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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 C), 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 B). 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 C

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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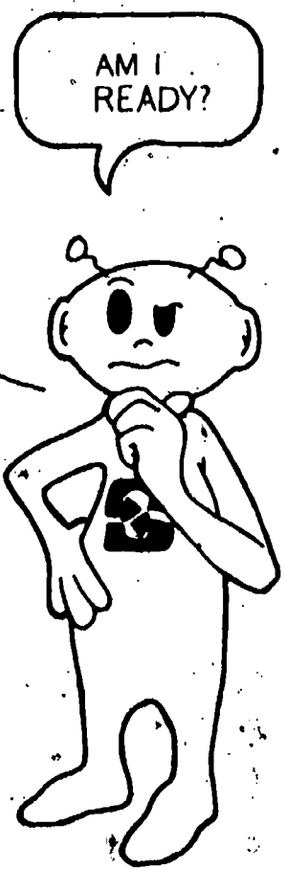
NOTES TO THE STUDENT

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

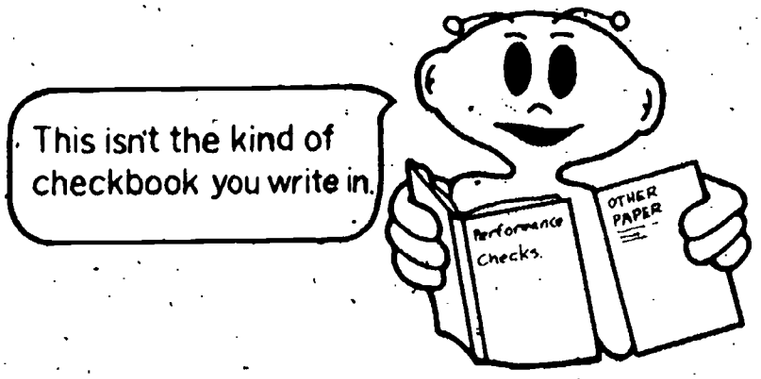
IO	-	03	-	Core	-	17	A	and	WU	-	01	-	Exc	2-2	-	2	A
text		unit		based on core material		check number	form of the check		text		unit		based on excursion material	excursion number		check number	form of the check

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. Observe the spectrum through the spectroscope. Determine whether the spectrum is different when observed with the left eye from the spectrum when observed with the right eye. 01-Core-1C

Get an 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 left side of the spectroscope. IO 01-Core-2C

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

What is a spectroscope? IO 01-Core-3C

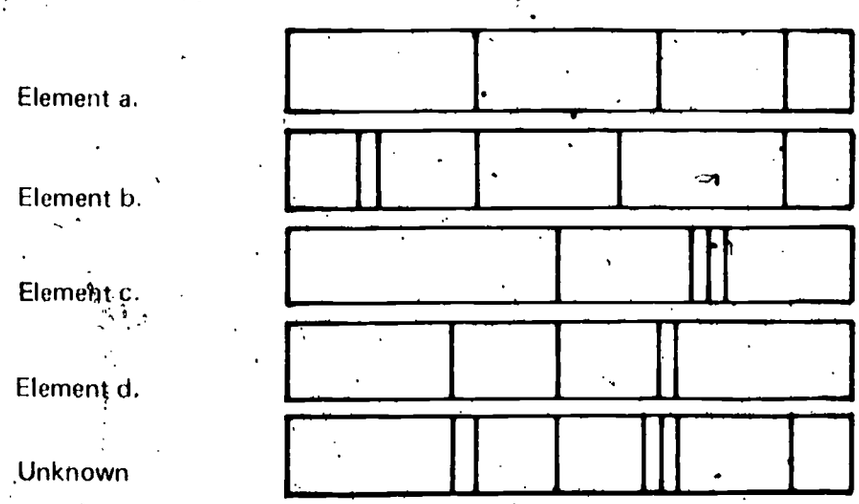
What does a diffraction grating in a spectroscope do to sunlight? IO 01-Core-4C

Define the term *spectrum*. IO 01-Core-5C

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-6C

Light Sources	Descriptions
1. 100-watt light bulb	a. Only a continuous spectrum
2. Crystals containing the element Sr (strontium) heated in a flame	b. Only a line spectrum
3. Neon fluorescent lamp	c. Both line and continuous spectra
	d. Neither a line nor a continuous spectrum

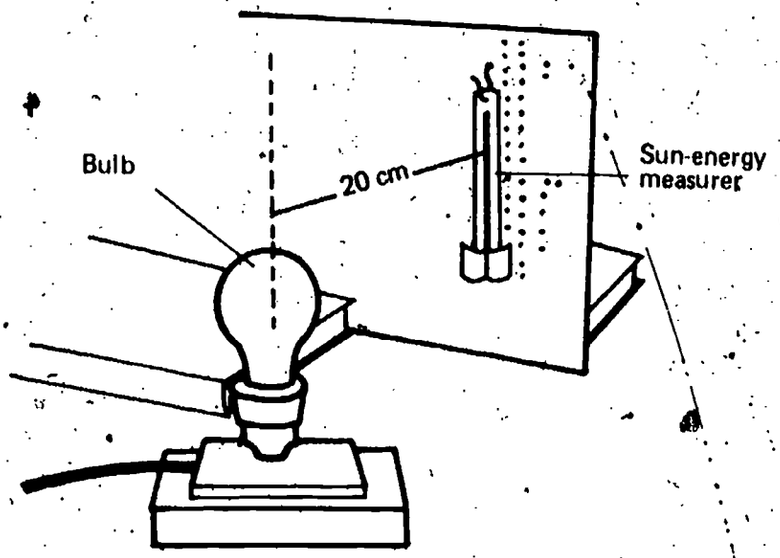
The first four spectra below are the spectra of crystals of four elements, a, b, c, and d. The last spectrum was obtained by heating a mixture of crystals containing some of the four elements. Which elements (a, b, c, d) are present in the unknown mixture? IO 01-Core-7C



IO 01-Core-8C	Suppose that you have viewed the line spectra of several labeled salts, using regular burner fuel. And then your teacher gives you an unknown mixture of these salts in solution to identify. There is no more of the regular burner fuel, so your teacher gives you a substitute fuel to use in your burner. Describe the steps you would perform to identify any salts present in your unknown salt solution.
IO 01-Core-9C	You observed the spectrum of the alcohol flame before placing the crystals of several chemicals into the flame. Why was that step necessary?
IO 01-Core-10C	Jane is drying her prints in the photography laboratory. There is a thin white cloth between the print and the bulb. Seeing that the prints are still coming out wet, Janes notes that there is a 150-watt bulb supplying the heat which is supposed to dry the prints. She has decided she will have to buy a larger bulb. Suggest two things that she could do, without changing the bulb, to increase the effect of the lamp so that the prints will dry.
IO 01-Core-11C	There are four variables that influence how much the temperature of an object changes when placed directly in the sunlight. List them.
IO 01-Core-12C	Anthony prepared two identical blocks of wax. He covered one block with white cloth and the other block with black cloth. He then placed both blocks of wax in the direct sunlight. 1. After thirty minutes, which of the two blocks is more likely to have the higher temperature? 2. Explain your answer.
IO 01-Core-13C	Explain why you had to blacken the copper strip in your sun-energy measurer.

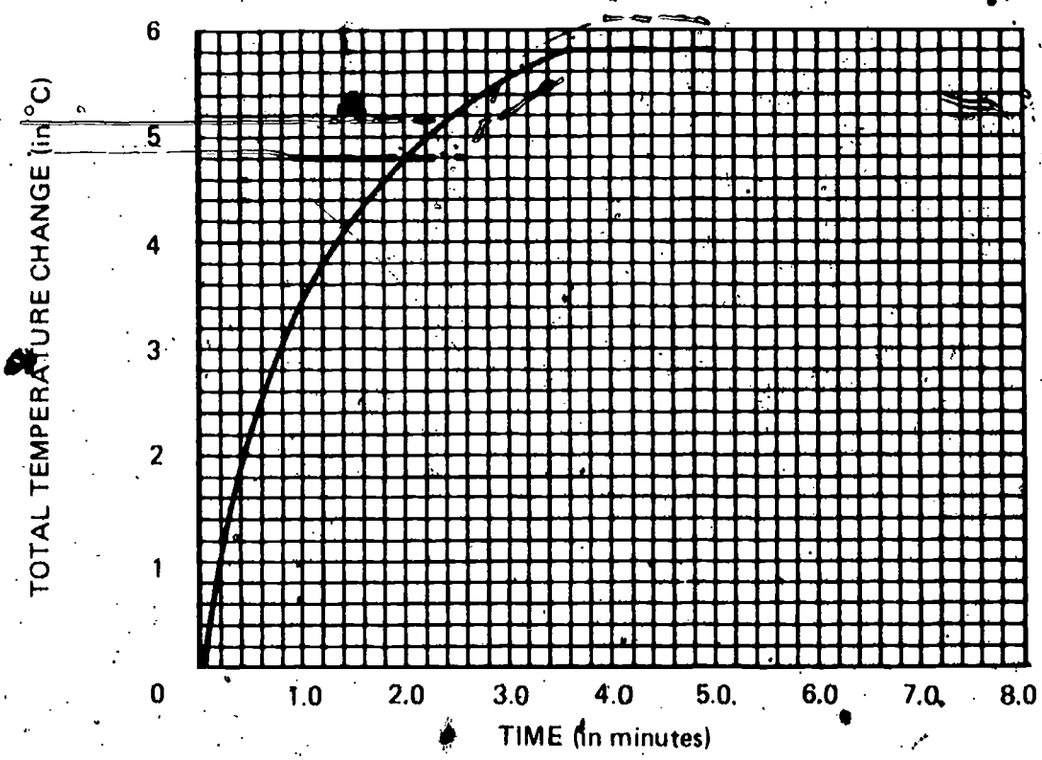
Using the setup shown below, Wayne found the effect of different wattages of light bulbs on his sun-energy measurer. Why did Wayne have to keep the following variables constant — the distance of the light bulb from the energy measurer and the time the bulb shone on the measurer?

IO
01-Core-14C



John plotted the data he collected in 5 minutes, using his sun-energy indicator and a 100-watt light bulb. Suppose the materials were left in place with the bulb lit. What do you predict will be the total temperature change of a sun-energy indicator at the 8-minute point on the graph below?

IO
01-Core-15C

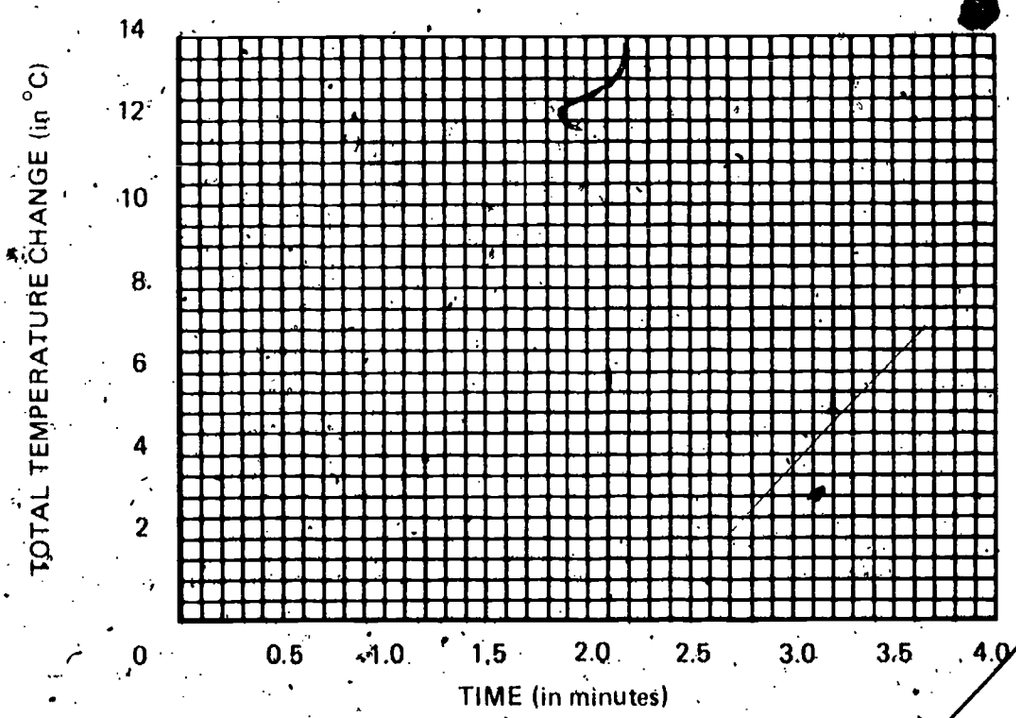


Before you begin this check ask your teacher for graph paper or a labeled grid like the one shown below.

