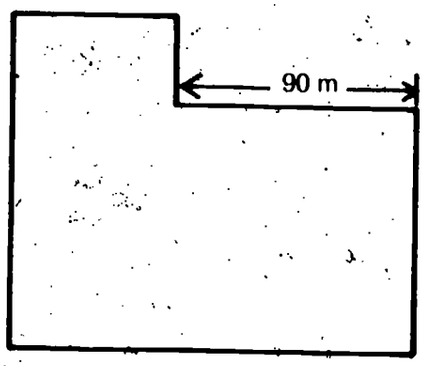
IO
02-Exc 4-3-1B



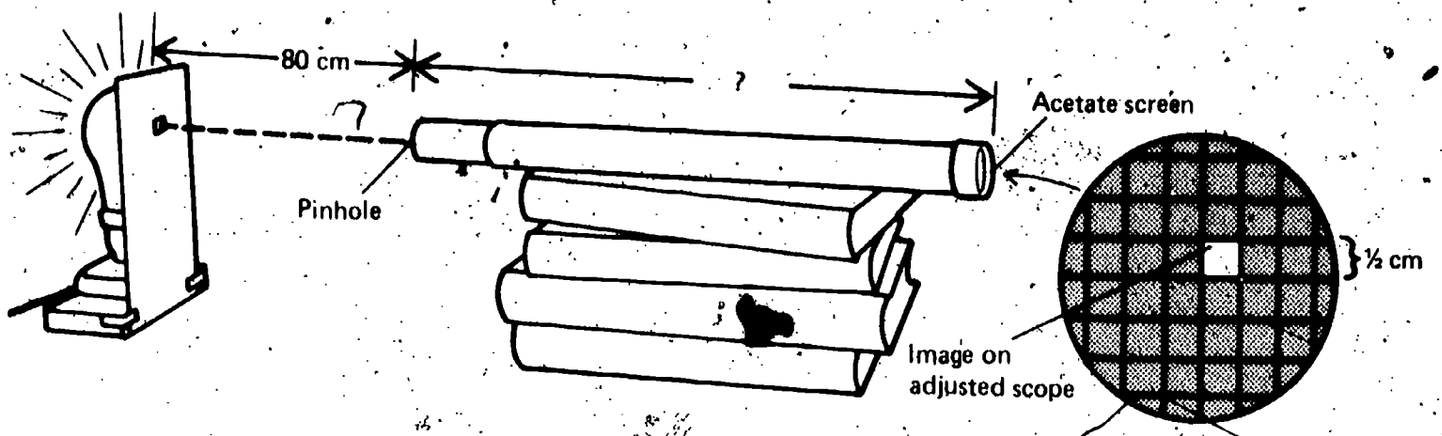
1. What is the actual distance from Charlotte to San Diego?
2. What is the actual distance from Miami to New York?

Below is a diagram of a section of land drawn to scale. What is the scale of this diagram?

IO
02-Exc 4-4-1B



10
03-Core-1B



Get a piece of cardboard with a 1-cm^2 hole in it, a sighting scope, and a 150-watt light bulb. 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 80 cm 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.

Linda says that it is impossible to measure the size of the sun. She says that if someone got close enough to measure it, he would get fried to a crisp.

10
03-Core-2B

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

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.

10
03-Core-3B

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

IO 03-Core-4B

Muxa is a science student on Mars. She wants to measure the distance across the sun, using a sighting scope. Here is the information she has gathered:

Sun to Mars distance = 142 million miles
Distance across sun's image on sighting scope = ½ cm
Distance from pinhole to screen = 81 cm

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

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

IO 03-Core-5B

A day on Jupiter is 10 hours long. If you measured the number of degrees that the sun appears to move across Jupiter's sky in one hour, what would your measurement be?

IO 03-Core-6B

It is difficult to prove that the earth rotates and that the sun does not around the earth each day. Why is this such a difficult thing to prove?

IO 03-Core-7B

A day on Saturn is about 10 hours, not 24 hours as on earth. Assume that the sun's path is over Saturn's equator on the day in question.

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

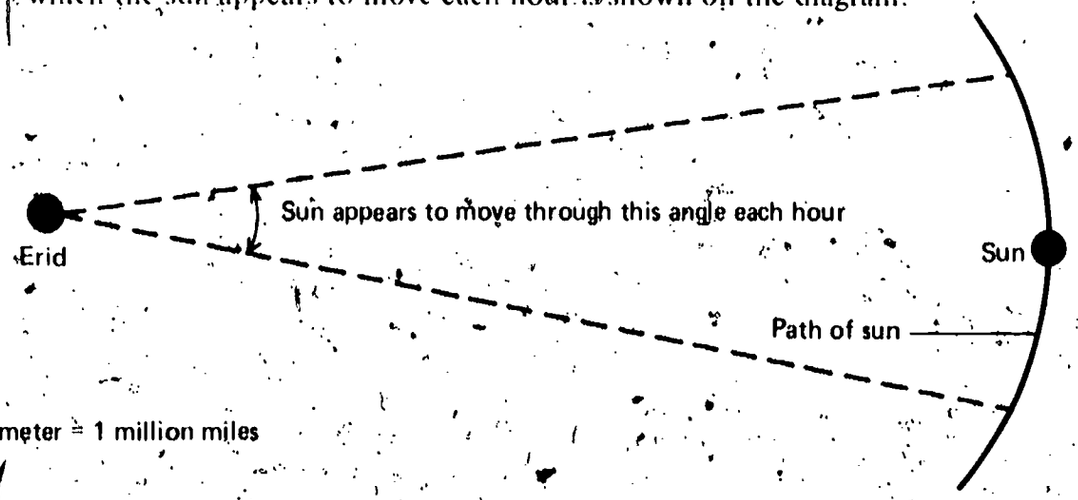
IO 03-Core-8B

During leap year, February has 29 days instead of 28. This usually occurs every four years.

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

IO 03-Core-9B

A group of science students on the planet Erid are trying to decide whether Erid turns on its axis each day or the sun makes one complete trip around Erid each day. They drew the scale diagram shown below of the sun and Erid. The angle through which the sun appears to move each hour is shown on the diagram.

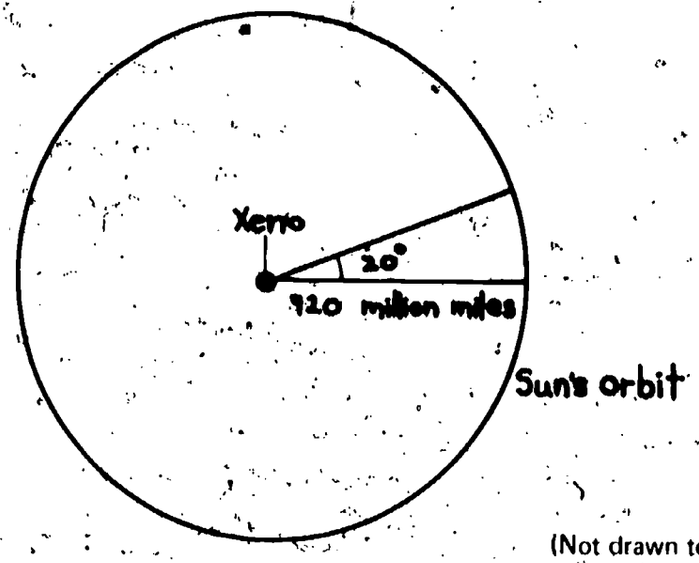


Scale: 1 millimeter = 1 million miles

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 Erid each day.

Suppose you lived on the planet Xeno and wanted to find out how fast the sun would travel if it made one trip around Xeno each day. You have made the following measurements and drawn the sketch below. 10 03-Core-10B

The distance from the sun to Xeno is 120 million miles.
The apparent motion of the sun across the sky is 20° per hour.



(Not drawn to scale).

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

State why it is unlikely that the sun travels around the earth each day. 10 03-Core-11B

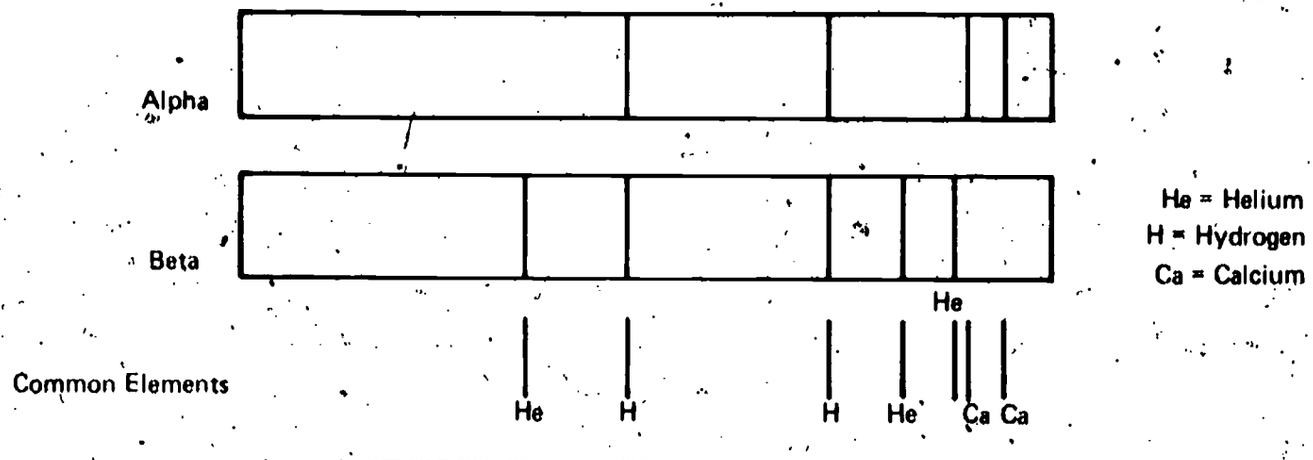
The earth has been divided into time zones. Briefly explain why. 10 03-Core-12B

Richard built a paint-drying tunnel, open at both ends, in which to dry the paint on his model cars. His source of heat is a 200-watt bulb. Russ decided to build a similar tunnel to dry his models, but he wants one twice the size of Richard's. This means that the bulb would be twice as far away from his models. What wattage light bulb would be needed to keep the temperature in the larger tunnel the same as in the smaller one? 10 03-Core-13B

Mary finds that a 100-watt bulb placed 20 cm from her sun-energy measurer has the same heating effect as a larger bulb placed 160 cm from the measurer. Find the wattage of the larger bulb. Show all of your work. 10 03-Core-14B

IO
03-Core-15B

The diagrams below show light from two different stars, Alpha and Beta, passed through a spectroscope. The spectral lines for some common elements are also shown below. Use the spectra and the other data to say as much as you can about the two stars. You should include a comparison of their composition and power (wattage).



STAR	DISTANCE FROM EARTH	TEMPERATURE RISE IN SUN-ENERGY MEASURER
Alpha	4 light-years away	2.4°C
Beta	8 light-years away	7.2°C

IO
03-Core-16B

The term *transit* is often used when talking about planets and the sun in our solar system. Define the term *transit* when it is used in this way.

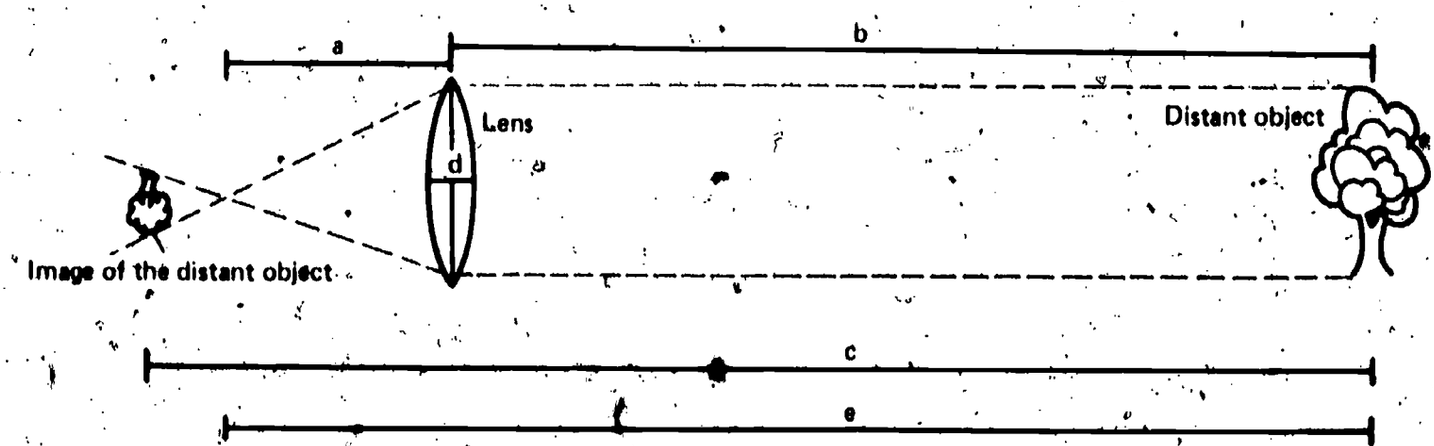
IO
03-Exc 5-1-1B

Anne was given a telescope. The objective lens of her telescope has a focal length of 40 cm, and the eyepiece lens has a focal length of 5 cm. Use the formula given below to calculate the power of the telescope.

$$\text{Power} = \frac{\text{Focal length of objective lens}}{\text{Focal length of eyepiece}}$$

IO
03-Exc 5-1-2B

Select the letter of the line that best represents the focal length for the lens on the diagram below.



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. **IO 03-Exc 5-1-3B**

Two lenses with focal lengths of 5 cm and 55 cm are to be used to make a telescope to magnify the distant object shown below. **IO 03-Exc 5-1-4B**

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

For thousands of years people did not have calendars. Explain why people began to develop and use calendars. **IO 03-Exc 6-1-1B**

Man has used many different calendars during the past several thousand years. Explain why these older calendars were rejected. **IO 03-Exc 6-1-2B**

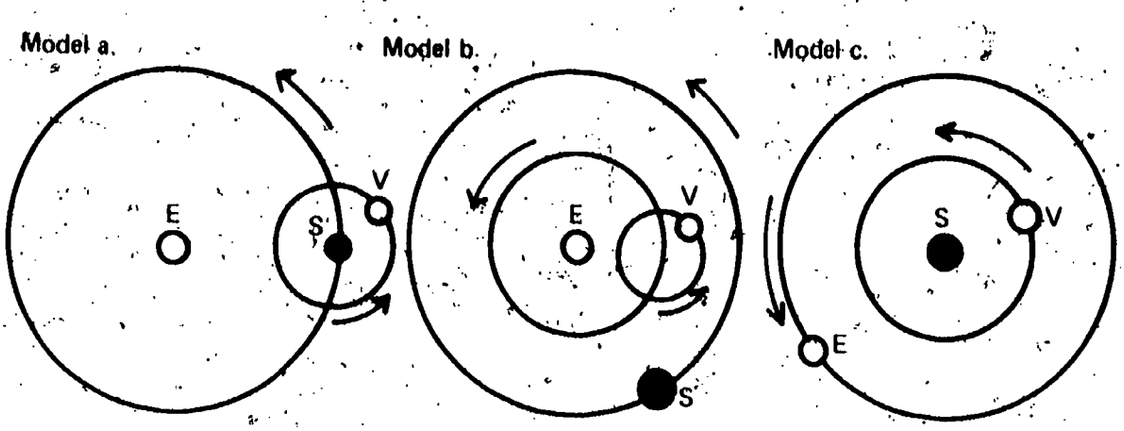
Some history books list George Washington's birthday as February 11, 1732. Others list his birthday as February 22, 1732. Why are two different dates given for George Washington's birthday? **IO 03-Exc 6-1-3B**

Galileo decided to accept the Copernican model of the solar system and to reject the Ptolemaic model. Select the best reason that Galileo could have had for accepting one model and rejecting the other. **IO 03-Exc 6-2-1B**

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

10
03-Exc 6-2-2B

1. Which of the models shown below represents Copernicus's model of the solar system?
2. Which of the models below represents Ptolemy's model of the solar system?