Glen 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	18.5	0.0
0.5	22.8	4.3
1.0	25.5	7.0
1.5	27.6	9.1
2.0	29.3	10.8
2.5	30.0	11.5
3.0	30.7	12.2
3.5	31.0	12.5
4.0	31.1	12.6

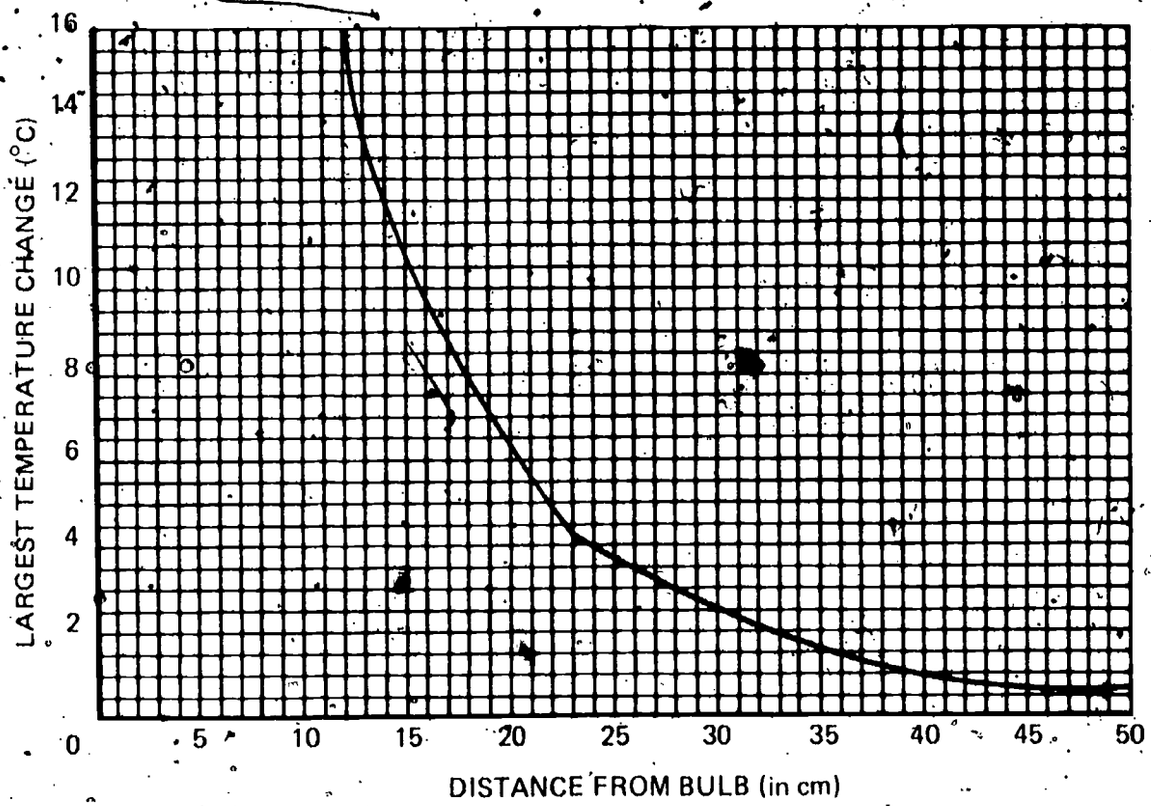
Graph Glen's measurements of the temperature change and the time on the grid.



The plastic ceiling light fixture in Steve's bathroom has the following message attached to it. "WARNING: BULBS OF MORE THAN 75 WATTS ARE NOT TO BE USED IN THIS FIXTURE." IO 01-Core-17C

1. Explain why the warning is on the fixture.
2. What might happen if Steve uses a 150-watt bulb in it?

Barbara put a sun-energy measurer in direct sunlight. She found that the largest temperature change of her sun-energy measurer was 9.5°C. She then measured the largest temperature changes of her measurer at different distances from a 100-watt bulb. She used her data to plot the graph shown below. IO 01-Core-18C



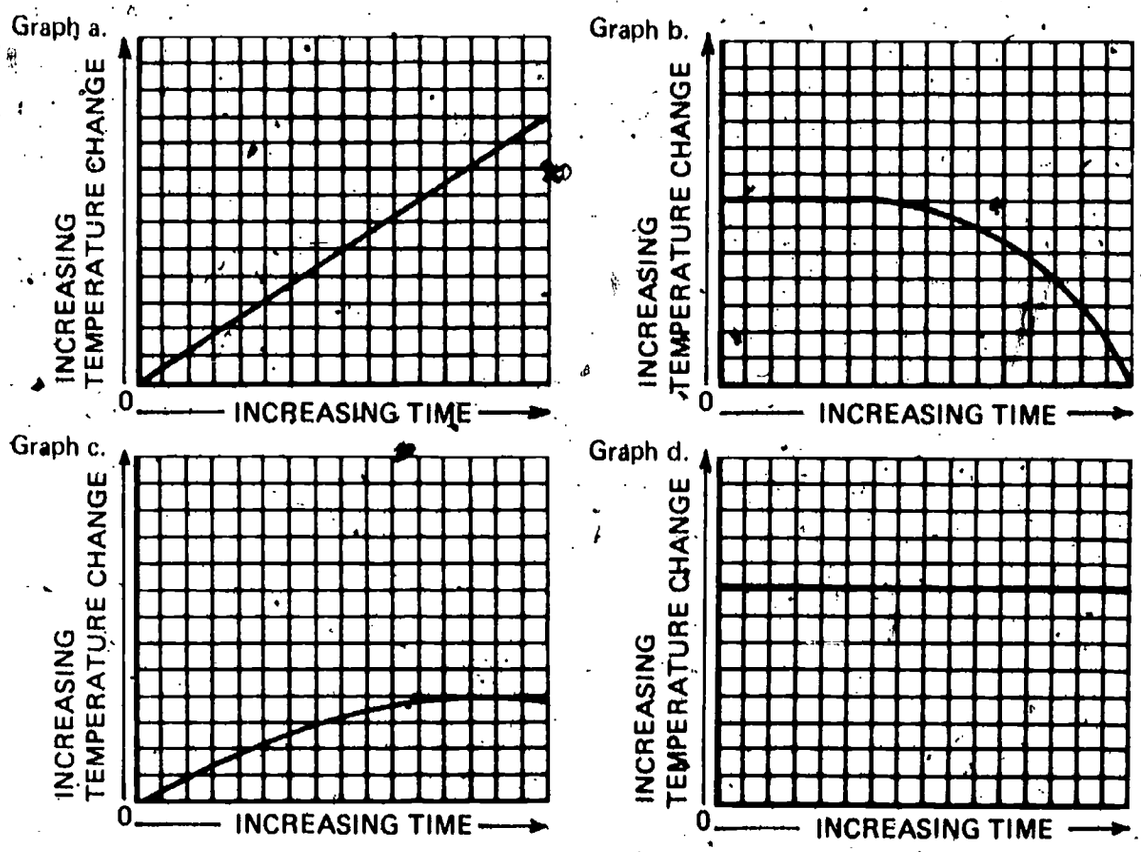
At what distance from the 100-watt bulb did her sun-energy measurer receive the same amount of energy as it did from the sun when it was placed in direct sunlight?

When Edwin began to make models in wax, he found that a 25-watt light bulb produced just enough heat to keep a pound of wax soft enough to be shaped. But the 25-watt bulb had to be kept so close to the wax that Edwin's hands couldn't move freely. Suppose he moved the lamp socket twice as far from the wax. Which wattage below would be needed to produce nearly the same heating effects as the 25-watt bulb? IO 01-Core-19C

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

10
01-Core-20C

Michelle recorded the temperature of her sun-energy measurer at room temperature. She then placed it on a hot plate after the hot plate reached a warm, steady temperature. She read the temperature every 30 seconds. Later she drew a graph showing the temperature rise of her sun-energy measurer with time. Select the graph below that best shows what Michelle's graph would look like.

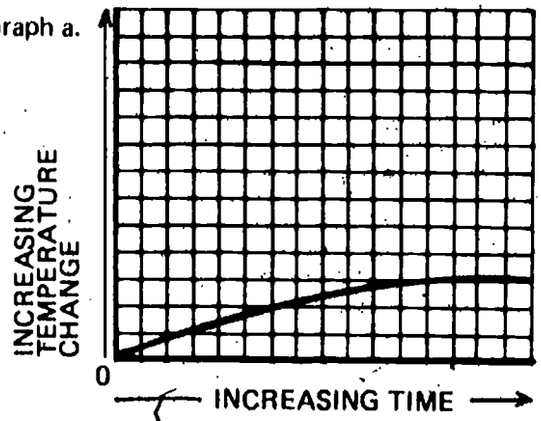


Tara measured the temperature changes in her sun-energy measurer when she placed it 20 cm from a 100-watt light bulb. She then changed to a 150-watt bulb and measured the temperature changes again. She also made measurements, using 200-watt and 300-watt bulbs. On your answer sheet, match the letters of the graphs she drew with the numbers of the light bulbs she used.

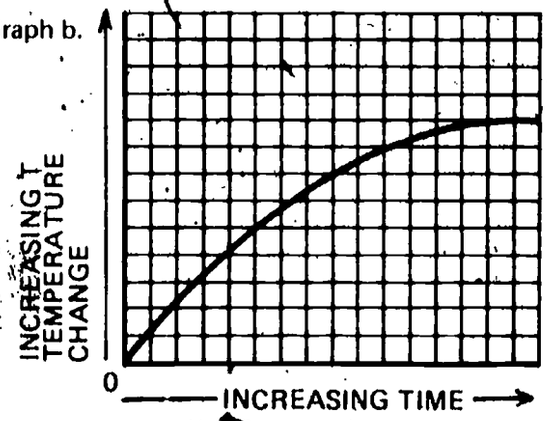
10
01-Core-21C

Bulbs	Graphs
1. 100 watt	
2. 150 watt	
3. 200 watt	
4. 300 watt	

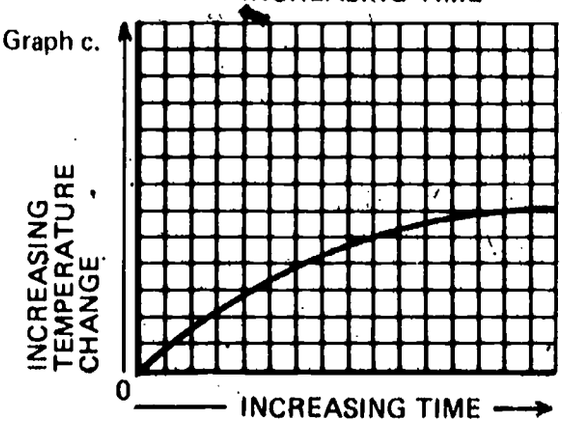
Graph a.



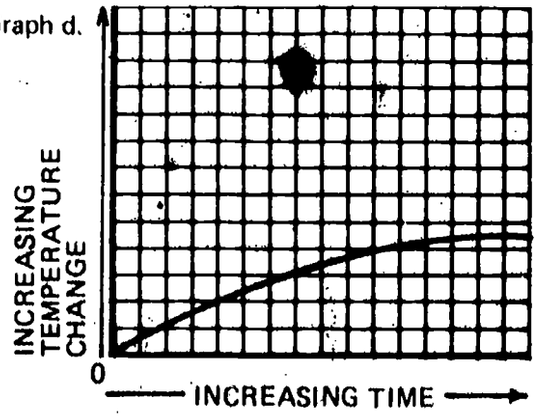
Graph b.



Graph c.

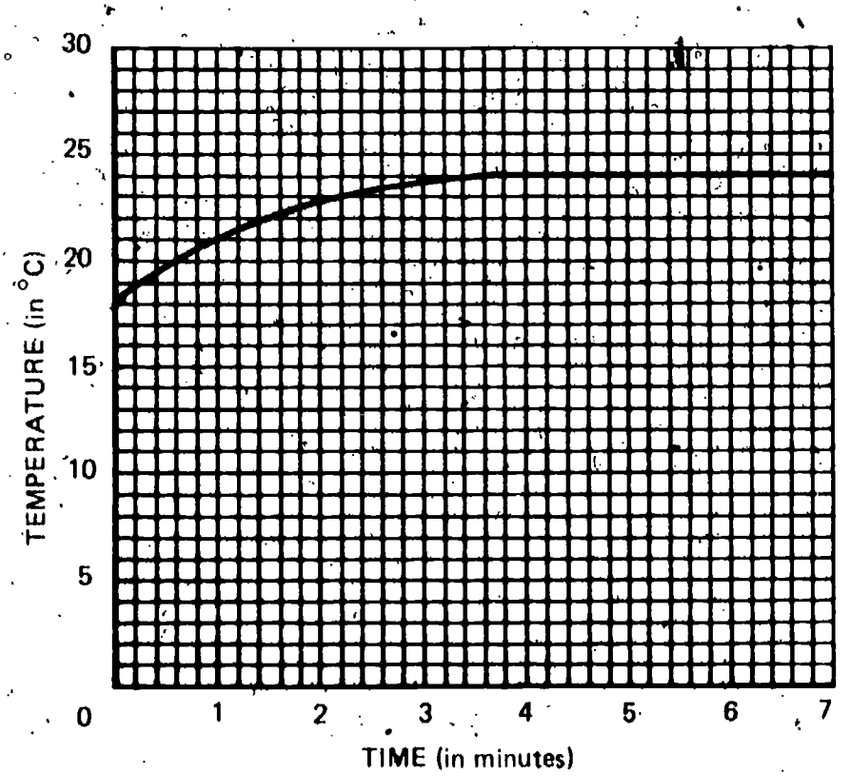


Graph d.



IO
01-Core-22C

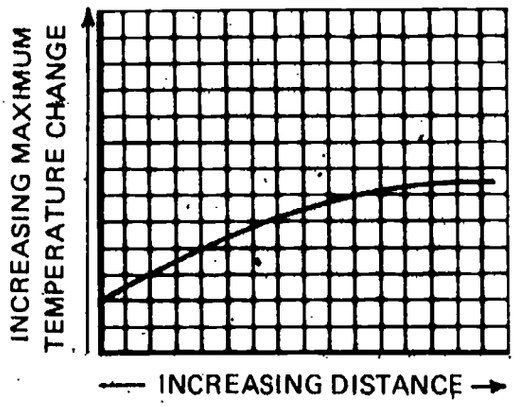
Sam put his sun-energy measurer 30 cm from a light bulb and read its temperature. He then read it every 30 seconds. He plotted his temperature data on the graph shown below.



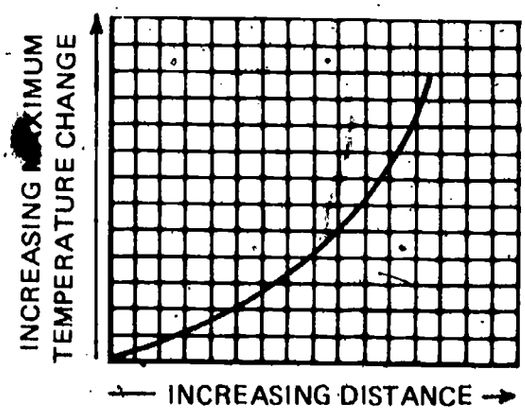
What was the total temperature change of Sam's sun-energy measurer?

Select the graph that best shows how the temperature change of a sun-energy measurer varies as its distance from the light source increases. IO 01-Core-23C

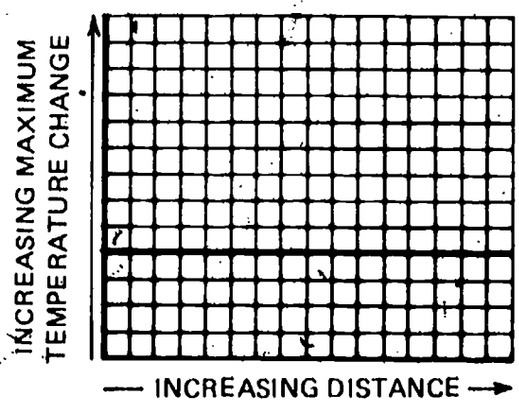
Graph a.



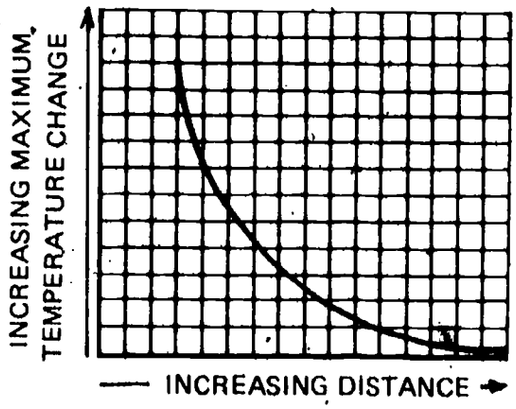
Graph b.



Graph c.



Graph d.



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

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

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

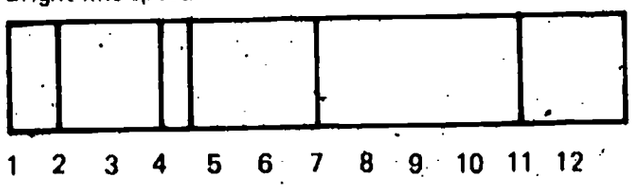
Your teacher will observe you for this check when he can. IO 01-Core-27C

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

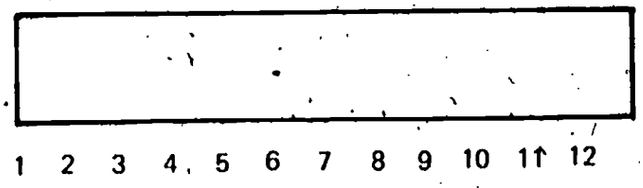
IO
01-Exc 1-1-1C

Sam drew the diagram below of the bright-line spectrum of element Z.

Element Z
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 Z.



IO
01-Exc 2-1-1C

There is a device for sale in an electronics shop. It is a box with no wires attached, and it has a little bulb on the top that blinks. The salesman told Tom that the device has been on the shelf in the store for several months without any outside source of energy attached.

1. Describe what is happening inside the box to operate the bulb.
2. Do you think the bulb will blink forever?
3. Explain your answer to part 2.

IO
01-Exc 2-1-2C

Bob wants to lift a box to a higher shelf. How can he calculate the amount of work done on the box in lifting it?

IO
01-Exc 2-1-3C

Scientists often use the term *conservation of energy*. What do they mean by this term?

IO
01-Exc 2-1-4C

Energy exists in many different forms. State three of them.

Sometimes the distances between objects would be very difficult to measure directly as you do when you use a ruler or meterstick. Describe two different situations each of which involves a different condition under which one should instead use indirect measurement of a distance between objects. You may recall that this can be done with a range finder that measures angles which are then changed into distance measurements. **IO 02-Core-1C**

When you measure with a range finder, you use the principle on which the range finder is based. State this principle. **IO 02-Core-2C**

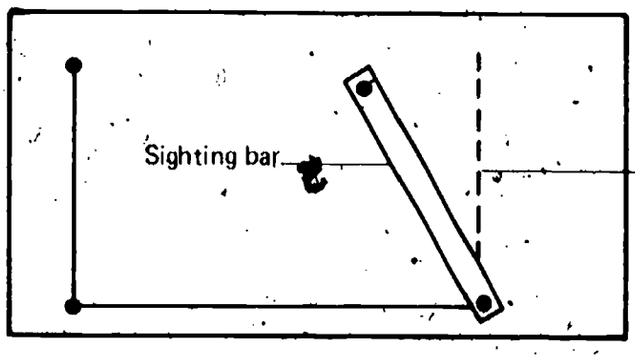
Technicians and scientists use calibrated measuring devices (measuring devices with scales) when carrying out an experiment. Why is it necessary to use calibrated rather than uncalibrated measuring devices? **IO 02-Core-3C**

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

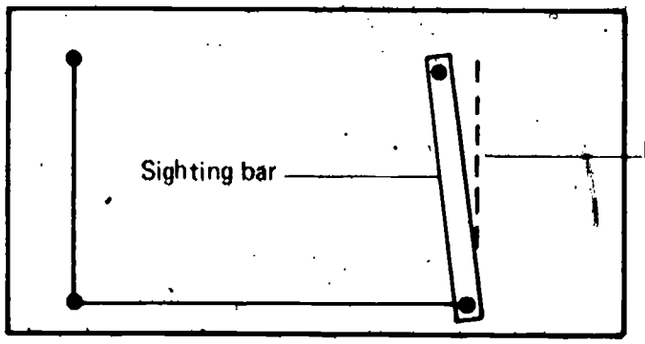
Examine the diagrams below of the two range finders. One is being used to sight a tree 8 meters away and the other is being used to sight a tree 14 meters away. **IO 02-Core-5C**

1. Which range finder is sighting the tree that is 14 meters away?
2. Explain the reason for your choice.

Range finder a.

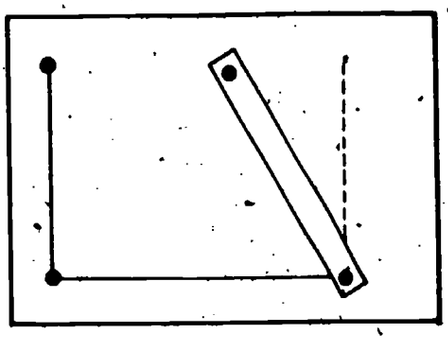


Range finder b.



10 02-Core-6C	Suppose you want to measure the distance between two objects that are more than 15 meters apart. You are to use one of the two range finders shown below.

Range finder a.

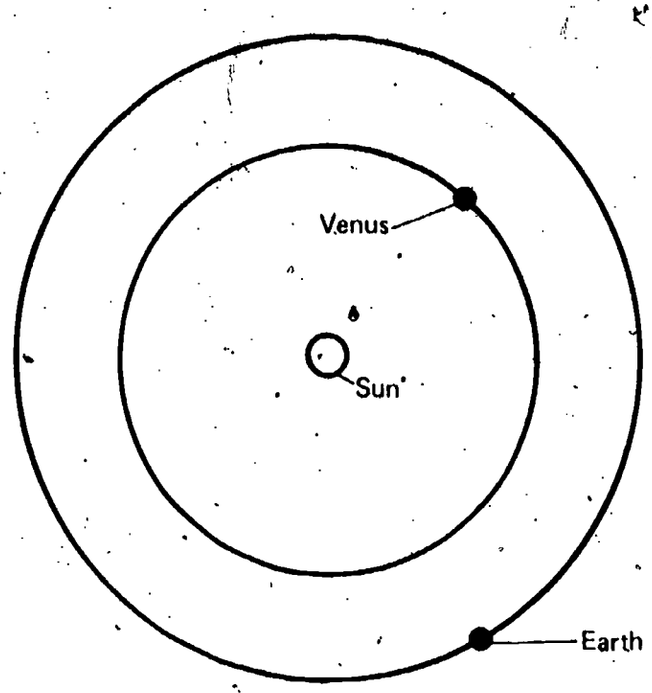


Range finder b.

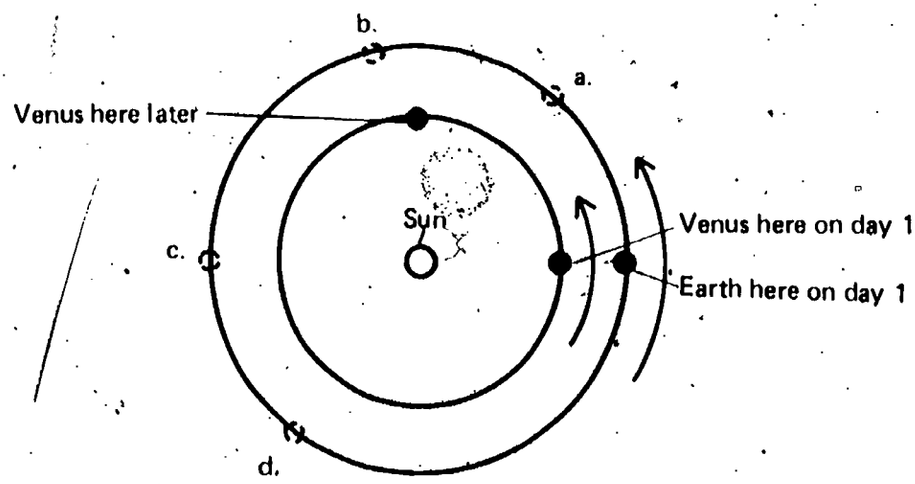
1. Which of the two range finders could measure this distance more accurately?
2. Explain your choice.