KEY	
SYMBOL	BODY
S	sun
V	Venus
E	earth

10
03-Exc 7-1-1B

When calculating power, you must consider two variables. One is work. What is the other variable?

10
03-Exc 7-1-2B

Mr. Capezio just bought a new lawnmower with a bigger engine which has more power than his old lawnmower.

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

10
03-Exc 7-1-3B

In Excursion 7-1, the terms *power* and *powerful* were defined as they are used by scientists. Consider the statement that generally trucks are more powerful than cars.

1. Does this statement use the word *powerful* the same way a scientist might use it?
2. Explain your answer.

10
03-Exc 7-2-1B

Kenneth found that his sun-energy measurer warmed up 7°C when it was held 25 cm from a 50-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.

10
03-Exc 7-2-2B

Square each of the following numbers.

1. 3
2. 8
3. 14

What's Up? WU

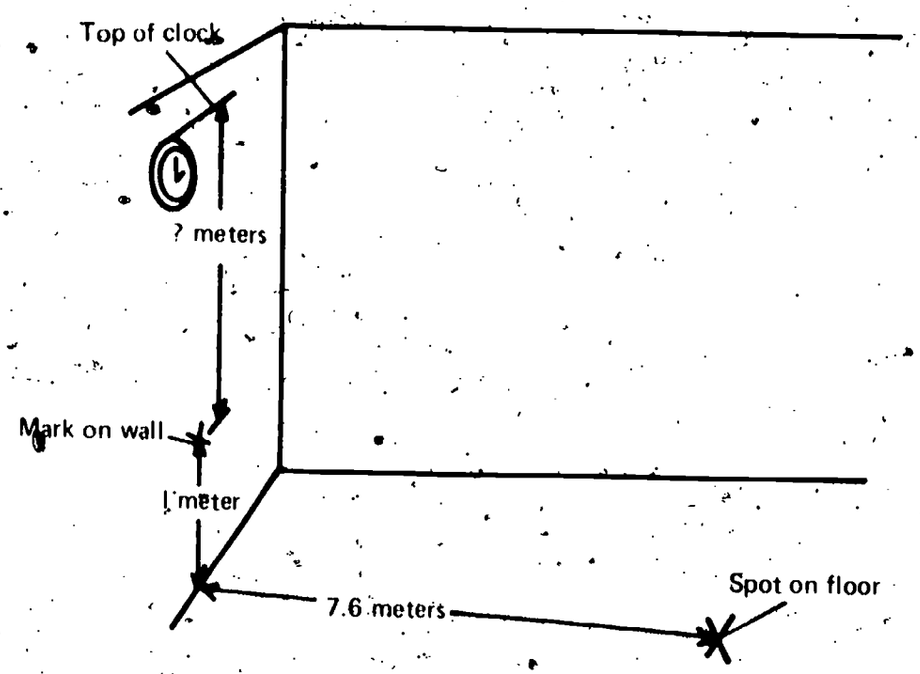
Get a water rocket with its pump and funnel, a meterstick, a 100-ml beaker, and some water. Tell your teacher you are ready to be observed. With the observer, go to the place outside designated by your teacher, and launch the rocket, using 50 ml of water.

WU 01-Core-1B

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 the clock. Use a quadrant and the table below to measure the distance between the mark 1 meter off the floor and the top of the clock.

WU 01-Core-2B

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



There are several ways to measure the height of a rocket's flight. Some methods are direct. Others, such as measuring the angle size, are indirect. What are some of the reasons why you used an indirect measurement?

WU 01-Core-3B

WU 01-Core-4B

Use the following table to answer the question below.

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

Your job at a rocket launching site was to calculate the maximum height reached by a rocket. At a distance of 25 meters from the launch site, you measured an angle of 80° when the rocket reached its greatest height. What is the maximum height to which the rocket climbed?

WU 01-Core-5B

At the launching of your rocket, there were two observers who measured the maximum heights of each of the rocket's flights. Why did two observers make the measurement rather than just one?

WU 01-Core-6B

State an operational definition for *performance* for a water rocket, based upon your activity with the quadrant.

WU 01-Core-7B

Pete designed an activity to determine the effects of changing the type of liquid and the amount of air on the performance of a rocket. He was told by his teacher to change only one variable at a time. State a reason for his teacher's instruction.

WU 01-Core-8B

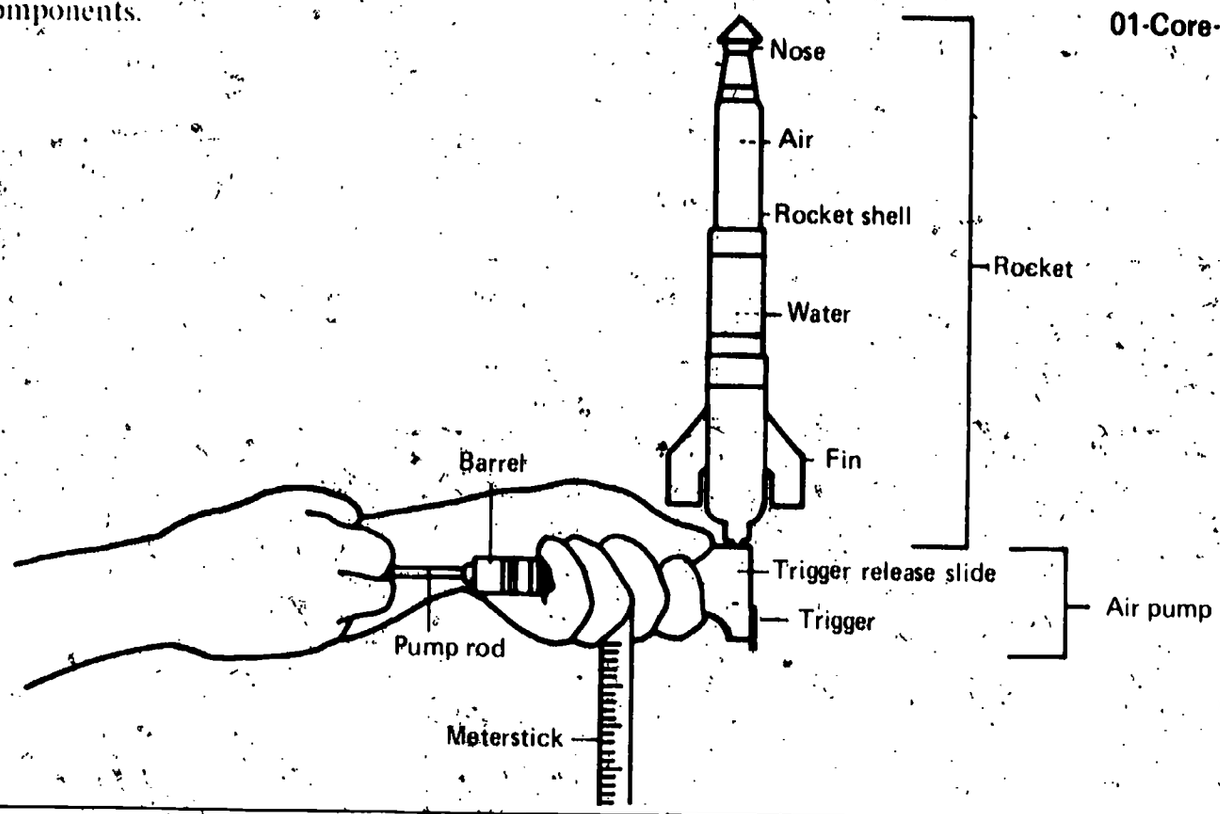
The performance of a toy water rocket might be affected by the shape of the rocket's fins. Design a plan to investigate the effect of this variable on the performance of the rocket.

WU 01-Core-9B

State the two variables that affect the performance of the water rocket you used in class activities.

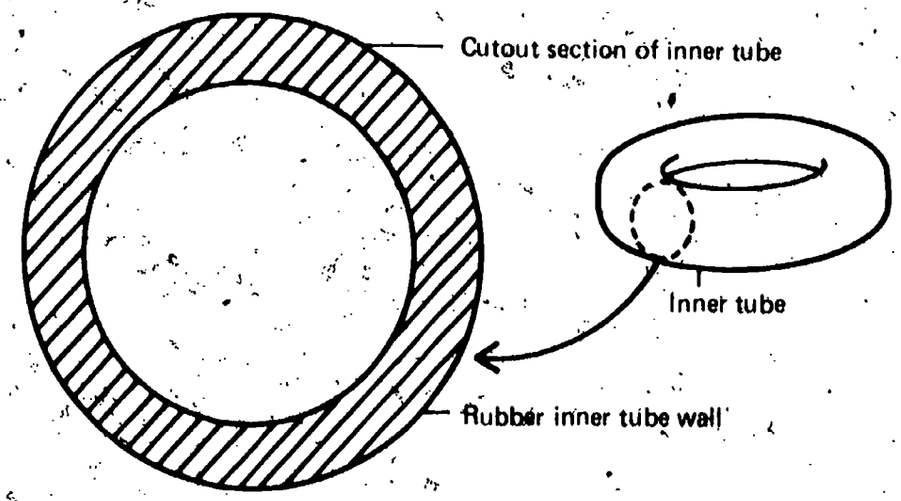
The rocket shown below is ready to be launched. List one system, two subsystems, and four components.

WU
01-Core-10B



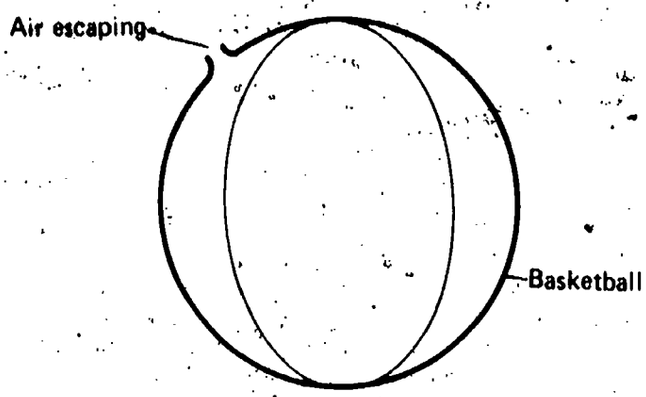
The inner tube shown below is filled with air. A cutout section of the tube is also shown. Copy the cutout section onto your answer sheet. Draw arrows to show the force (the pressure) that the air exerts on the inside walls of the inner tube.

WU
01-Core-11B



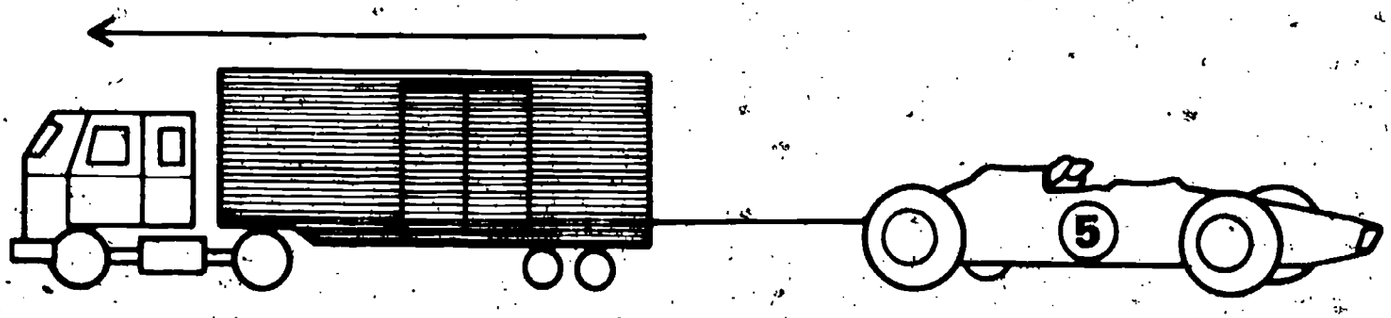
WU
01-Core-12B

The drawing below shows air escaping from a hole in the side of a basketball. Copy the diagram below onto your answer sheet, and draw an arrow to indicate the direction of the unbalanced force acting on the ball.



WU
01-Core-13B

Tony and Wayne hook up their battery-operated toys, a moving van and a racing car, as shown in the diagram below. They produce forces acting in opposite directions. When released, both toys move in the direction shown by the arrow. An unbalanced force is acting, since the moving van forces the racing car to move backwards. How could this unbalanced force be measured?

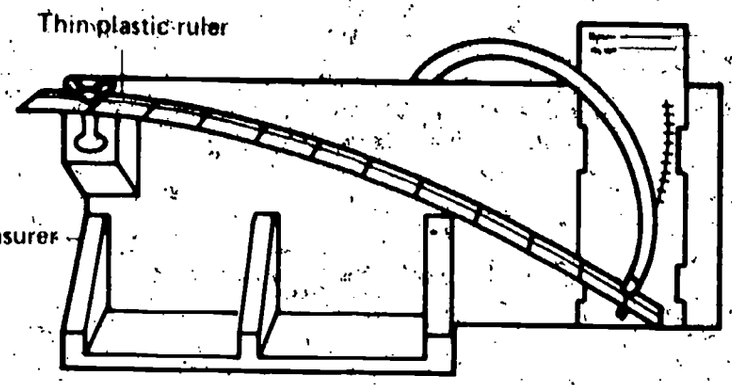


WU
01-Core-14B

Suppose three of your ISCS classmates invite you to enter your water rocket in a contest to determine whose rocket produces the most thrust, or force. Describe a method which you can use to measure this thrust to see who has won the contest.

You studied the thrust produced by a water jet. While doing that, you used a thin plastic ruler as part of your force measurer. Suppose that you had wanted to compare the force produced by your water jet with the forces of your classmates' jets. WU 01-Core-15B

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.



Suppose you and two of your lab partners found several water jets of different sizes. One of your partners suggests that the jets could be used to find out what effect the speed at which water left a jet has on the unbalanced force. He also suggests keeping the rate of flow the same and changing only the speed. Describe a plan you could carry out following your partner's suggestions to measure the effect on the unbalanced force of changing the speed at which water leaves a jet. WU 01-Core-16B

Suppose that astronauts can measure the unbalanced force of their rockets before they leave the earth's atmosphere and again in the near vacuum of outer space. WU 01-Core-17B

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

In class, you studied a simple water-rocket system. Give two reasons why many experiments are performed on simplified systems rather than on larger, more complex systems. WU 01-Core-18B

Your teacher will observe you for this check when he can. WU 01-Core-19B

Your teacher will observe you for this check when he can. WU 01-Core-20B

Your teacher will observe you for this check when he can. WU 01-Core-21B

WU 01-Core-22B	Your teacher will observe you for this check when he can.
WU 01-Core-23B	Your teacher will observe you for this check when he can.
WU 01-Exc 2-1-1B	Write an operational definition of *force*.
WU 01-Exc 2-1-2B	Write an operational definition of *unbalanced force*.