10 02-Core-7C	Your ISCS range finder is limited to measuring distances of 15 meters or less. What are the two variables that limit the greatest distance you can measure accurately with a range finder?
10 02-Core-8C	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 that the bright light is the sun. Have your teacher watch you as you measure the distance to the sun (the bulb).
10 02-Core-9C	You are not able to measure the distance to Rigel, a distant star, with your range finder. Why can this distance not be measured by a range finder like yours?

To make a model of the Earth-sun-Venus system, certain assumptions must be made if the model is to explain the system. You drew a model of the Earth-sun-Venus system like the one shown below. What were four assumptions you made in drawing your model? 10 02-Core-10C

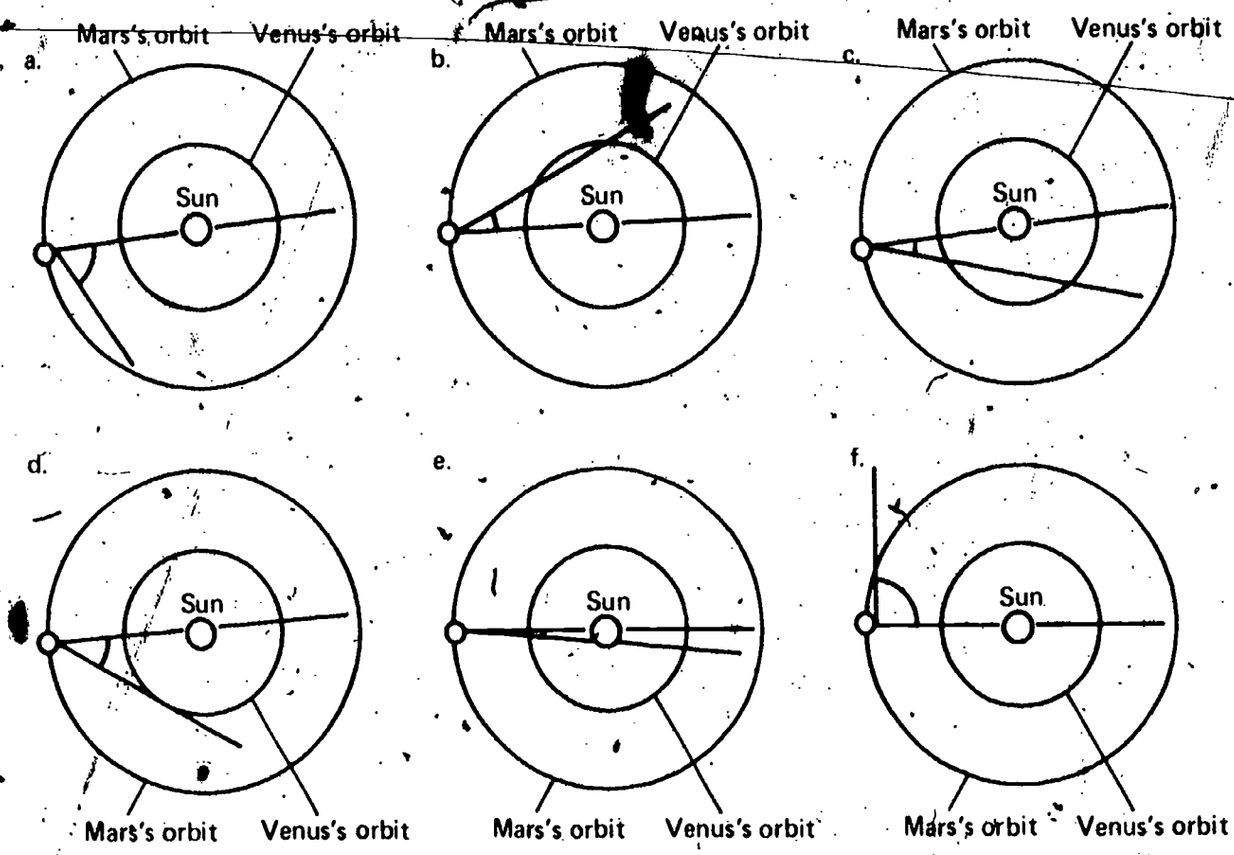


The diagram below shows the positions of Earth and Venus on the same day and of Venus a few months later. Select the letter of the approximate position of Earth at this later time. 10 02-Core-11C



10
02-Core-12C

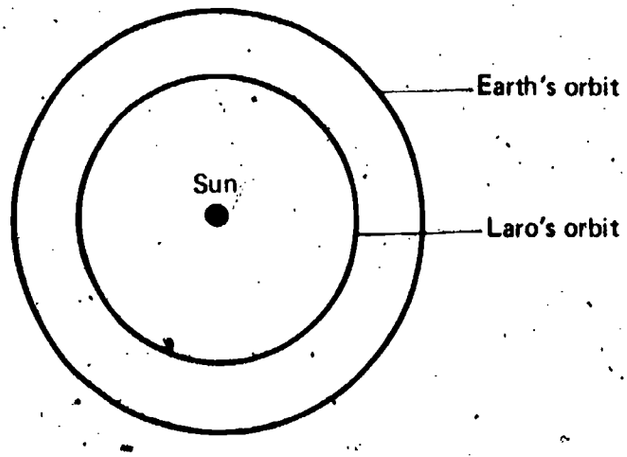
Select the diagram below that shows the greatest possible MV-MS angle.



10
02-Core-13C

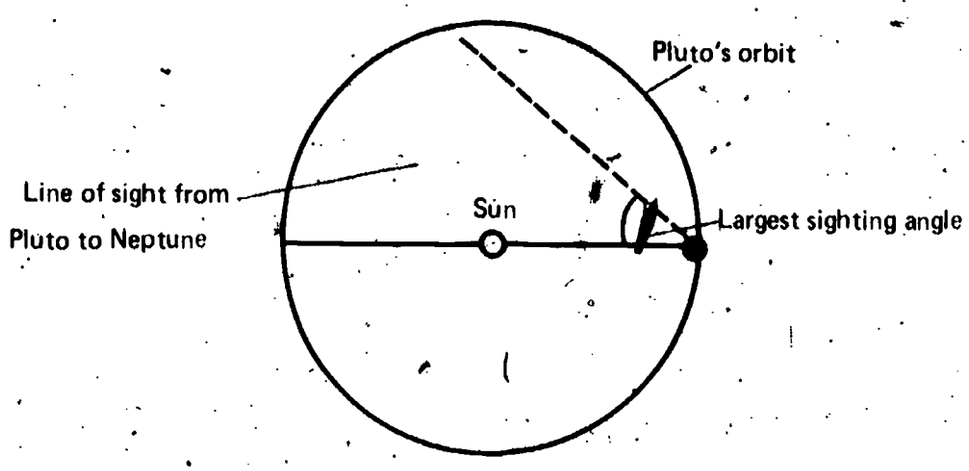
Get a drawing compass and a ruler, and copy the diagram below.

Suppose that planet Laro, whose orbit is between Earth and the sun, has just been discovered. A model of the Earth-sun-Laro system is shown:



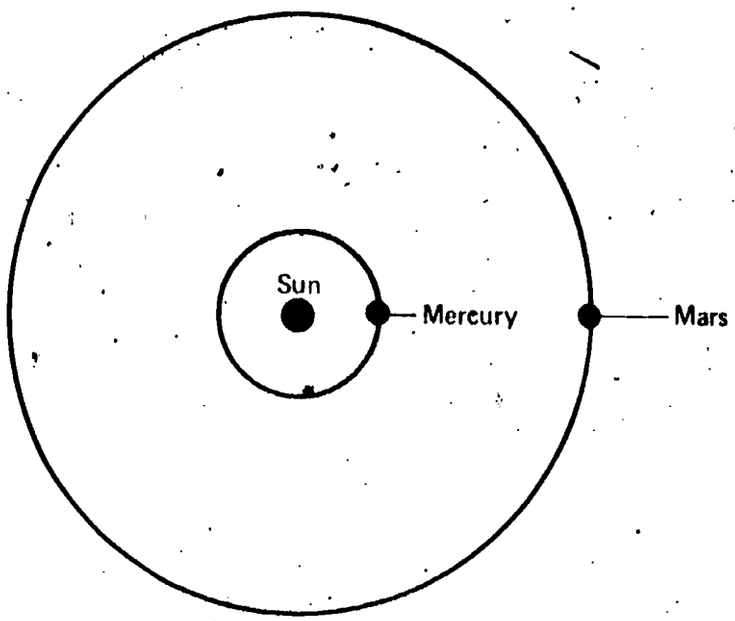
On your copy of the diagram, draw the lines of sight from Earth to Laro and from Earth to the sun that would give the largest ES-EL angle.

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



Suppose an asteroid, a hunk of rock which orbits the sun, has been discovered between the sun and the Earth. The largest angle between the sun and the asteroid which we observed from earth is 38°. Draw a circle with a radius of 8 cm to represent the orbit of the earth. Then draw a second circle to scale to represent the orbit of the asteroid. You may use a drawing compass, a metric ruler, and a protractor. **IO 02-Core-15C**

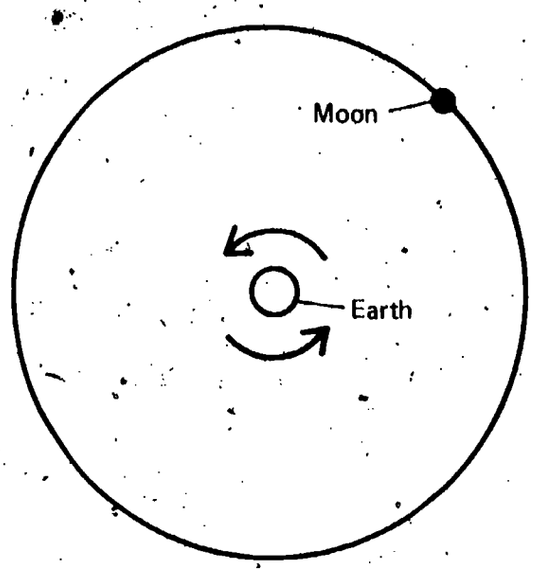
The scale diagram shown below represents the orbits of Mars and Mercury. The minimum distance between Mars and Mercury is 106 million miles. **IO 02-Core-16C**



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

IO
02-Exc 3-1-1C

The figure below represents the earth-moon system. In order to find the moon's diameter, you made certain assumptions. What were two of those assumptions?

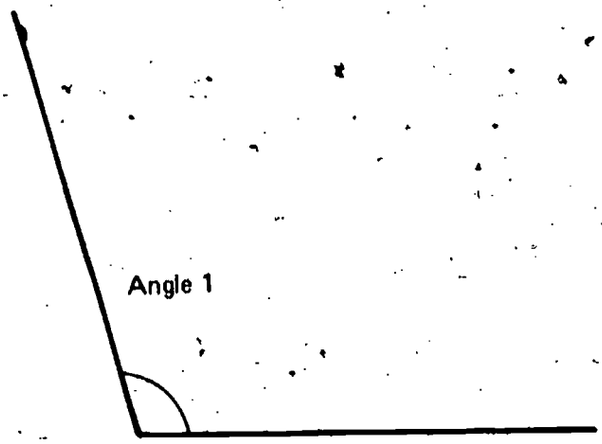


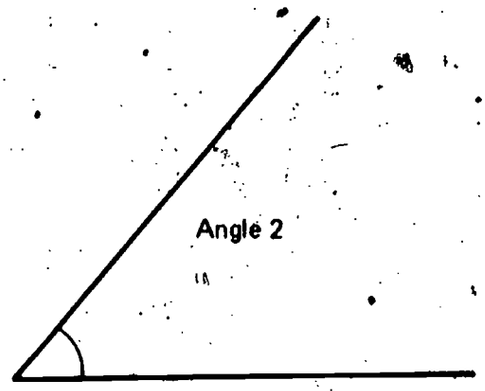
IO
02-Exc 4-1-1A

What is the process by which radar measures the distance to an object?

IO
02-Exc 4-2-1A

Using a protractor, measure each of the angles below.

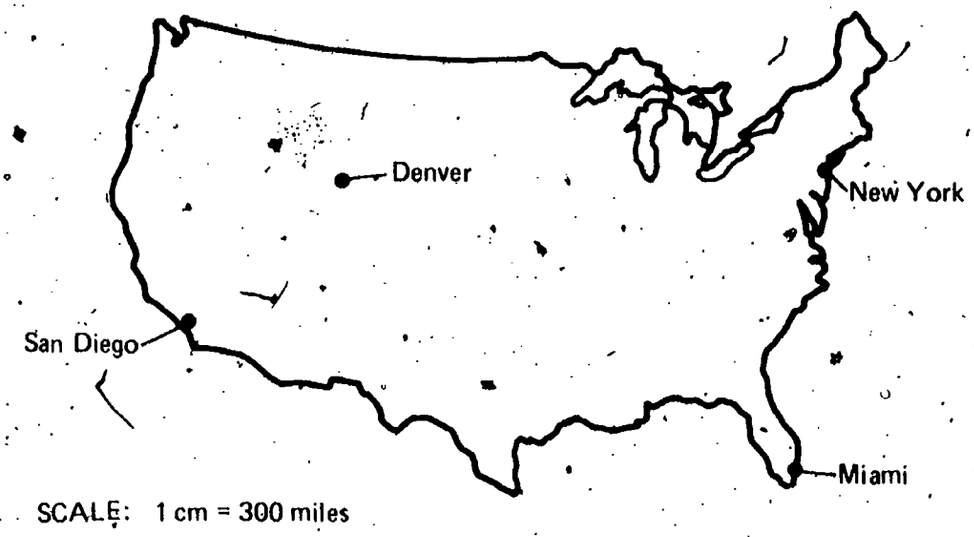




IO
02-Exc 4-2-2A

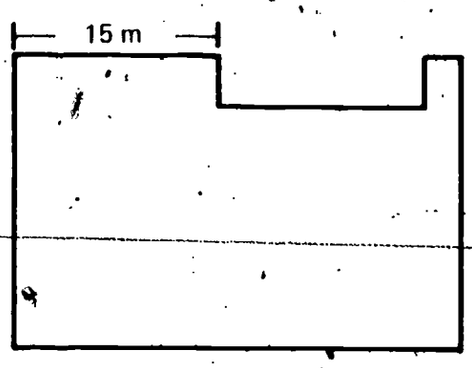
Use your protractor to construct angles of 48° and 133°.

Using the scale drawing below, answer the questions that follow. 10
02-Exc 4-3-1C

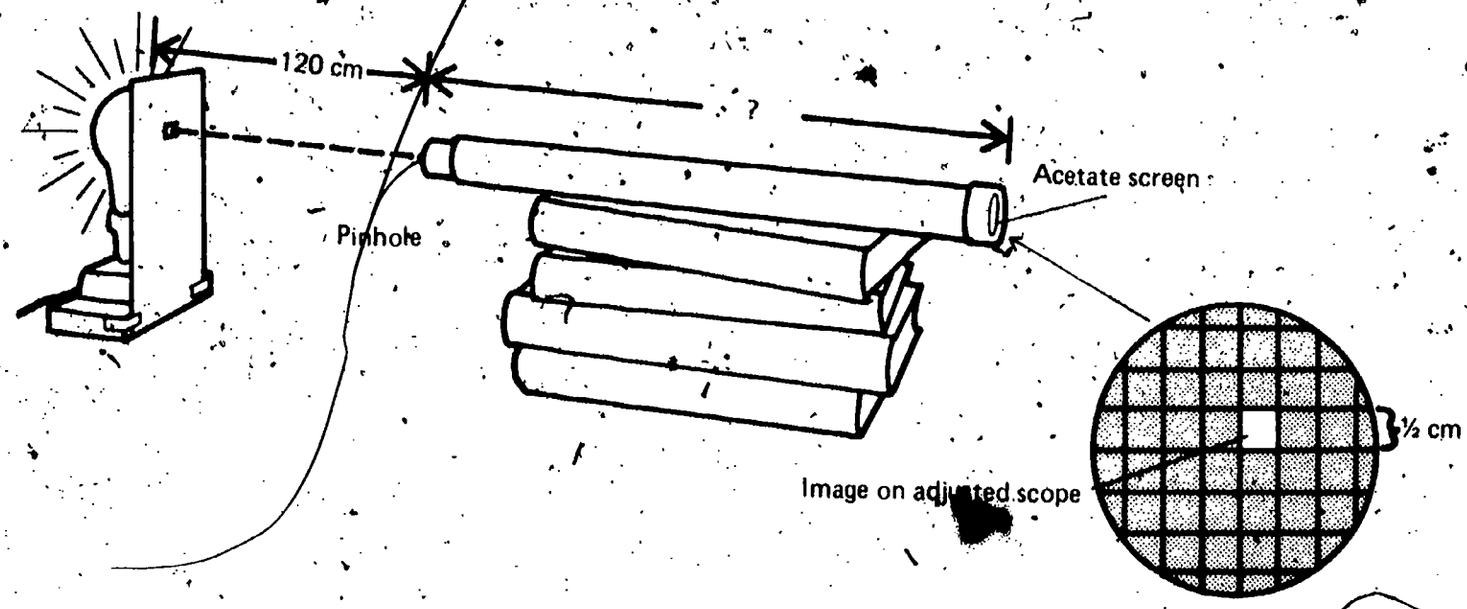


1. What is the actual distance from New York to San Diego?
2. What is the actual distance from Miami to Denver?

The diagram below of a classroom is drawn to scale. What is the scale of the diagram? 10
02-Exc 4-4-1C



10
03-Core-1C



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 120 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.

Connie was reading an astronomy book. She noticed that at one place the book gave a measurement for the diameter of the sun. Connie thought that measuring the size of the sun was impossible because if someone were to get close enough to the sun to measure it, he would get fried to a crisp.

10
03-Core-2C

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

Your teacher has set up 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-3C

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

IO 03-Core-4C

Loz is a science student on Jupiter. He is attempting to measure the distance across the sun, using a sighting scope. He collected the following information.

Sun to Jupiter distance = 482 million miles
Distance across sun's image on sighting scope = ½ cm
Distance from pinhole to screen = 280 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-5C

Suppose that a day on Neptune is 15 hours long. If you measured the number of degrees that the sun appears to move across Neptune's sky in one hour, what would your measurement be?

IO 03-Core-6C

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

IO 03-Core-7C

A day on Neptune is about 16 hours, not 24 hours as on earth. Assume that the sun's path is directly over Neptune's equator on the day in question.

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

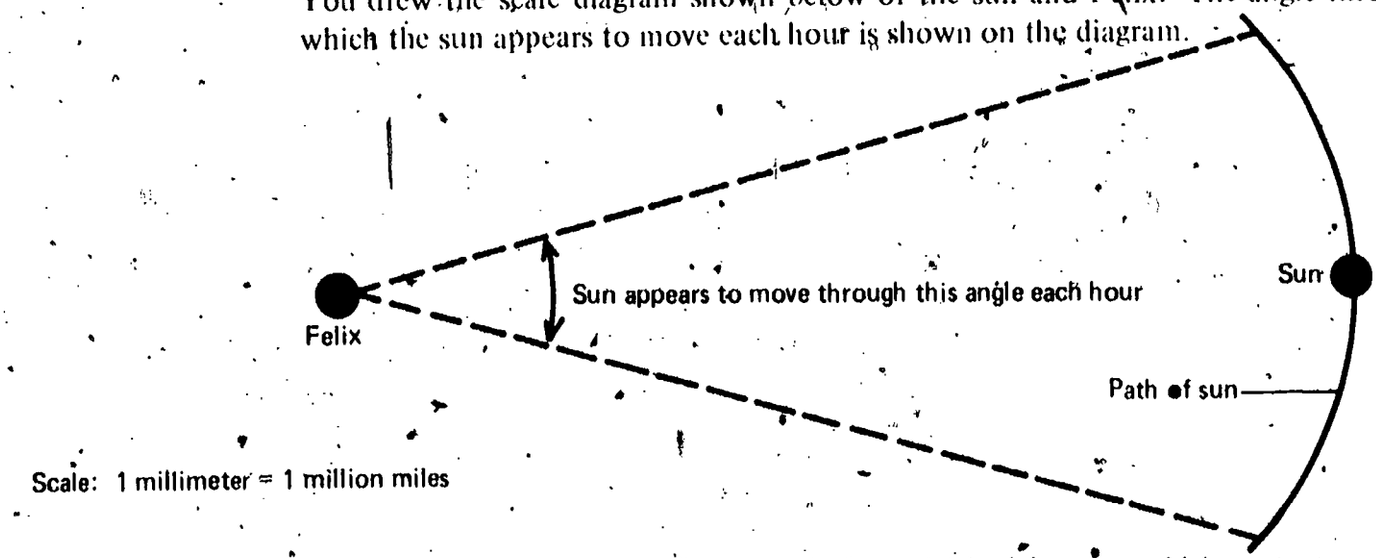
IO 03-Core-8C

Leap year occurs nearly every fourth year, and then February has 29 days instead of 28 days.

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

IO 03-Core-9C

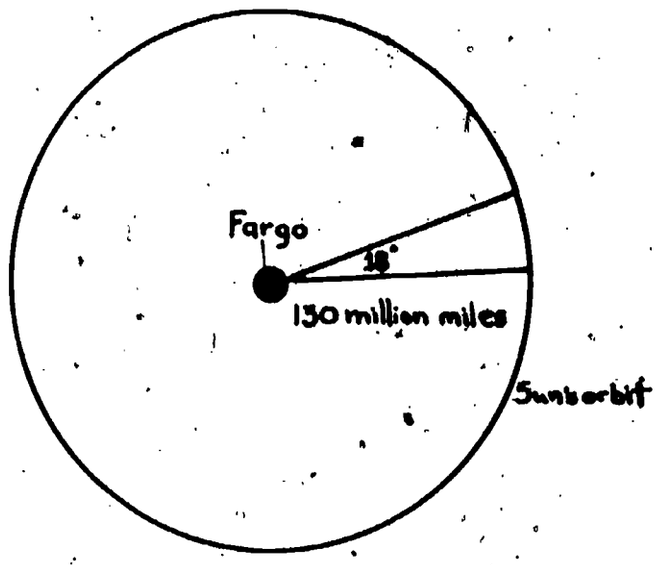
Suppose you are an astronaut on the planet Felix. You want to know whether Felix turns on its axis each day or the sun makes one complete trip around Felix each day. You drew the scale diagram shown below of the sun and Felix. The angle through which the sun appears to move each hour is shown on the 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 Felix each day.

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

The distance from the sun to Fargo is 130 million miles.
The apparent motion of the sun across the sky is 18° per hour.



(Not drawn to scale)

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

People once thought that the sun traveled around the earth each day. State why that is unlikely. IO 03-Core-11C

Time zones have been established for the earth. Briefly explain why this was done. IO 03-Core-12C

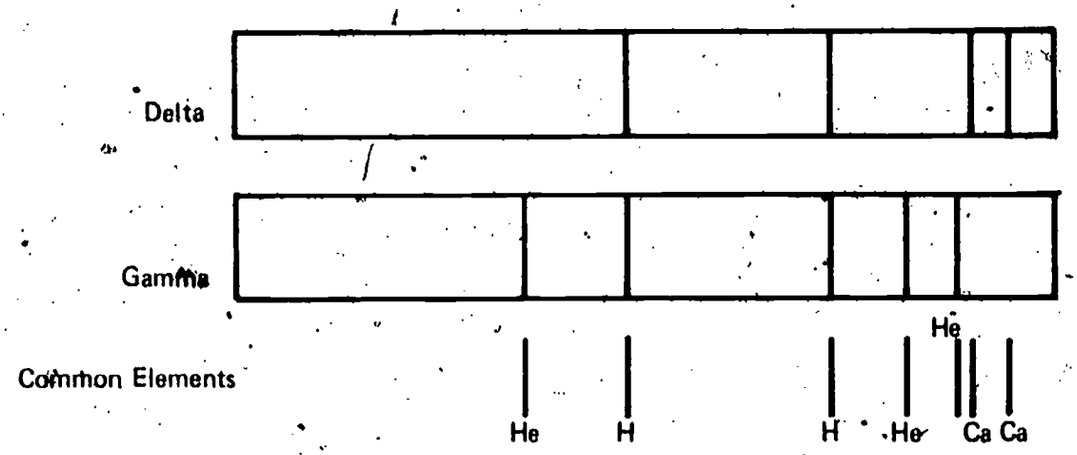
Wes was drying photographic prints with a 100-watt bulb. He realized that if he moved the bulb twice as far away from the prints, he could dry more prints at a time. If he put a new bulb twice as far from the prints as the old one, what wattage bulb would be needed to warm the prints to the same temperature as the 100-watt bulb? IO 03-Core-13C

A 5-watt bulb is placed 15 cm from a sun-energy measurer. It produces the same heating effect as a larger bulb placed 240 cm from the measurer. Find the wattage of the larger bulb. Show all your work. IO 03-Core-14C

IO
03-Core-15C

Suppose two unknown, bright, star-like objects named Delta and Gamma have been observed, and that the light from the two objects has been passed through a spectroscope. Their spectra and the spectrum of some common elements are given below. Use the spectra and the other data given below to say as much as you can about the two objects. You should include comparisons of their composition and power (wattage).