Rose has a model rocket which weighs 1.1 newtons without an engine or fuel. She decides to buy an engine for her rocket. The engine catalog gives the following information.

WU 02-Core-1B

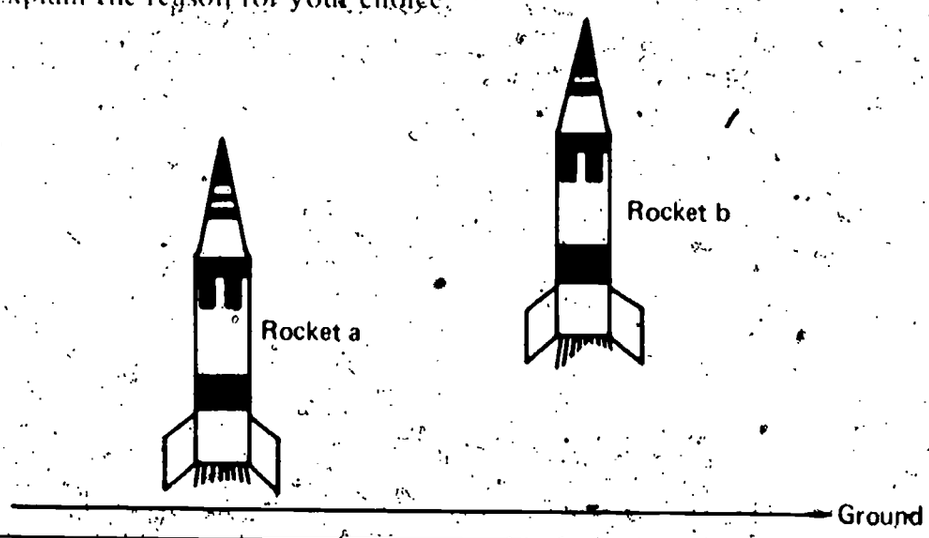
ENGINE MODEL	TOTAL WEIGHT OF ENGINE AND FUEL (in N)	THRUST (in N)
a	0.1	0.4
b	0.2	0.8
c	0.3	1.1
d	0.4	1.5
e	0.5	2.0

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

Rockets a and b below are identical. They lifted off the launch pad at the same time.

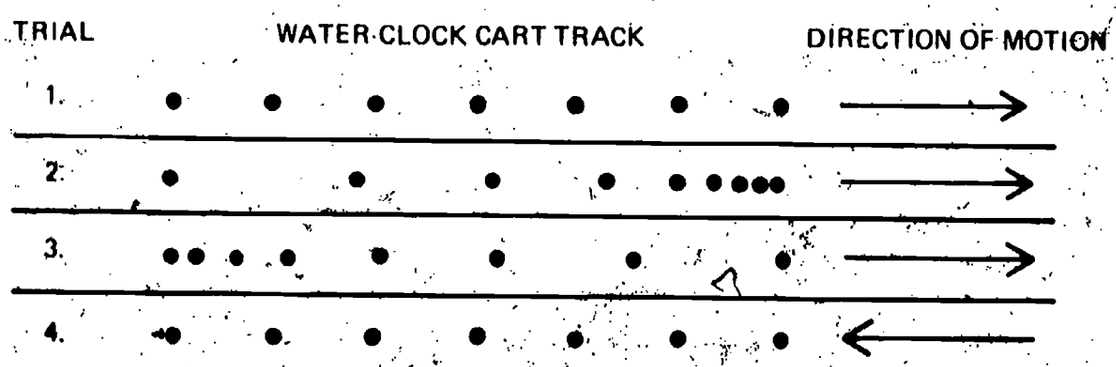
WU 02-Core-2B

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



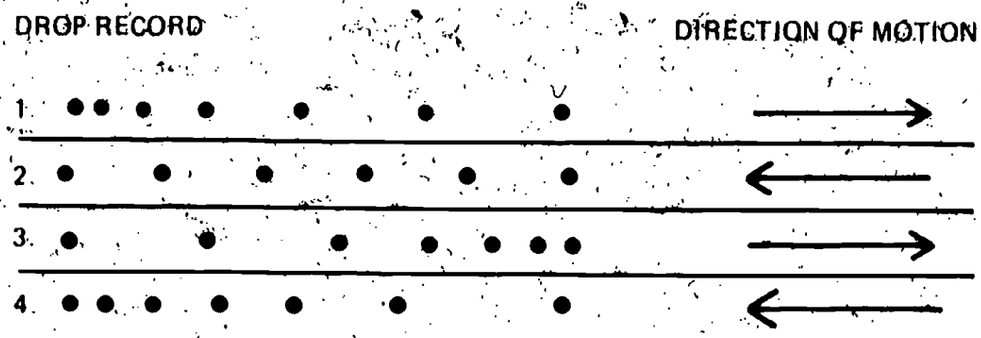
The diagram below shows the water drops left by a moving water-clock cart during four trials. The arrow shows the direction of motion of the cart for each trial. Indicate whether the cart's speed increases, decreases, or remains constant during each of the four trials.

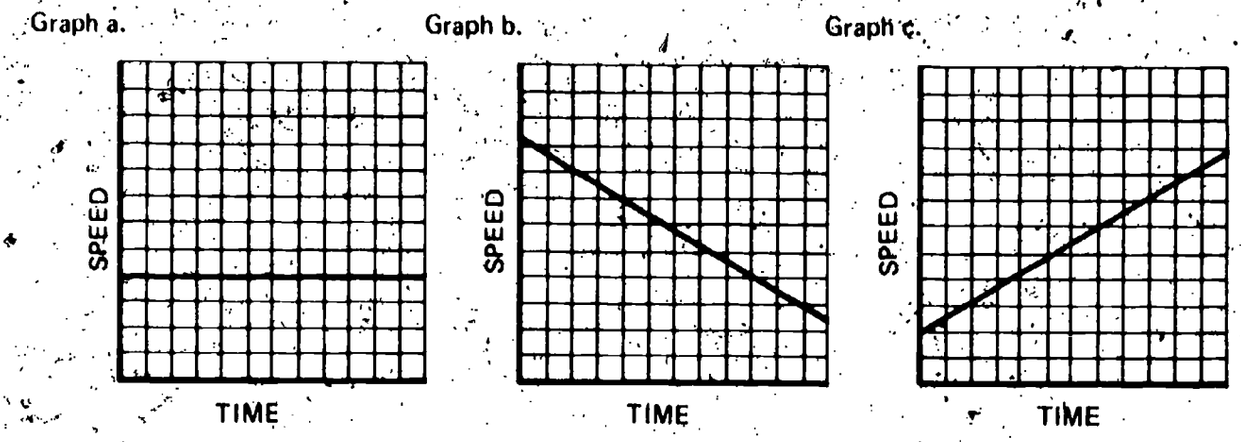
WU 02-Core-3B



WU 02-Core-4B

The three 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.





WU 02-Core-5B

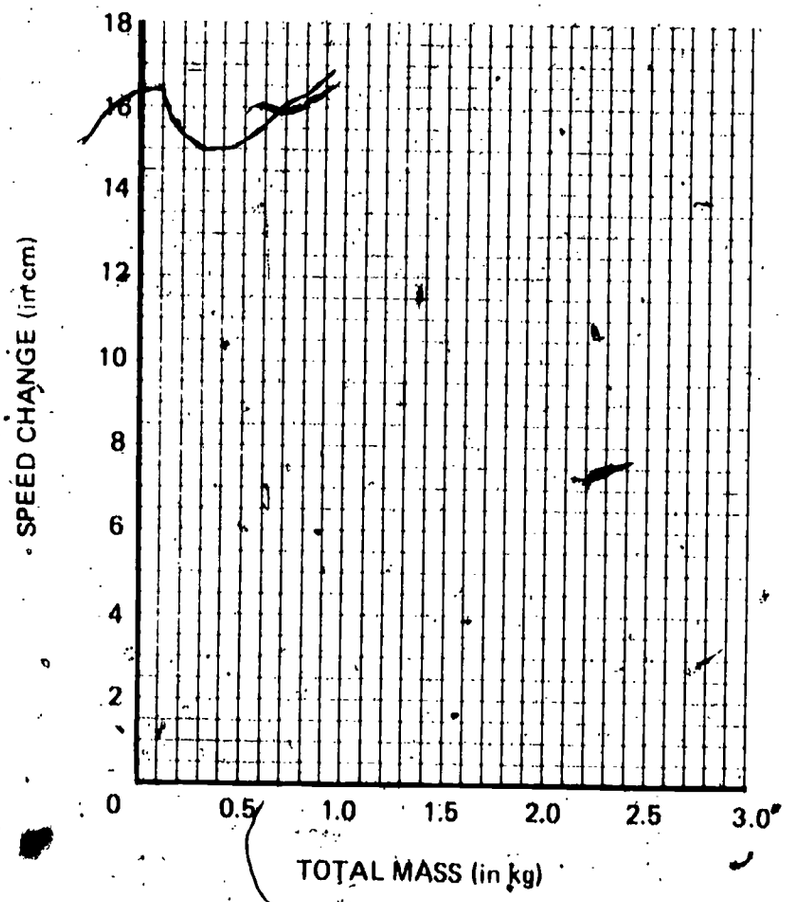
Suppose Bill and Dave each build a wooden cart to race. Both carts are identical, but Dave weighs 130 pounds and Bill weighs 100 pounds. Each boy gets into his own cart, and both are pushed with the same force.

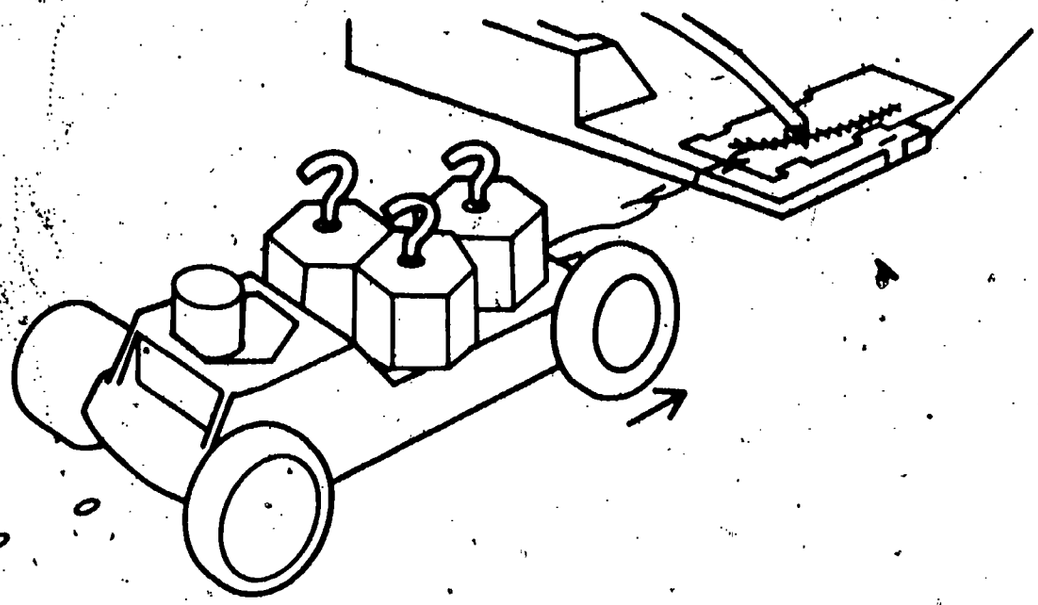
1. Whose cart, Dave's or Bill's, will speed up more quickly?
2. Explain your answer.

Get from your teacher either a copy of the labeled grid below or grid paper. On the grid paper, label the axes as shown below.

Pete measured the distance traveled by his cart during five equal time intervals while he exerted a force of 0.2 N. He changed the mass of his cart for each of the five trials. The table below shows his data. On your labeled grid, draw a graph of his data.

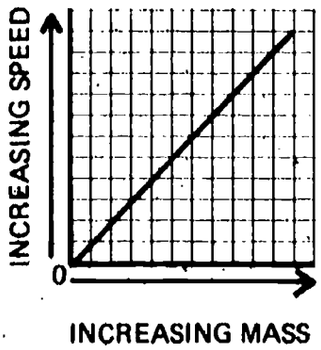
TOTAL MASS (in kg)	DISTANCE CHANGE (in cm)
2.5	3
2.0	5
1.5	8
1.0	12
0.5	17



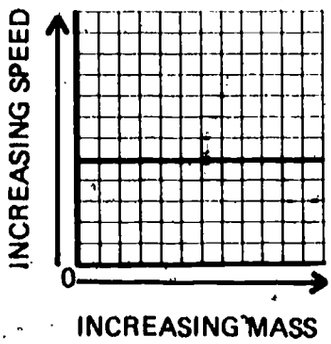


The force acting on the water cart shown above is a constant 0.2 N for each trial. The mass of the cart is varied by using weights of different sizes. Select the graph below which best shows the relationship between the mass of the cart and its load and the speed of the cart.

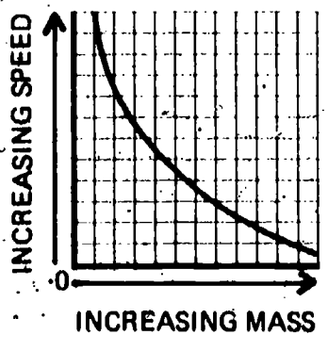
Graph a.



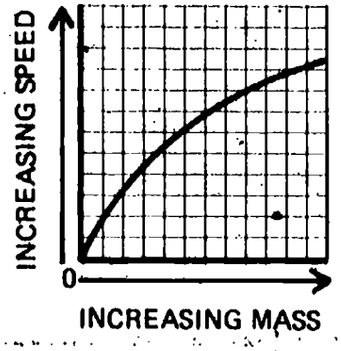
Graph b.



Graph c.



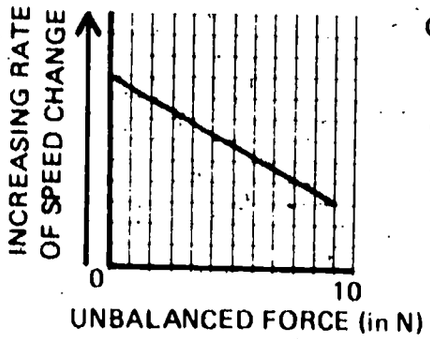
Graph d.



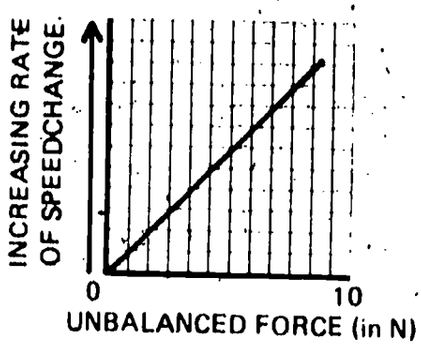
When you worked with your water cart, you applied different forces to it. As a result, the speed changed at different rates. Select the graph below that best shows how the rate at which speed changes varies as the force applied is changed.