He = Helium
H = Hydrogen
Ca = Calcium



STAR	DISTANCE FROM EARTH	TEMPERATURE RISE IN SUN-ENERGY MEASURER
Delta	10 light-years away	14.6°C
Gamma	5 light-years away	7.3°C

IO
03-Core-16C

When referring to the sun and its planets, the term *transit* is often used. Define the term *transit* used this way.

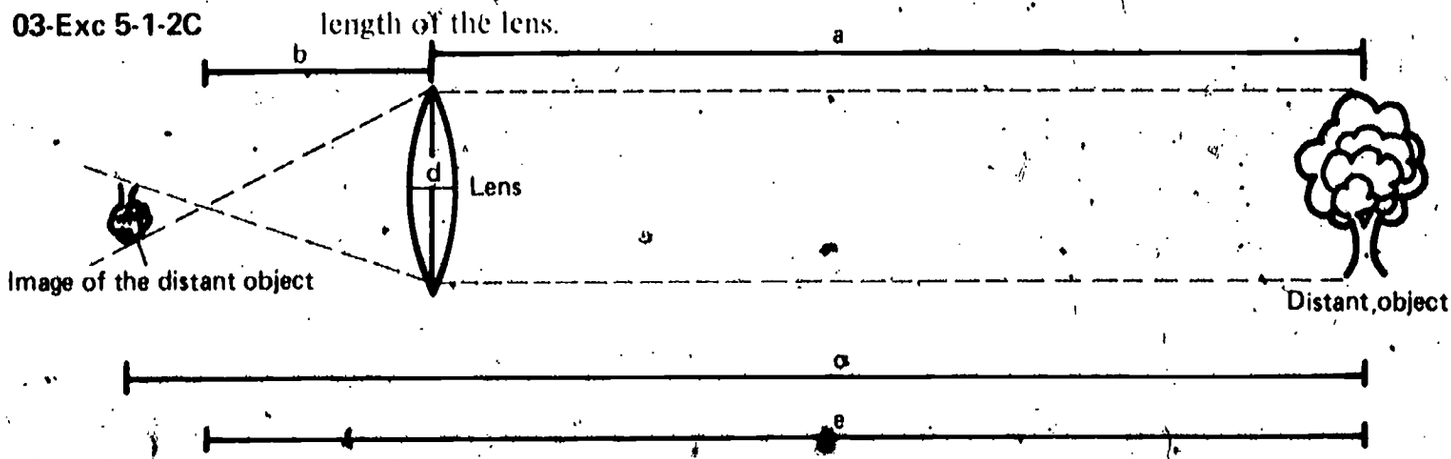
IO
03-Exc 5-1-1A

Cynthia was given a telescope which had an eyepiece focal length of 8 cm and an objective lens focal length of 48 cm. Use the formula below to calculate the power of her telescope.

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

IO
03-Exc 5-1-2C

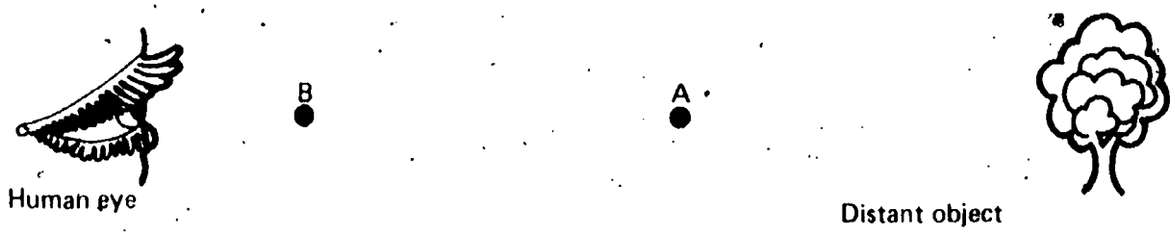
Select the letter of the line on the diagram below which best represents the focal length of the lens.



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 5-1-3C

Two lenses with focal lengths of 4 cm and 80 cm are to be used to make a telescope to magnify the distant object shown below. IO 03-Exc 5-1-4C

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?



In ancient times, people did not have calendars. Explain why people began to develop and use calendars. IO 03-Exc 6-1-1C

During the past several thousand years many different calendars were devised and rejected. Why were these older calendars rejected? IO 03-Exc 6-1-2C

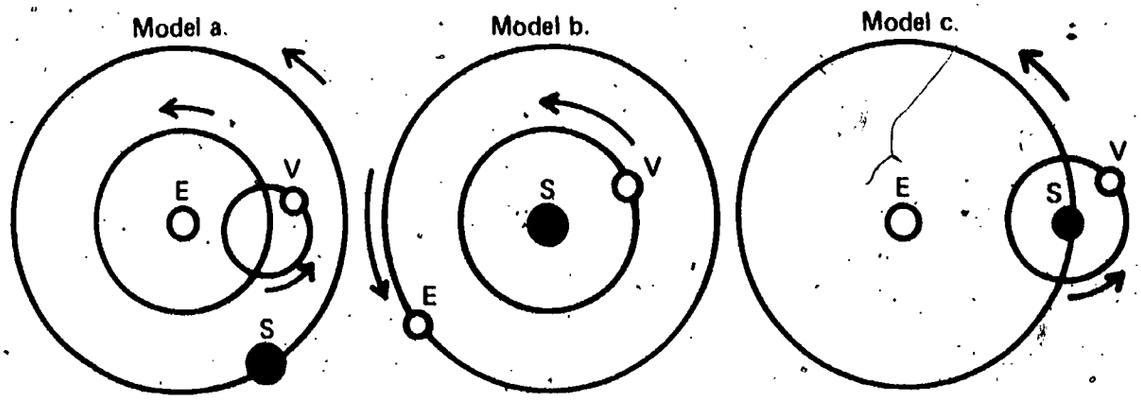
Different history books give two different dates for the beginning of the Russian Revolution. Some say the Revolution started on October 20, 1917. Others say it began on November 1, 1917. Why are two different dates reported for the same event? IO 03-Exc 6-1-3C

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. IO 03-Exc 6-2-1C

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

10
03-Exc 6-2-2C

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



KEY	
SYMBOL	BODY
S	sun
V	Venus
E	earth

10
03-Exc 7-1-1C

To calculate power, you need two variables. One of these variables is work. Name the other variable.

10
03-Exc 7-1-2C

Mr. Rogers used to have a hand saw in his shop, but now he uses a new electric saw which has more power.

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

10
03-Exc 7-1-3C

In Excursion 7-1, the terms *power* and *powerful* were defined as they are used by scientists. A heavier lawnmower is sold at a higher price than a lighter one at a local hardware store. The store salesman says that the heavier model is more powerful.

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

10
03-Exc 7-2-1C

Jeff found that his sun-energy measurer warmed up 13°C when it was held 35 cm from a 75-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 315 cm.

10
03-Exc 7-2-2

Square each of the following numbers.

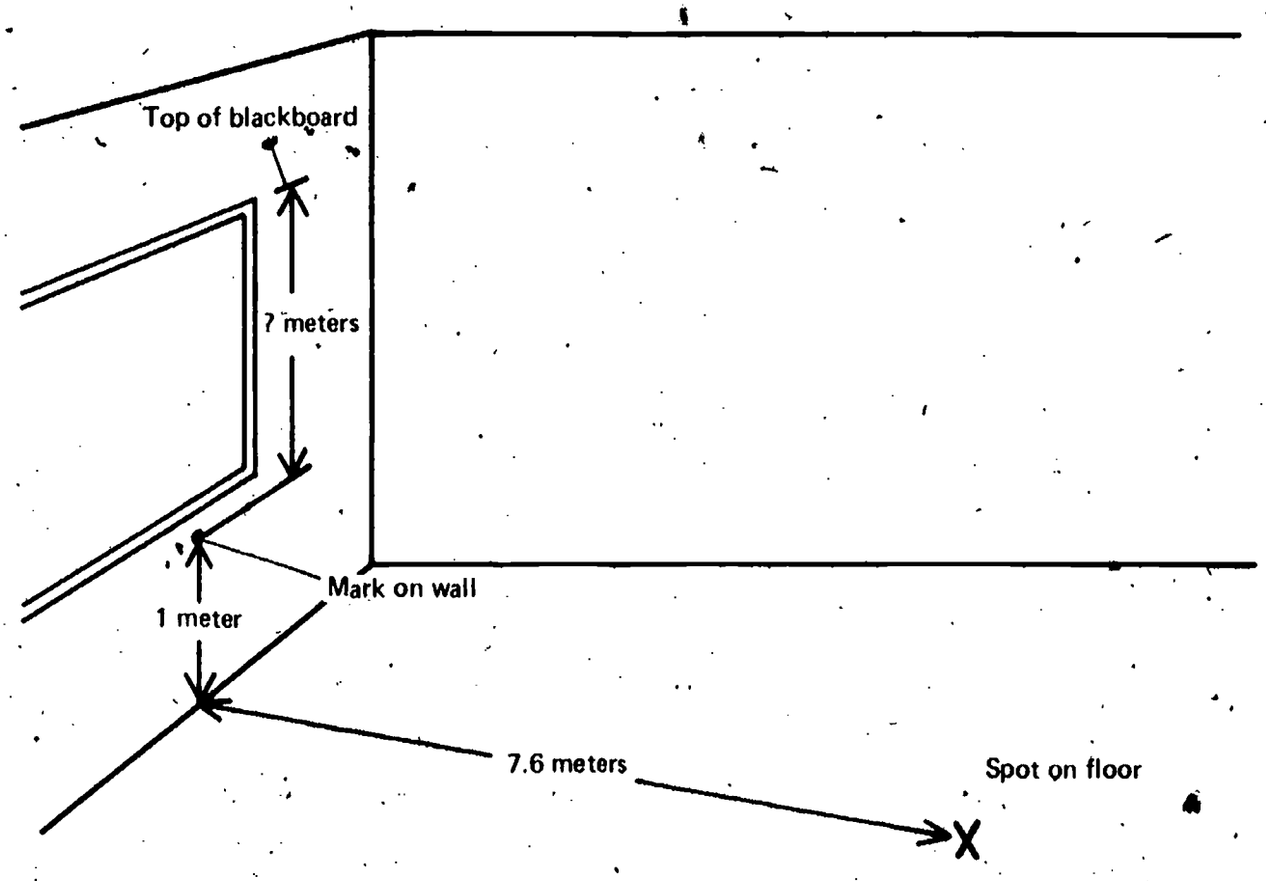
1. 4
2. 6
3. 17

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-1C**

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 blackboard. Use a quadrant and the table below to measure the distance between the mark one meter off the floor and the top of the blackboard. **WU 01-Core-2C**

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



Direct as well as indirect methods are used to measure height. To measure the height of the rocket's flight, you estimated the angle size rather than determining the height directly. What are some of the advantages of finding the height indirectly? **WU 01-Core-3C**

WU 01-Core-4C

Use the table that follows 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

Suppose you and your friend are observing a water-rocket launch at a distance of 25 meters from the launch site. You decide to show him how to measure the distance of maximum height. You measure an angle of 50° when the rocket is at its maximum altitude. What is the actual maximum height to which the rocket climbed?

WU 01-Core-5C

You and your team members measured the maximum heights of each of the flights of the water rocket. Why did two members of your team make each of the measurements rather than just one?

WU 01-Core-6C

Operationally define *performance* for a water rocket, based upon your activity with the quadrant.

WU 01-Core-7C

The performance of a rocket is affected by two variables – the weight of the empty rocket and the amount of water. In designing an activity to study these variables and their effect, you were told to change only one variable at a time. State why this was necessary.