WU
02-Core-8B

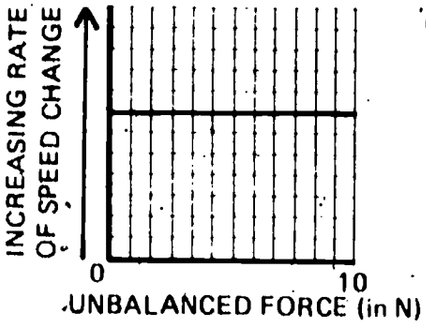
Graph a.



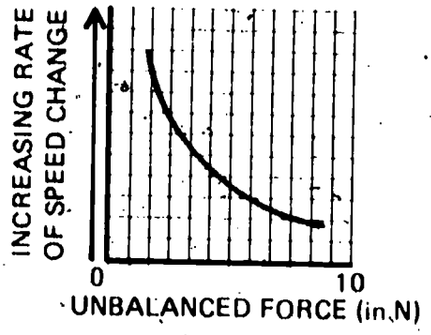
Graph c.



Graph b.



Graph d.



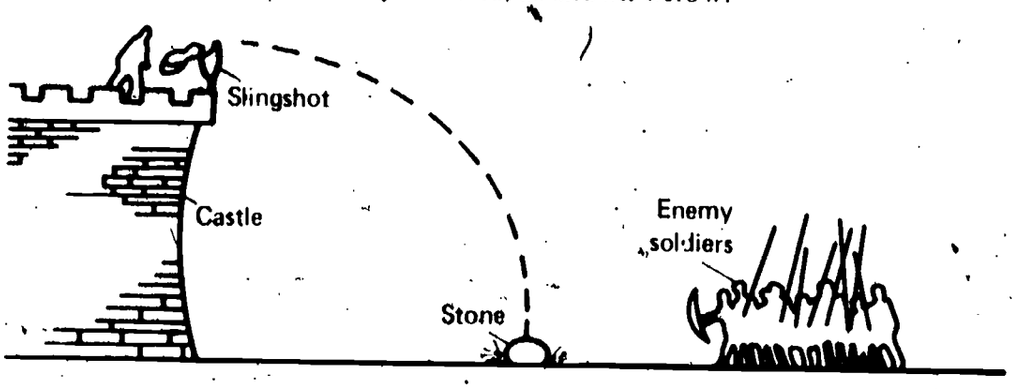
Twin brothers, Tim and Jim, weigh the same. They are fired from a cannon in a circus act. The launching force is exerted on Tim for a shorter length of time than on Jim.

WU
02-Core-9B

1. Which brother, Tim or Jim, will reach the greater speed?
2. Explain your answer.

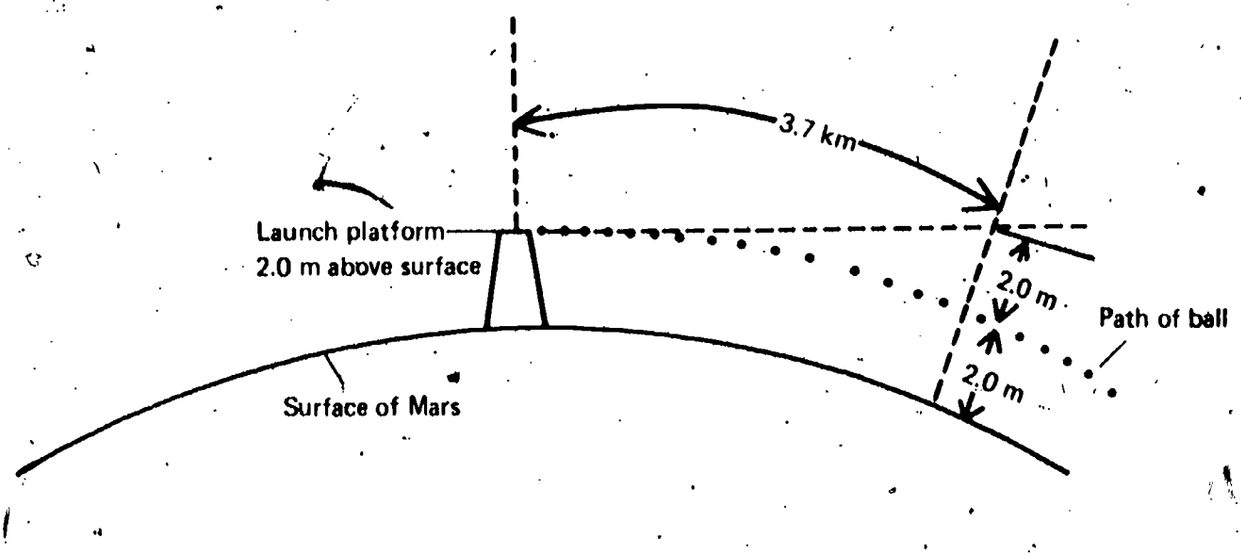
Large slingshots were used in battles centuries ago to throw stones. Suppose there was a large slingshot mounted on top of a castle wall. The slingshot could not be moved or tilted up and down. It could be fired only straight ahead. The first stone fired from it fell short of the enemy soldiers, as shown below.

WU
02-Core-10B



1. If you had been in charge, what could you have done to increase the firing range of the slingshot?
2. Explain why this would have had the desired effect.

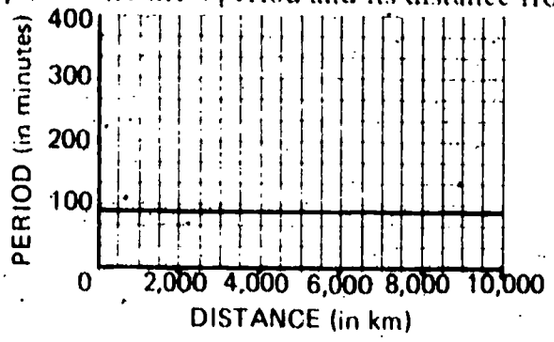
WU 02-Core-11B	In the activity in which you investigated the effect of the sideward force on the fall time of a ball, you always had one ball which fell straight down. What was the purpose of using this ball that always fell straight down?
WU 02-Core-12B	Suppose that two 18th century soldiers conducted an experiment. At the same time as one soldier fired a cannon ball horizontally from a cannon, a second soldier dropped a pebble from the same height as the cannon barrel. 1. If the ground was flat, would the ball or the pebble hit the ground first? 2. Explain your answer.
WU 02-Core-13B	Suppose the diagram below shows the surface of Mars. An object dropped near the surface of Mars falls 2.0 meters in 1 second. Use this information and the diagram below to determine the orbiting speed of a satellite near Mars's surface.



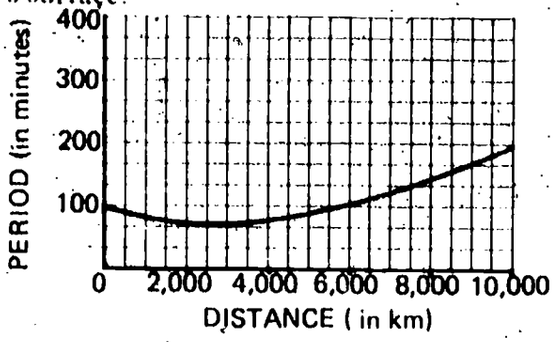
The graphs below show possible relationships between the period of a satellite and the satellite's distance from the earth. Select the graph which best shows the actual relationship of a satellite's period and its distance from the earth's surface.

WU 02-Core-14B

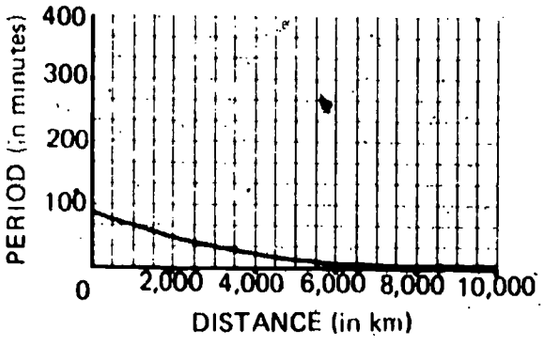
Graph a.



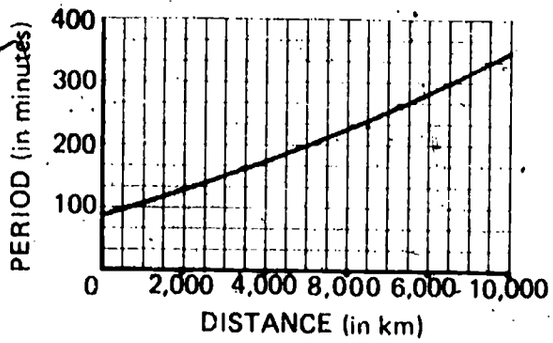
Graph b.



Graph c.



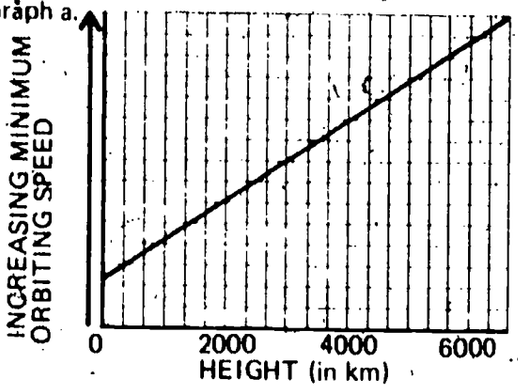
Graph d.



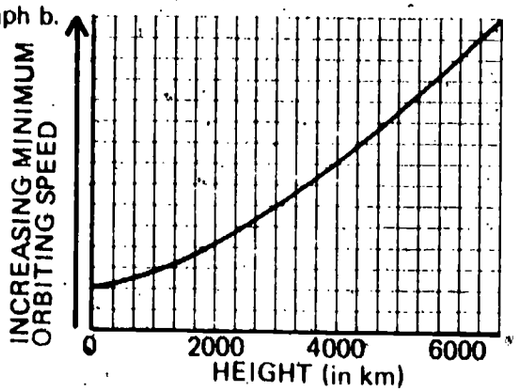
Select the graph below which best shows how the minimum orbiting speed of a satellite changes as the satellite gets farther above the earth's surface.

WU 02-Core-15B

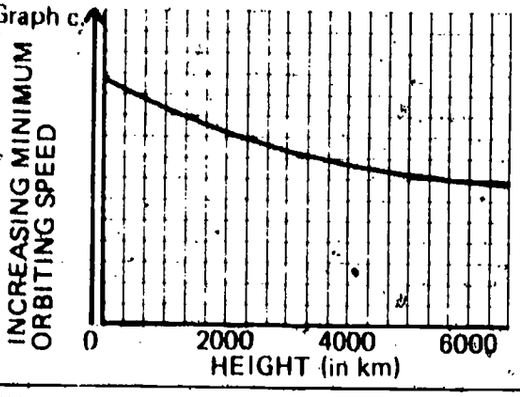
Graph a.



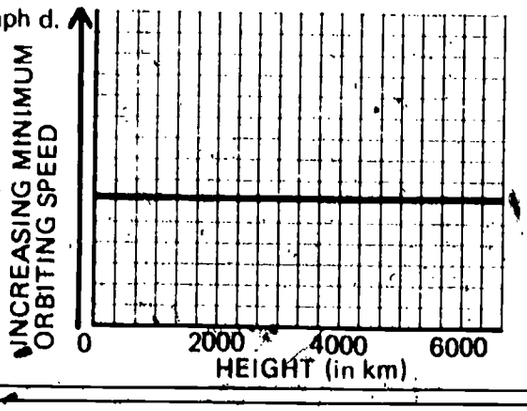
Graph b.



Graph c.



Graph d.



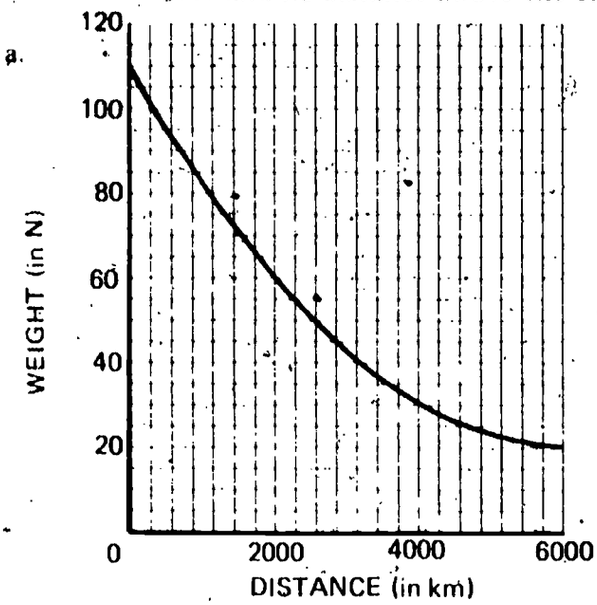
What are two forces that slow down a rocket's speed as it leaves the earth on a space flight?

WU 02-Core-16B

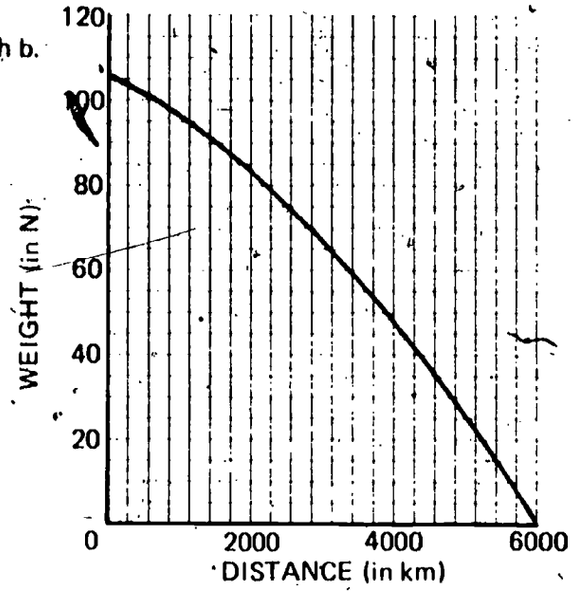
WU 02-Core-17B

Which of the graphs below best shows the relationship between the weight of an object and its distance above the earth's surface?

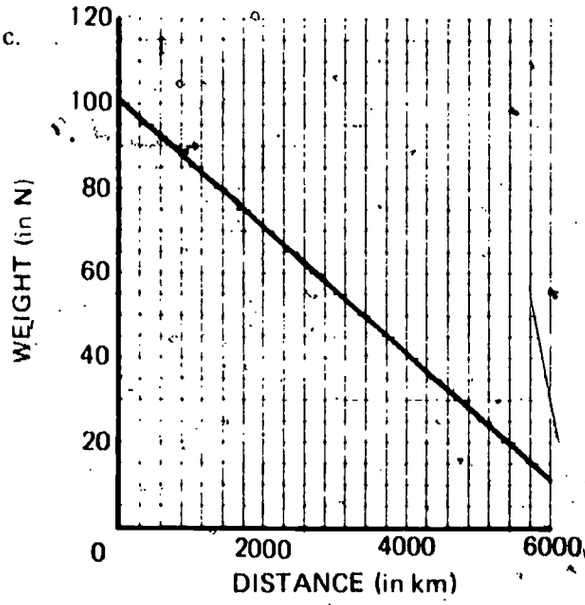
Graph a.