WU 01-Core-8C

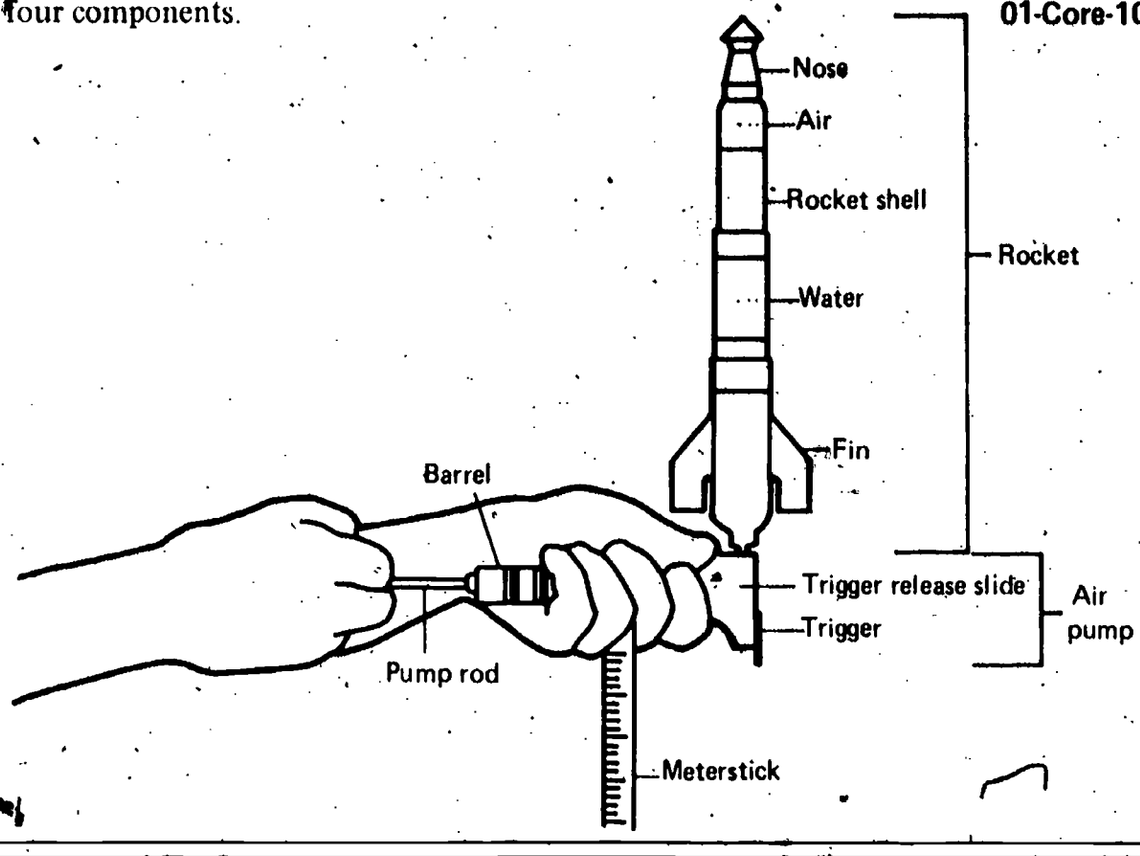
Liquids other than water may be used to fill the rocket you used in your activities. But the kind of liquid is a variable that might affect the performance of a rocket. Design a procedure to investigate the effect of this variable on the performance of the rocket.

WU 01-Core-9C

In the activities you did with the water rocket, you found that two variables affect its performance. What are the two variables?

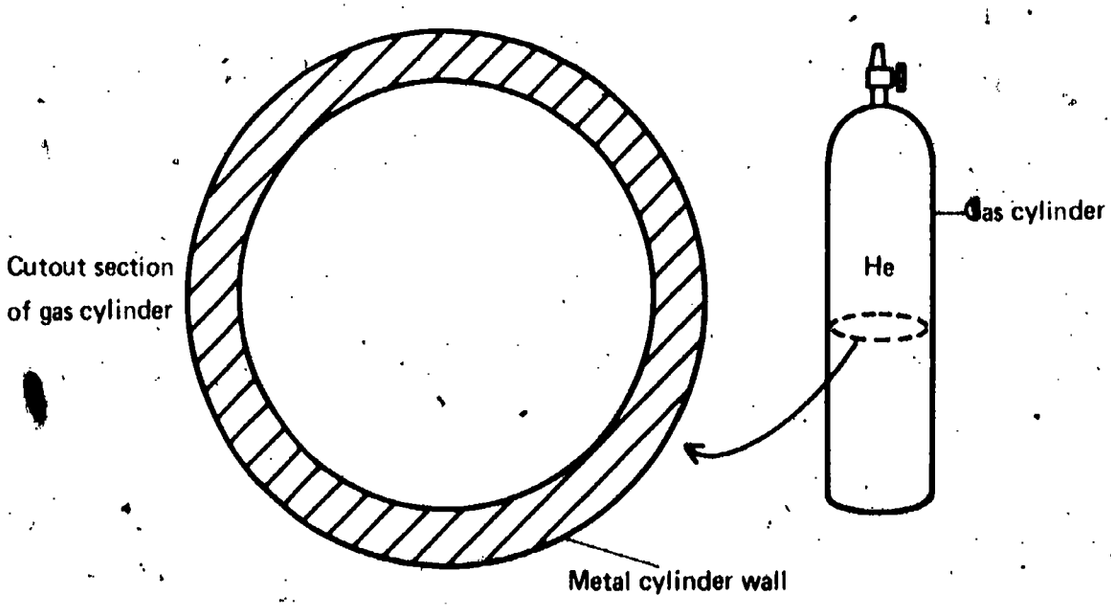
The diagram below shows a water rocket ready for launching. Identify one system, two subsystems, and four components.

WU 01-Core-10C



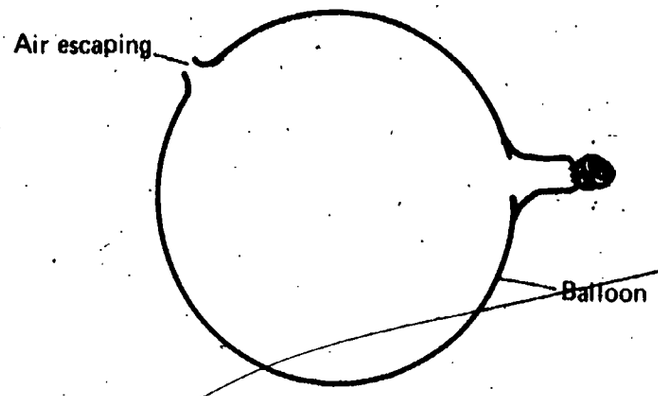
The gas cylinder below is used to fill balloons at the fair. It is filled with the gas helium under pressure. The figure also shows a cutout section of the cylinder. Copy the cutout section onto your answer sheet. Draw arrows to show the force (the pressure) that the gas exerts on the walls of the cylinder.

WU 01-Core-11C



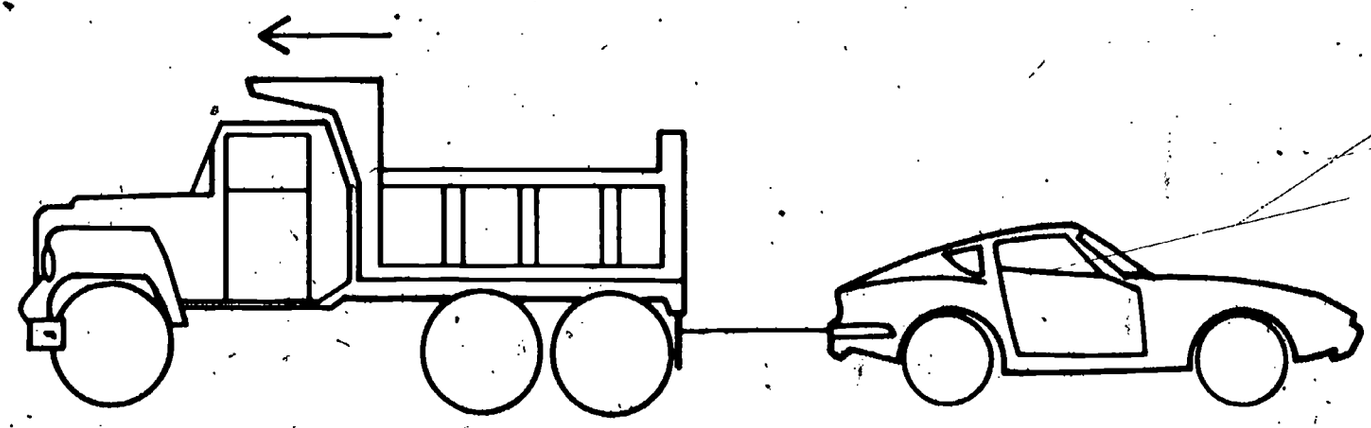
WU 01-Core-12C

The diagram below shows a balloon from which air is 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.



WU 01-Core-13C

Dan and Elmer hook up their battery operated toys, a dump truck and a car, as shown in the diagram below. They exert forces in opposite directions. When released, the toys move in the direction shown by the arrow. An unbalanced force is acting, since the dump truck forces the car to move backwards. How could this unbalanced force be measured?

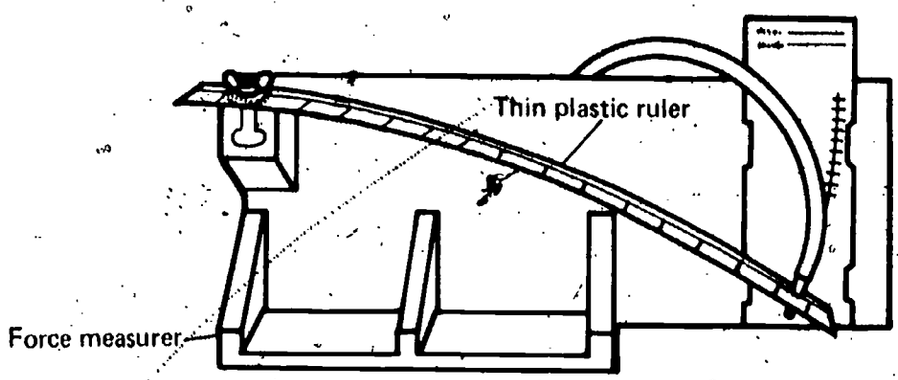


WU 01-Core-14C

Suppose your science teacher wants to buy some additional water rockets. He would like to find out the thrust, or force, of these water rockets. Describe a method you could suggest to your teacher for measuring this thrust.