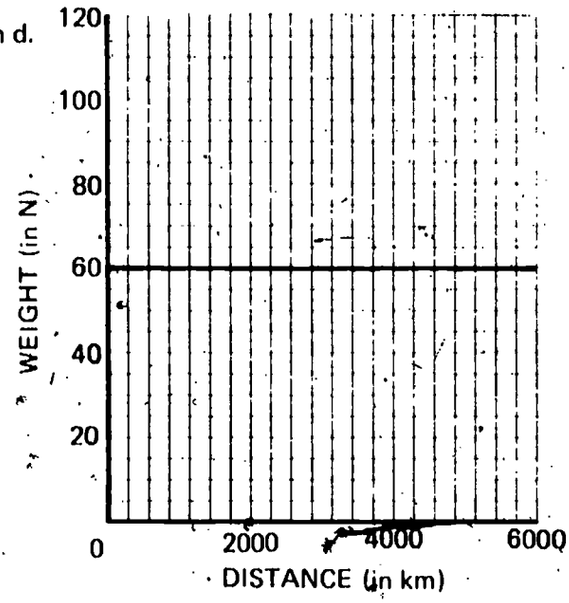
Graph b.



Graph c.



Graph d.



WU 02-Core-18B

While on a trip through space, astronauts keep a record of the magnitude of the force of gravity as the distance from the earth's surface increases.

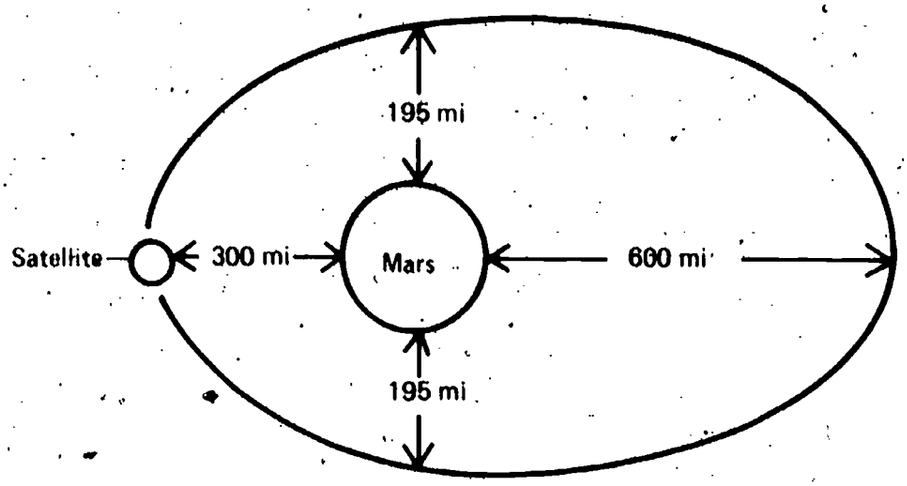
1. At what distance from the earth would they note that the effect of the earth's gravity is zero?
2. Explain your answer.

WU 02-Core-19B

What is meant by the term *period* of a satellite?

Mariner 7 was one of the probing satellites around Mars. It was 15 feet in diameter, orbited Mars once every 65 minutes, and rotated on its axis once every 75 minutes, as shown in the diagram below.

WU
02-Core-20B



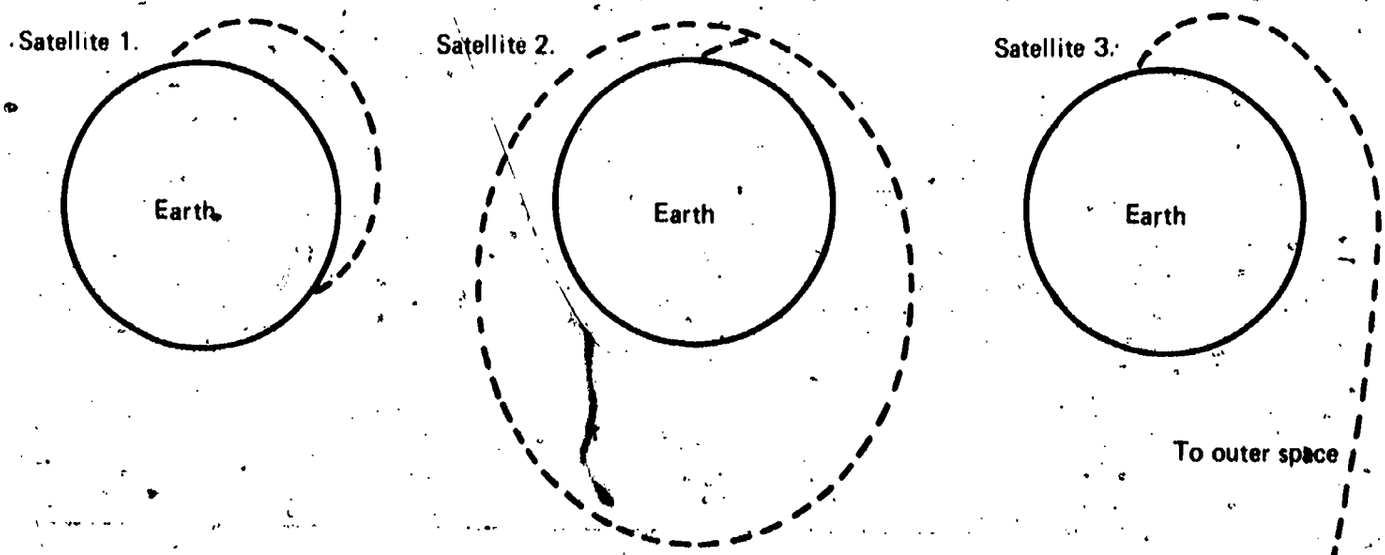
Choose the letter of the item which represents the period of Mariner 7.

a. 300 miles
b. 600 miles
c. 65 minutes
d. 75 minutes
e. 195 miles

The diagrams below show the paths of three different satellites. Select from the statements below the one which best describes the speed of each of the satellites. Write the number of the satellite on your paper and after it the letter of the matching statement:

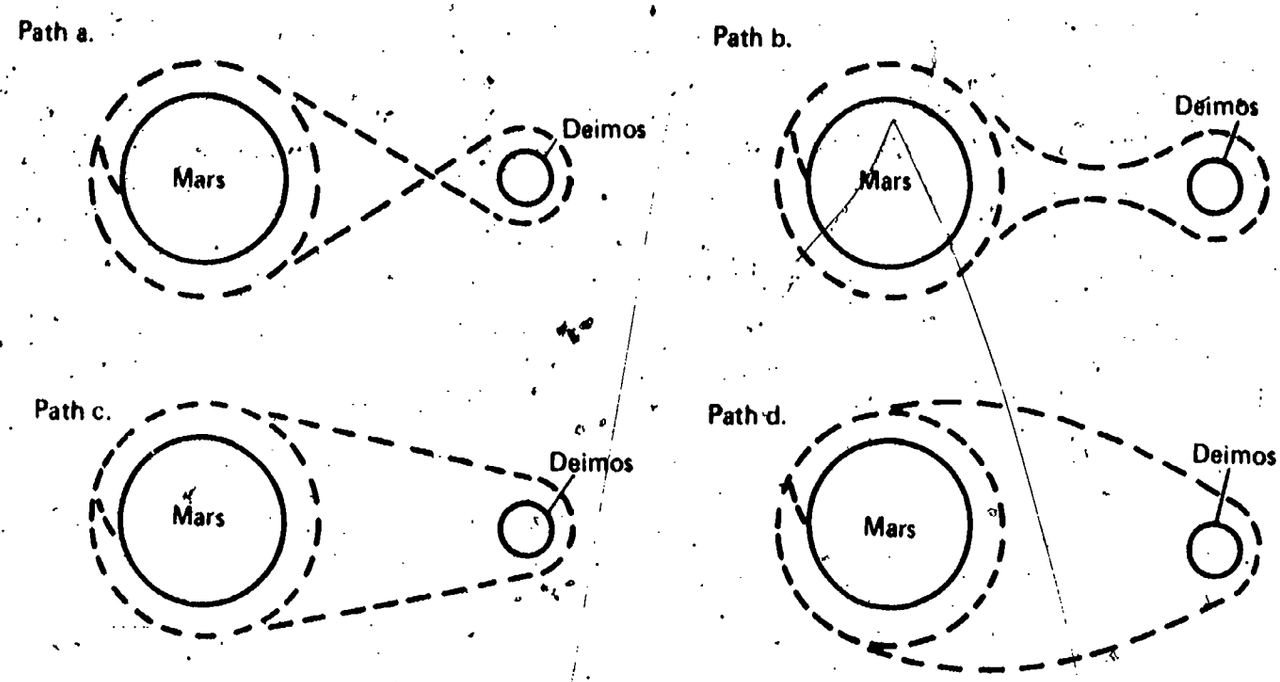
WU
02-Core-21B

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



WU 02-Core-22B

The four diagrams below represent several rocket paths from the planet Mars to its moon Deimos and back to Mars. Select the diagram which shows a free-return path.



WU 02-Core-23B

One of the important variables in achieving an orbit around the moon in a rocket mission from the earth to the moon is the speed of the spacecraft.

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

WU 02-Core-24B

One of the pieces of equipment that is carefully tested before a space flight is the heat shield. Why does a spacecraft require a heat shield?

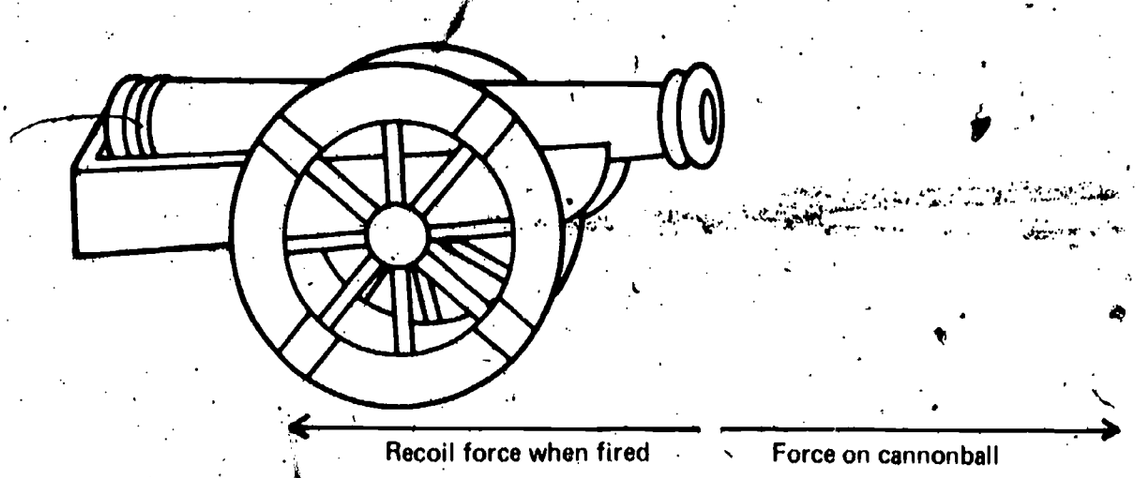
WU 02-Core-25B

The astronauts noticed that a spacecraft slows down greatly when it nears the earth even when no retro-rockets are fired.

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

WU 02-Exc 3-1-1B

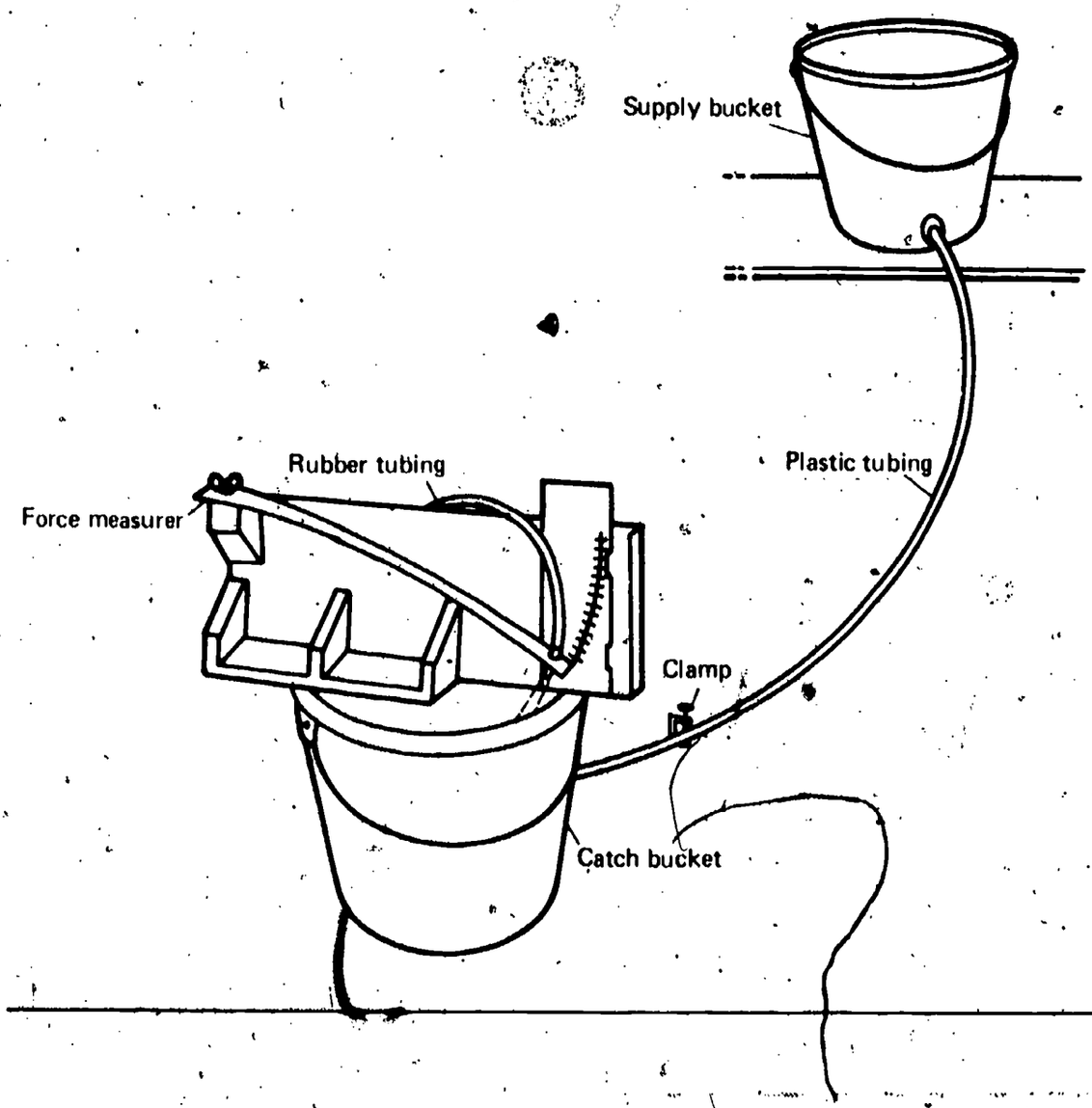
A cannon was fired for the President's visit to China. When the cannon was fired, the soldiers noted that the cannon moved backwards. Explain why there is a backward force on the cannon. See the illustration on the next page.



Scott set up the equipment shown below. He found that when he used water and a flow rate of 8 ml per second, the force from the jet was 5 units. Suppose he now repeated the experiment, using alcohol and the same flow rate of 8 ml per second.

WU
02-Exc 3-1-2B

1. When Scott used alcohol, would his force measurement be more than 5 units, less than 5 units, or exactly 5 units? (Note that 8 ml of alcohol weighs less than the 8 ml of water.)
2. Explain your answer.



WU 02-Exc 3-2-1B	A rocket carrying a satellite is put into orbit. It ejects 0.10 kg of mass each second. The mass is thrown out from the rocket at a speed of 500 m per second. What is the thrust (force) of this rocket?
WU 02-Exc 3-2-2B	The rocket engineers at the Space Center have greatly improved the thrust (force) of rockets. What are two ways that the engineers may increase the thrust of rockets?
WU 02-Exc 3-2-3B	The Titan and Saturn rockets used in the space program were built to burn their fuel in several stages. Explain why rockets are built to burn their fuel in several stages.
WU 02-Exc 4-1-1B	In the past, many incorrect ideas were accepted for long periods of time. For example, for many hundreds of years, people thought that overeating was the only explanation for being overweight. In the past few years, we have learned otherwise. Select the best reason why this incorrect idea lasted so long. a. The first schools started about 200 years ago. b. The greatest thinkers are alive today. c. People are smarter now than they were before. d. The old idea was not tested by performing controlled experiments. e. The old idea explained the experimental observations just as well as the modern ones.
WU 02-Exc 4-1-2B	From the list of variables below, select any that affect the period of a pendulum. a. Length of the pendulum b. Timing device used c. Weight of the ball d. Time of day
WU 02-Exc 4-2-1B	Two scientists have developed different models for the same thing. One scientist bases his model on mathematical formulas and equations. The other scientist does not use mathematics but uses descriptions in words instead. Why is the model which uses mathematics more likely to be useful than the one which does not?

Suppose that a communications satellite is put into orbit around Jupiter. The scientists want the satellite to remain directly over the same spot on Jupiter's surface at all times. They have the following information about Jupiter.

WU
02-Exc 4-3-1B

Time for Jupiter to revolve around the sun	11.9 earth years
Time for Jupiter to make one complete rotation on its axis	9.8 earth hours
Diameter of Jupiter	8.68 of earth's diameter
Force of gravity at Jupiter's surface	2.64 of earth's gravity

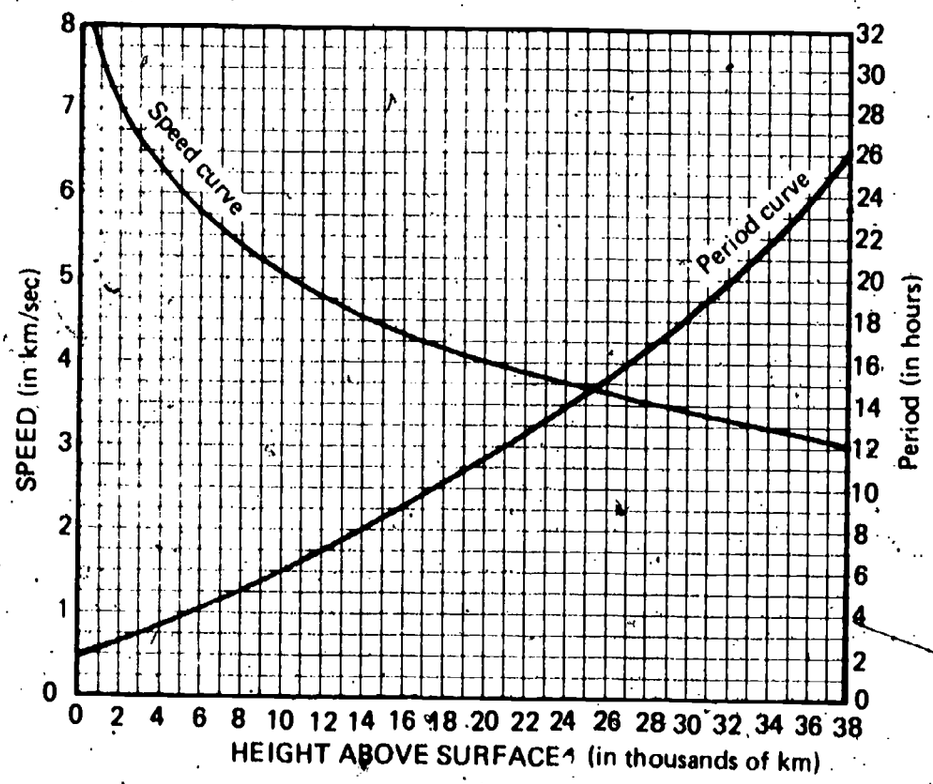
Which of the following gives the correct period for the satellite?

a. 11.9 earth years
b. 9.8 earth hours
c. 8.68 earth diameters
d. 2.64 earth gravity units

A graph like the one below is used in every flight of an orbiting vehicle. Use this graph to calculate the following information for a satellite with a period of 16 hours.

WU
02-Exc 4-3-2B

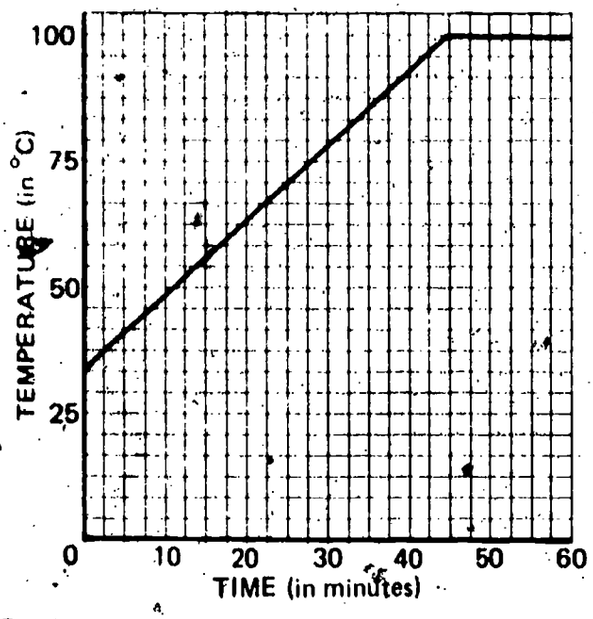
1. Height above surface
2. Orbital speed



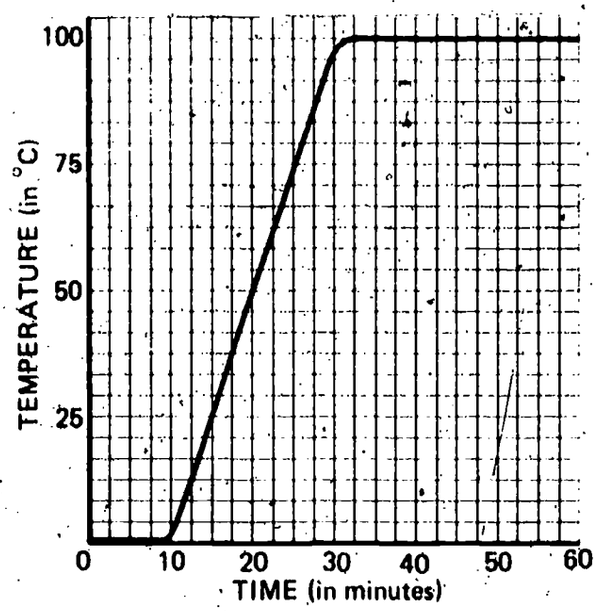
WU 02-Exc 4-4-1B

One of the four graphs below represents the heating of ice from its freezing point (0°C) to its boiling point (100°C) until all the water boils away. Select the graph that best shows how the temperature would change during the entire heating process.

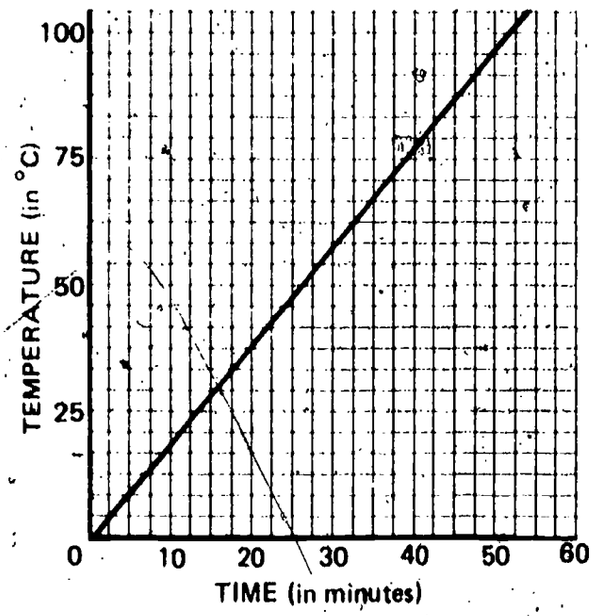
Graph a.



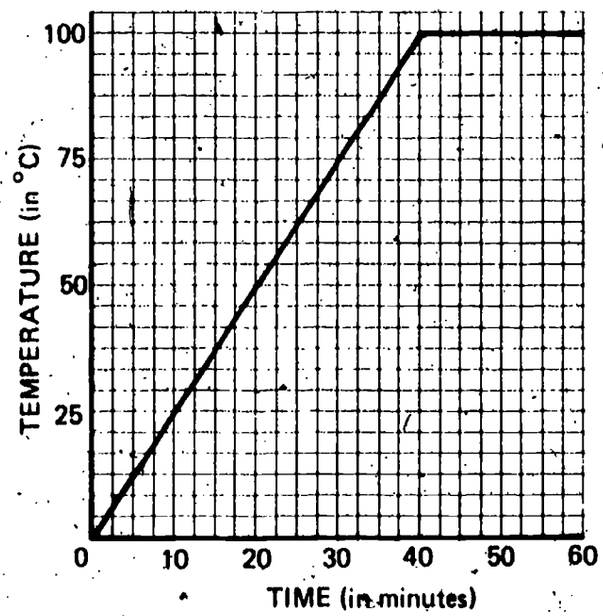
Graph b.



Graph c.



Graph d.

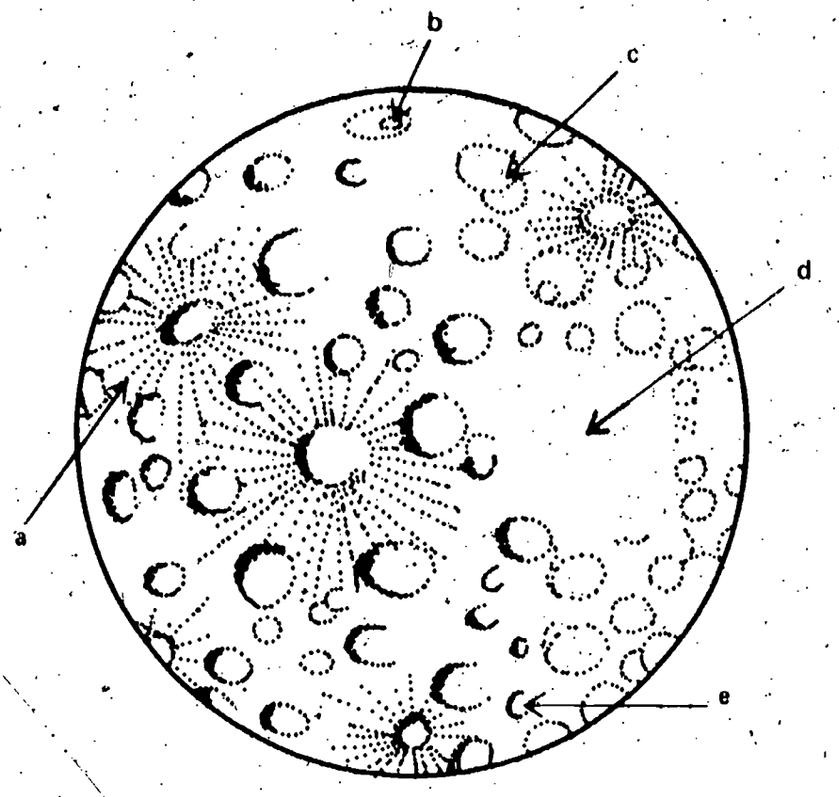


WU 02-Exc 4-4-2B

The space program spent much time working on the problem of heat generated during the reentry of a spacecraft. They finally solved the problem. Explain why a spacecraft does not burn up from the heat generated during its reentry.

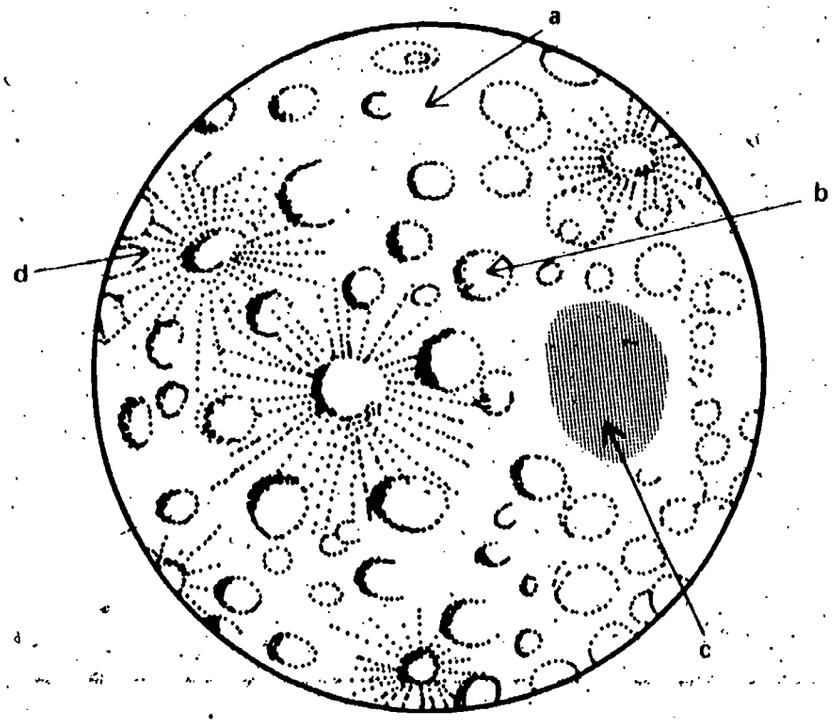
The diagram below shows the moon as it might be viewed from a spacecraft. Write the letter of the arrow that points to a mare.

WU
03-Core-1B



The diagram below shows the surface of the moon as seen from an approaching spacecraft. Select the letter of the arrow on the illustration which indicates a ray.

WU
03-Core-2B

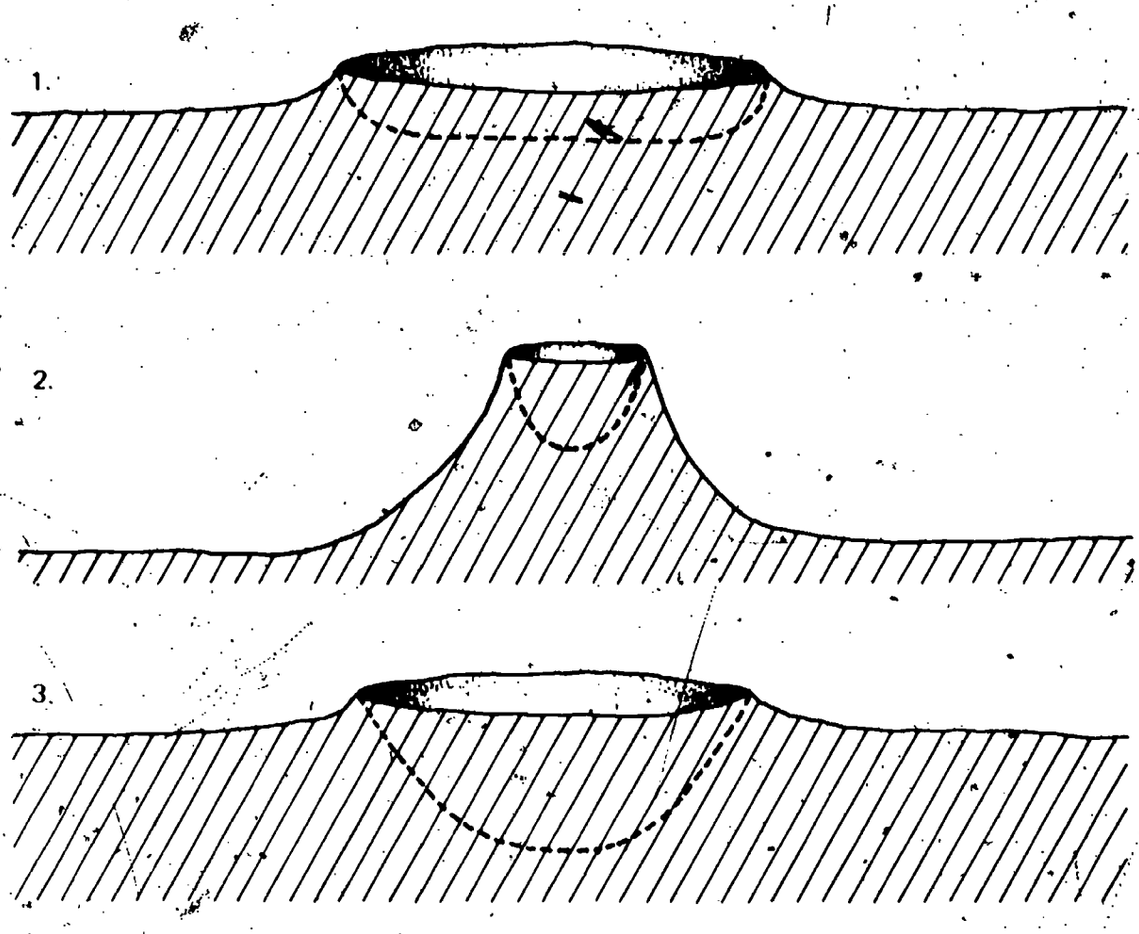


WU 03-Core-3B

On the Apollo missions, one of the astronauts has usually been a geologist, a scientist who studies the origin of rocks and minerals. Why are scientists particularly interested in the origin of the moon's rocks?

WU 03-Core-4B

Many craters are found on earth. They are usually classified as to their origin. On your answer sheet, write the most probable cause of each of the craters shown below. The dashed lines show the interiors of the craters.



WU 03-Core-5B

When the astronauts were exploring the moon in the lunar rover, they studied the variables that determine the size of a crater that is formed by a falling body. State those two variables.

WU 03-Core-6B

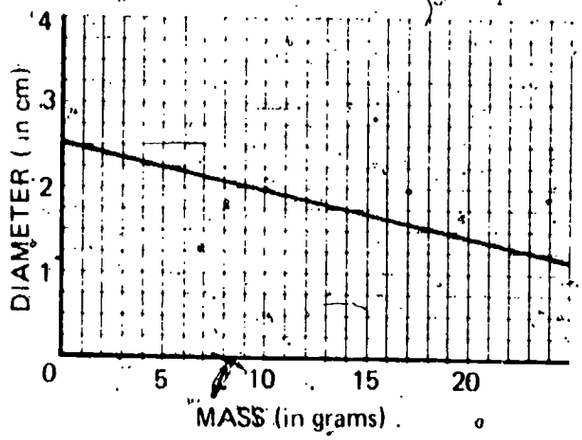
Suppose you were helping to roof a house and you dropped equal-sized steel and rubber hammers from the same height at the same time.

1. Which object would be traveling faster when it hit the ground?
2. Explain your answer.

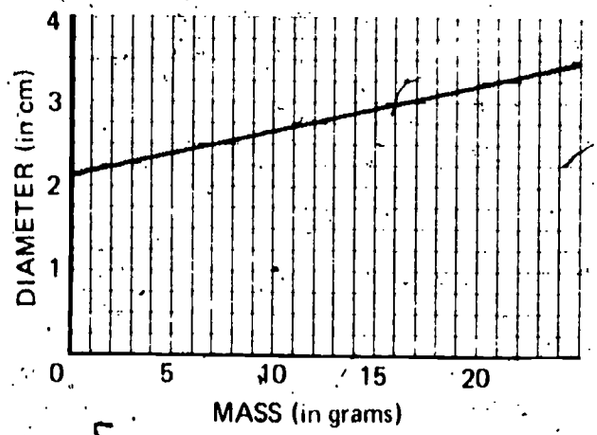
The four graphs below show possible relationships between the mass of a ball and the diameter of the crater it forms when the ball falls into a pan full of sand. Select the graph that best shows how the diameter of a crater changes when balls of different masses but the same diameter are used.

WU
03-Core-7B

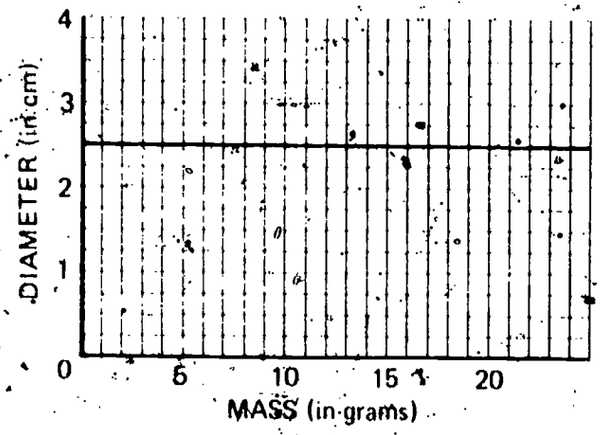
Graph a.



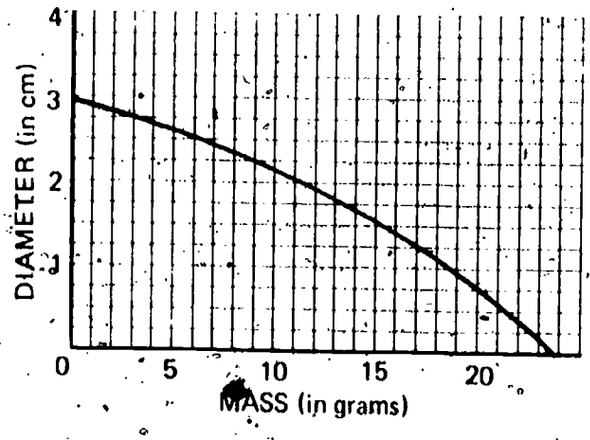
Graph b.



Graph c.



Graph d.



Suppose that Tony was given a tray containing sand and balls of several different masses. His task was to study the variables involved in the formation of craters of different sizes. He changed the mass by using different balls. He also changed the distance of fall to give a different impact speed. Why should Tony change only one of these variables at a time?

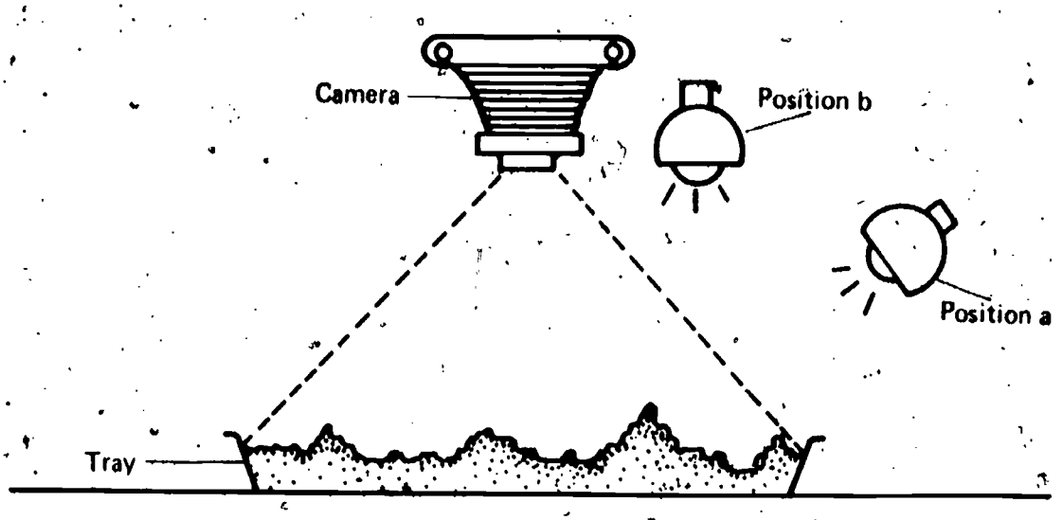
WU
03-Core-8B

Suppose you are one of the scientists at the Space Center and your job includes planning investigations. You want to find out the effect of changing the diameter of a falling body on the size of the crater it forms. Describe a plan you could carry out. You may use balls and sand. Be sure to include in your plan the variables you would vary and those which you would keep the same throughout the investigation.

WU
03-Core-9B

WU 03-Core-10B

Suppose that after making your model of the moon's craters, you decide to take a picture of the model. There are several ways to take the picture. The diagram below shows two different positions of the bulb.



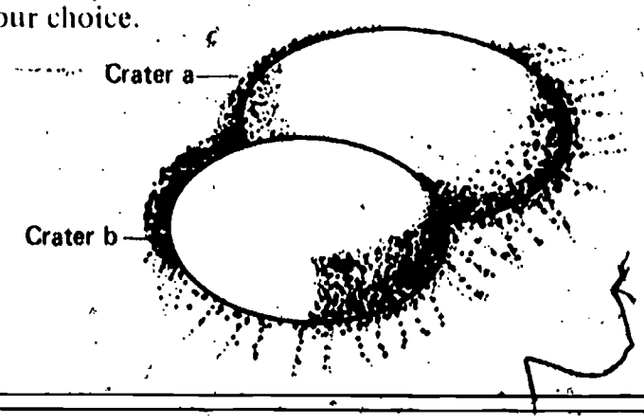
1. Which position of the bulb, a or b, will allow you to get the most detail in your picture?
2. Explain your answer.

WU 03-Core-11B

Astronauts know that there is never any rain or wind on the moon, and yet surface features such as craters and cones show signs of erosion. What causes craters and cones on the moon's surface to erode?

WU 03-Core-12B

1. Which of the moon craters in the diagram below is the older of the two?
2. Explain the reason for your choice.



WU 03-Core-13B

For years, scientists used the sand model of the surface of the moon. This model explained the shape and size of craters. Today this model has been replaced by the rottenstone-on-top-of-bentonite model. Why?

WU 03-Core-14B

Imagine an astronaut on the moon near a crater that has rays coming from it. He drills into the surface and examines the rock that he hauls up. Predict how the color of the rock might change as he drills deeper.

Prior to the lunar flights, Space Center scientists used the darkening of light-sensitive paper as you did in Activity 5-12 to simulate the effect of sunlight on the moon's surface. Which statement below describes the best conclusion that can be drawn from the results of the experiment?

WU 03-Core-15B

a. Since sunlight causes some substances to darken, this might explain the moon's surface material being darker than that under the surface.
b. Since sunlight darkens the moon's surface, that surface is made of the same chemicals as the light-sensitive paper.
c. Sunlight darkens the surface material on the moon but does not affect the material thrown out from below the surface.
d. Sunlight causes the surface of the moon to darken.

Suppose that an astronaut kicks a football on the moon.

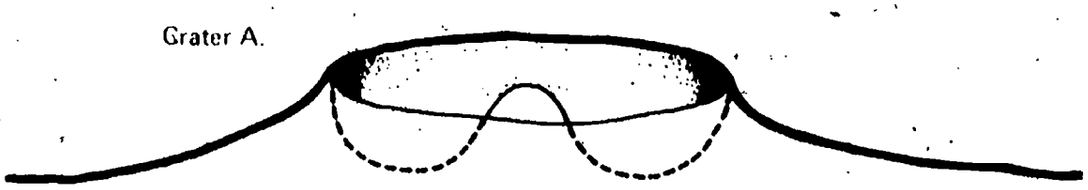
WU 03-Core-16B

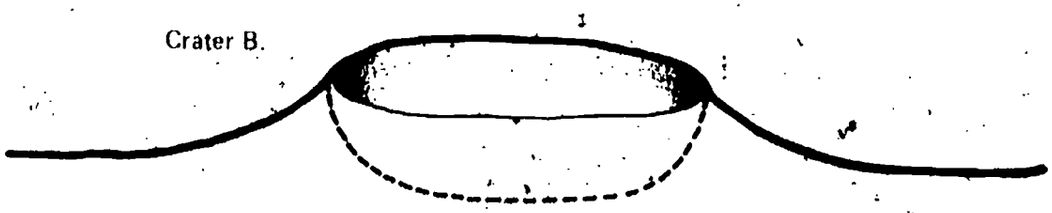
1. Will the football go a greater or a smaller distance than it would on earth?
2. State two reasons for the difference.

Neil Armstrong, while walking on the moon, may have noticed craters A and B pictured below. Both of them were formed by the impact of meteors on identical areas of the lunar surface. The dashed lines show the interiors of the craters.

WU 03-Core-17B

1. Was the meteor that caused crater B traveling more slowly or more rapidly than the meteor that caused crater A?
2. What evidence do you have for your answer?





Dropping water on a layer of bentonite produces a crater with a central peak. In what three ways can you increase the size of your model's central peak during the crater's formation?

WU 03-Core-18B

WU 03-Core-19B

Suppose Iggy is on the moon. He spots a cinder cone like the one drawn below. What is the most likely cause of this cinder cone?

WU 03-Core-20B

Scientists have found dome-shaped mountains on the surface of the moon. What is a possible cause for these mountains?

WU 03-Core-21B

The diagrams below show four different features of the moon's surface. After the number of each feature, write the letter of the probable cause of that feature.

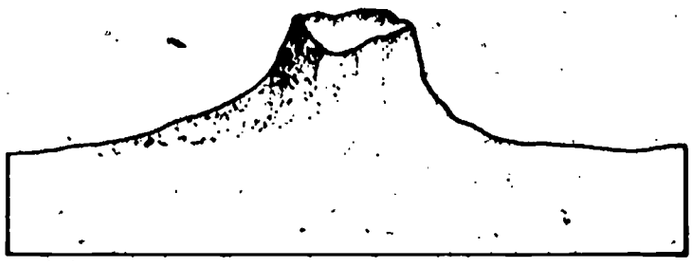
Feature

Probable Cause

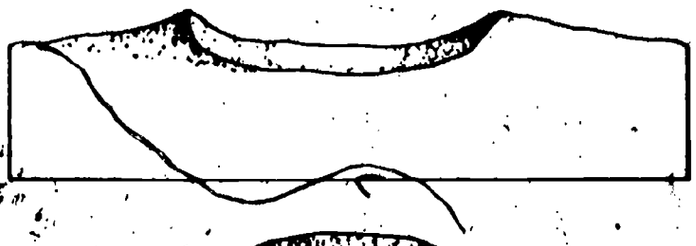
a. Underground magma flow
b. Low-speed meteor impact
c. Volcanic eruption
d. High-speed meteor impact
e. Explosion below the surface

1.

2.



3.



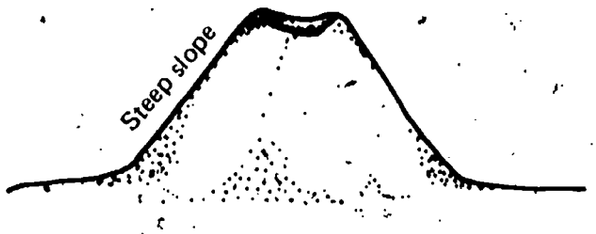
4.

An astronaut scientist exploring the moon in a lunar rover discovered a cinder cone whose features indicate that it was caused by volcanic activity. However, all cinder cones on earth which scientists have observed have fairly gentle slopes, whereas cones on the moon have steep slopes, as shown in the diagram below.

WU
03-Core-22B

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.

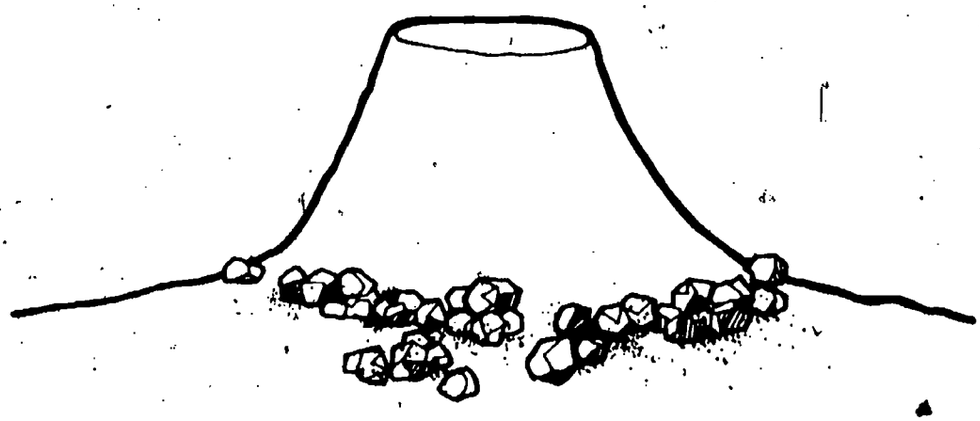
Cinder cone on earth



Cinder cone on moon

Use the diagram below to answer the questions that follow.

WU
03-Core-23B



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?

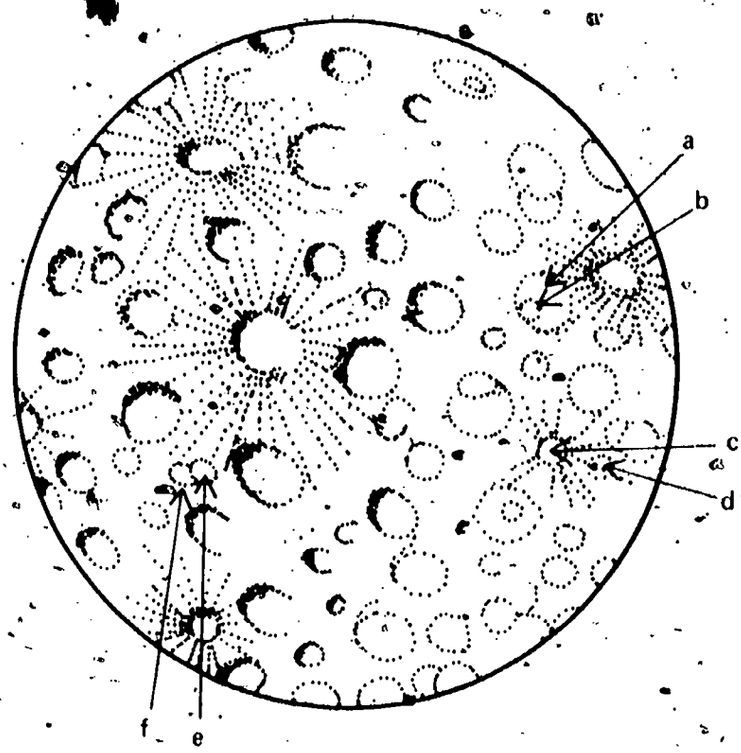
The moon does not have wind and rain like the earth has to produce changes in the moon's surface. But there are three things that may cause the surface of the moon to change. What are they?

WU
03-Core-24B

WU
03-Core-25B

Several features are indicated by arrows on the diagram of the moon's surface below.

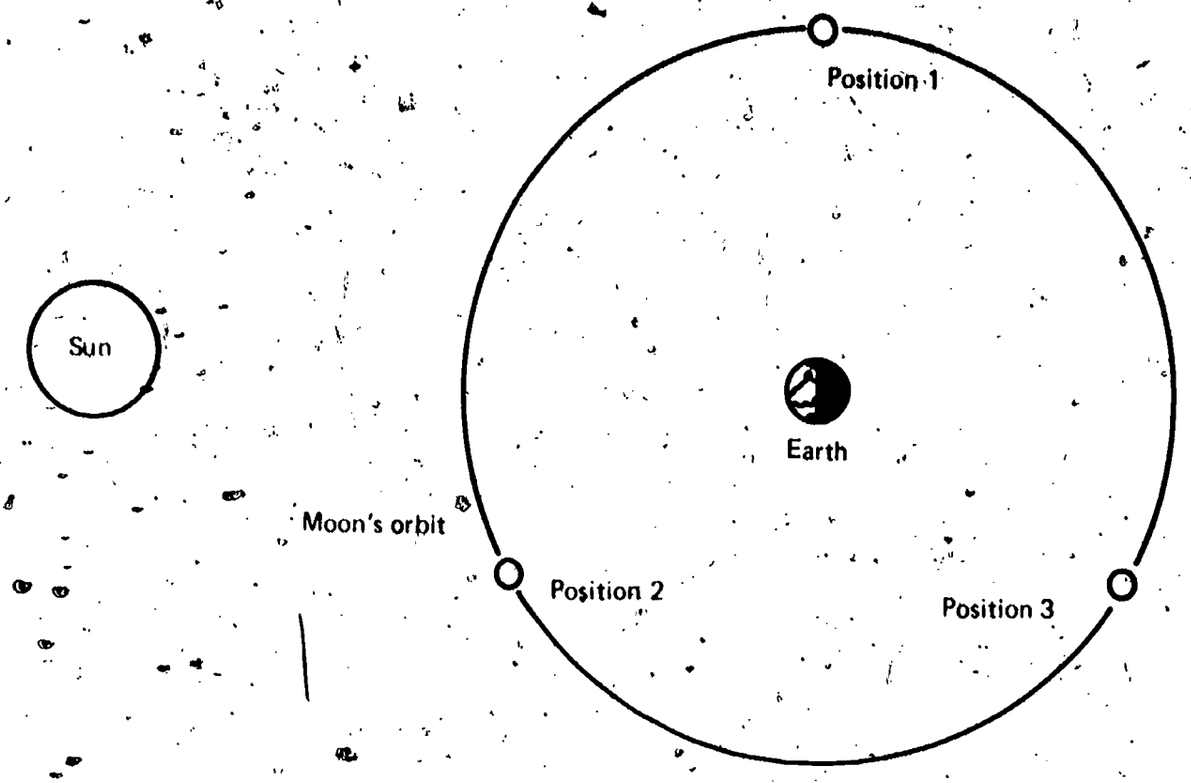
1. Indicate which of the two features in each of the following pairs is probably the older of the two features.
   (1) a or b
   (2) c or d
   (3) e or f
2. For each pair, state why you think the feature you selected is the older feature?



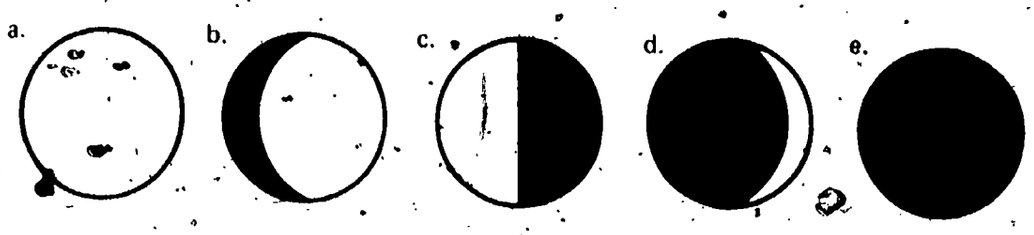
WU
03-Core-26B

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.

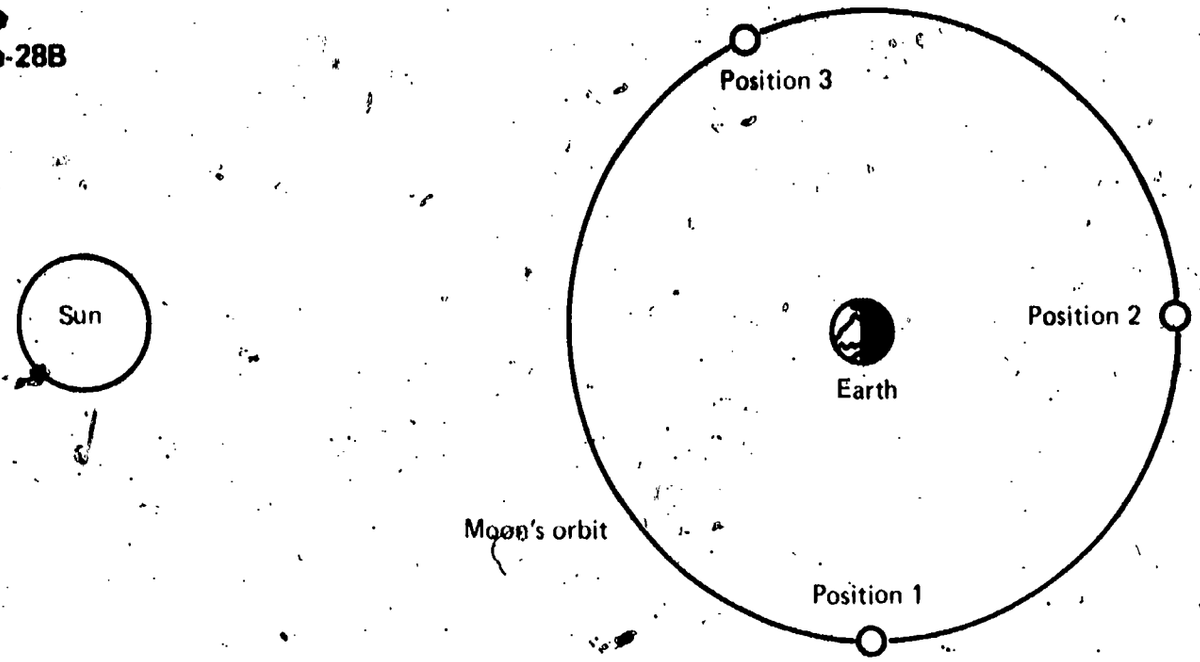
1. What fraction of the earth's surface would an observer on the moon see in a 12-hour period?
2. What fraction of the earth's surface would an observer on the moon see in a 6-hour period?



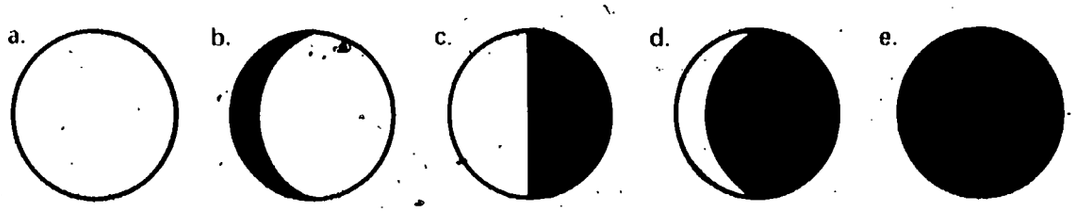
Use the sun-earth-moon model shown above to determine how the moon would appear to an observer on earth who is facing the moon when the moon is in each of the three positions shown in the model. Write the number of the position and after it the letter of the diagram which shows the most likely appearance of the moon in that position.



WU
03-Core-28B



Consider the sun-earth-moon model shown above. Then for each of the three positions of the moon, match the diagram below which best shows how the earth would appear to an observer on the moon when the moon is in that position. Write the number of the moon's position and after it the letter of the earth diagram.



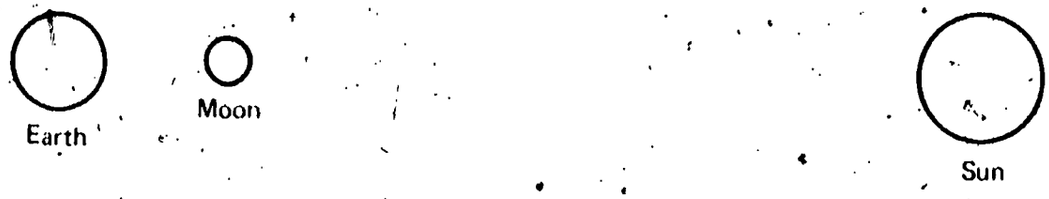
WU
03-Core-29B

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. On the horizon
b. Impossible for him to see the earth
c. Directly overhead
d. About one-quarter of the way between the horizon and overhead

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 in this position as dimly lighted rather than completely dark.

WU
03-Core-30B



Explain why as the moon revolves around the earth only one side of the moon is ever visible from the earth.

WU
03-Core-31B

State the period in days of the moon's revolution around the earth.

WU
03-Core-32B

State the period in days of the earth's revolution around the sun.

WU
03-Core-33B

Suppose you weighed yourself on the earth's surface and on the moon's surface.

1. Would your weight on the moon's surface be more, less, or about the same as your weight on the earth's surface?
2. If it would be more or less, how much more or less would it be?

WU
03-Exc 5-1-1B

During one of the Apollo flights, the astronauts' equipment was weighed on earth and on the moon's surface. The weight of the battery pack on the land rover was 480 pounds. What was its weight on the surface of the moon? Show your work.

WU
03-Exc 5-1-2B

1. Are there important differences between the surface features of the far side of the moon and the surface features of the side of the moon that is visible from the earth?
2. If so, describe the differences.

WU
03-Exc 7-1-1B