You made your force measurer more sensitive when you studied the force produced by a water jet. You did this by substituting a thin plastic ruler for the metal blades. Suppose that you and your classmates had wanted to compare the measurements you made. **WU 01-Core-15C**

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 that you found that the sizes of the openings of the ISCS water jets varied. You wished to study what effect the speed at which water leaves a jet has on the unbalanced force. You decide to keep the rate of water flow the same and change only the speed. Describe a plan you could carry out to measure the effect on the unbalanced force of changing the speed at which water leaves a jet. **WU 01-Core-16C**

During a rocket launch, Herbert asks whether the rocket will have a greater unbalanced force when it is in the atmosphere or in the near vacuum of outer space. **WU 01-Core-17C**

1. What would you tell Herbert?
2. Explain your answer.

In the activities you did in class, you used a simple water rocket rather than a complicated rocket system like the Saturn rocket. State two reasons why activities are often performed on simplified systems rather than on larger, more complex systems. **WU 01-Core-18C**

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

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

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

Your teacher will observe you for this check when he can. **WU 01-Core-22C**

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

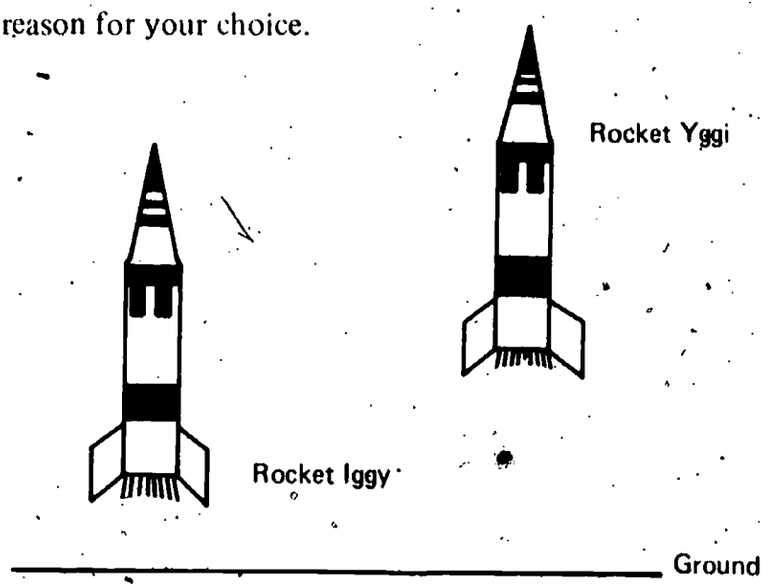
A model rocket without an engine or fuel weighs 0.4 newtons. The engine catalog below shows the rocket engines available. **WU 02-Core-1C**

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

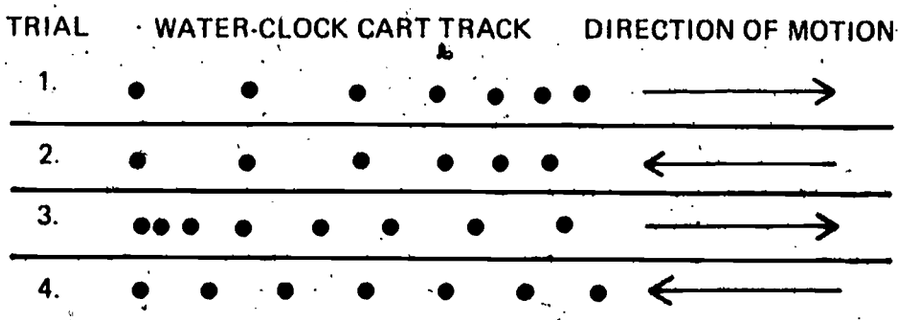
1. Which is the smallest engine that will allow the rocket to lift off?
2. Explain the reason for your choice.

Two identical rockets, IGGY and YGGI, lifted off the launch pad at the same time. **WU 02-Core-2C**

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

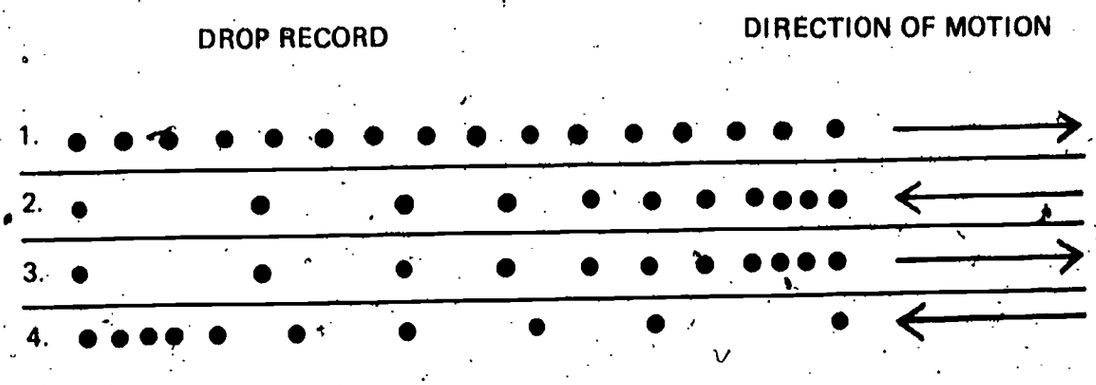


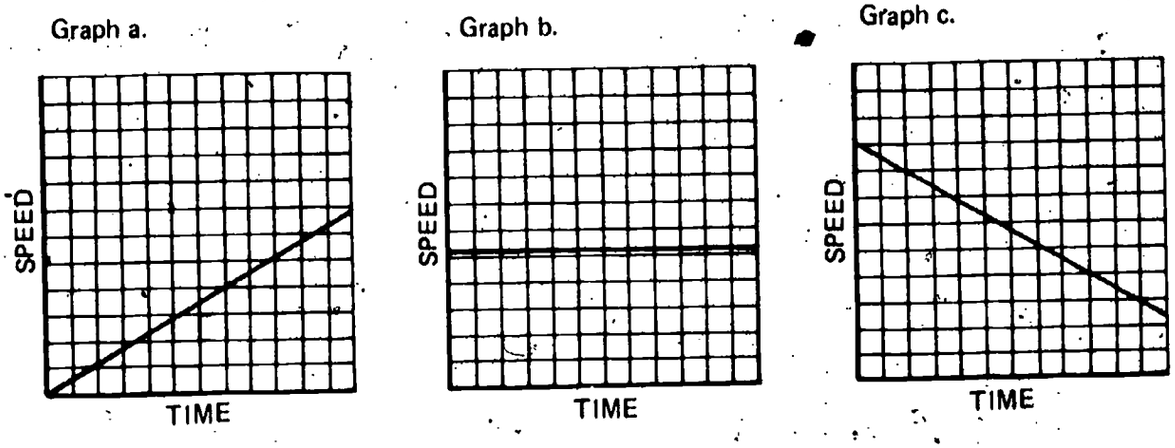
The diagram below shows the water drops left by a moving water-clock cart during four trials. The arrow shows the direction of motion of the cart for each trial. Indicate whether the cart's speed increases, decreases, or remains constant during each of the four trials. **WU 02-Core-3C**



WU
02-Core-4C

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-5C

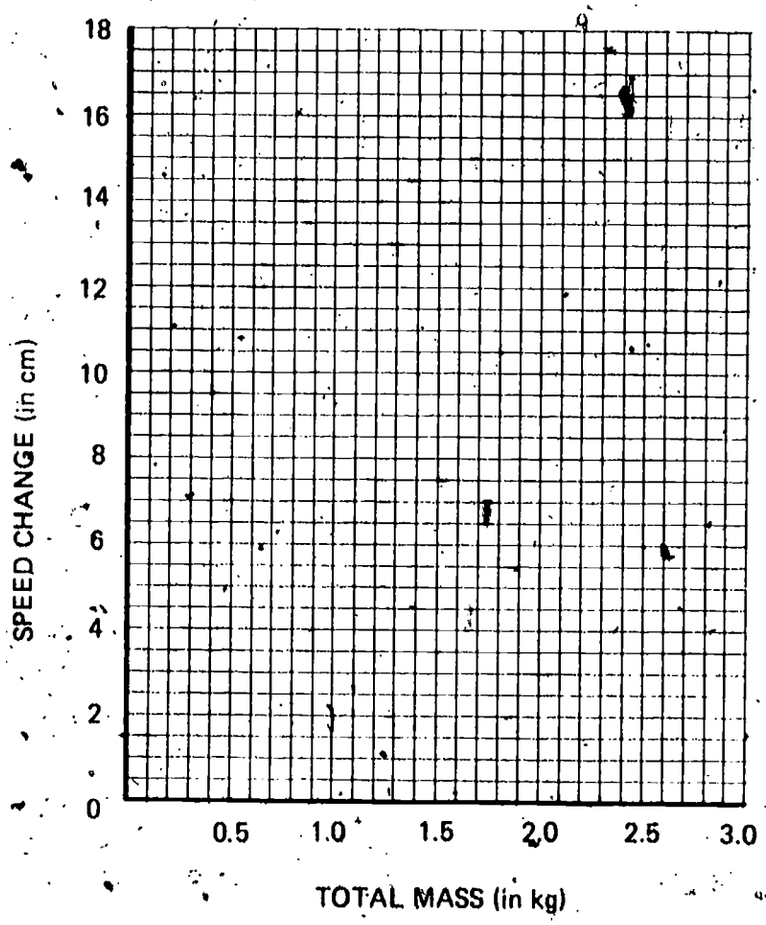
Mark and Al were both given model rockets as presents. Mark's rocket weighs 250 grams. Al's rocket weighs 500 grams. Both rockets are started with the same force, using the same mechanism.

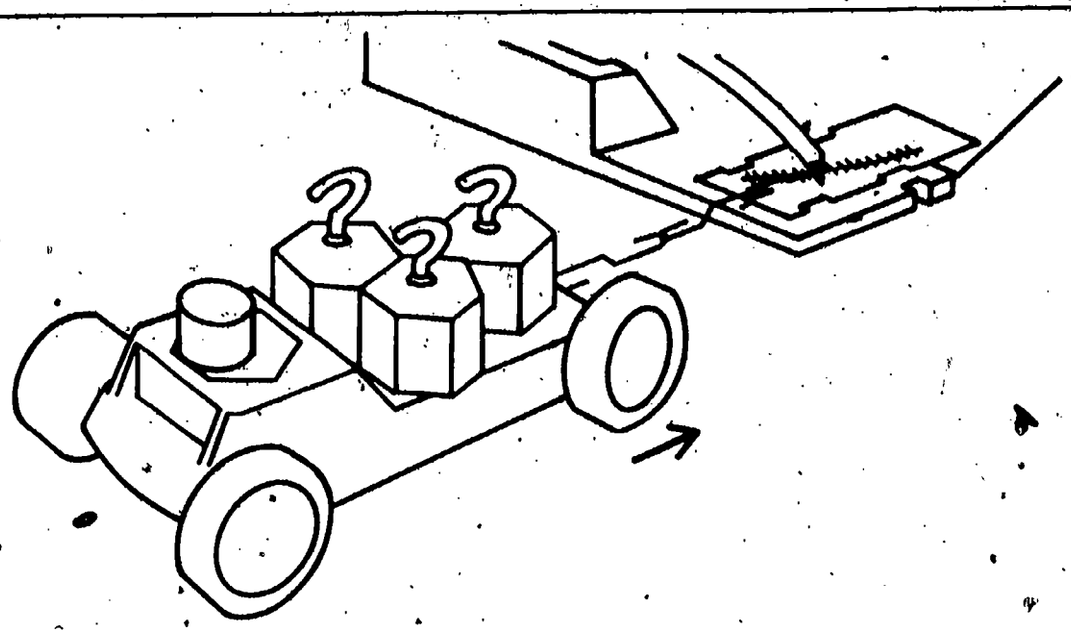
1. Whose rocket will speed up more quickly?
2. Explain your answer.

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.

Alice 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.

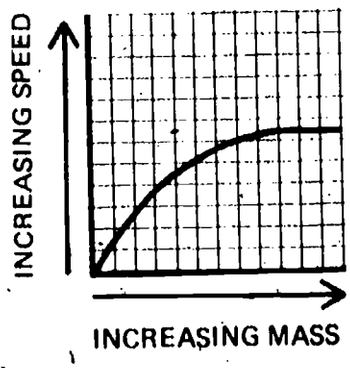
TOTAL MASS (in kg)	DISTANCE CHANGE (in cm)
2.5	2
2.0	4
1.5	7
1.0	11
0.5	17



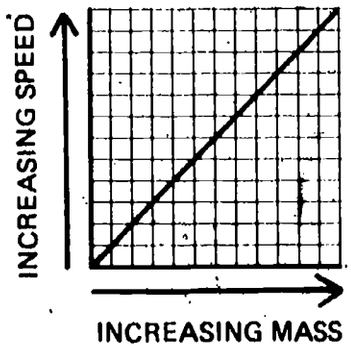


Suppose you are working with a water cart and several weights, as shown above. The force acting on the water cart is a constant 0.2 N for each trial. The mass on the cart is varied. Select the graph below which best shows the relationship between the mass of the cart and its load and the speed of the cart.

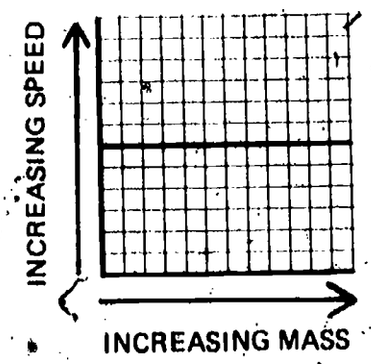
Graph a.



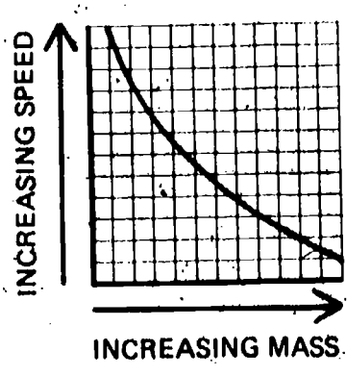
Graph b.



Graph c.

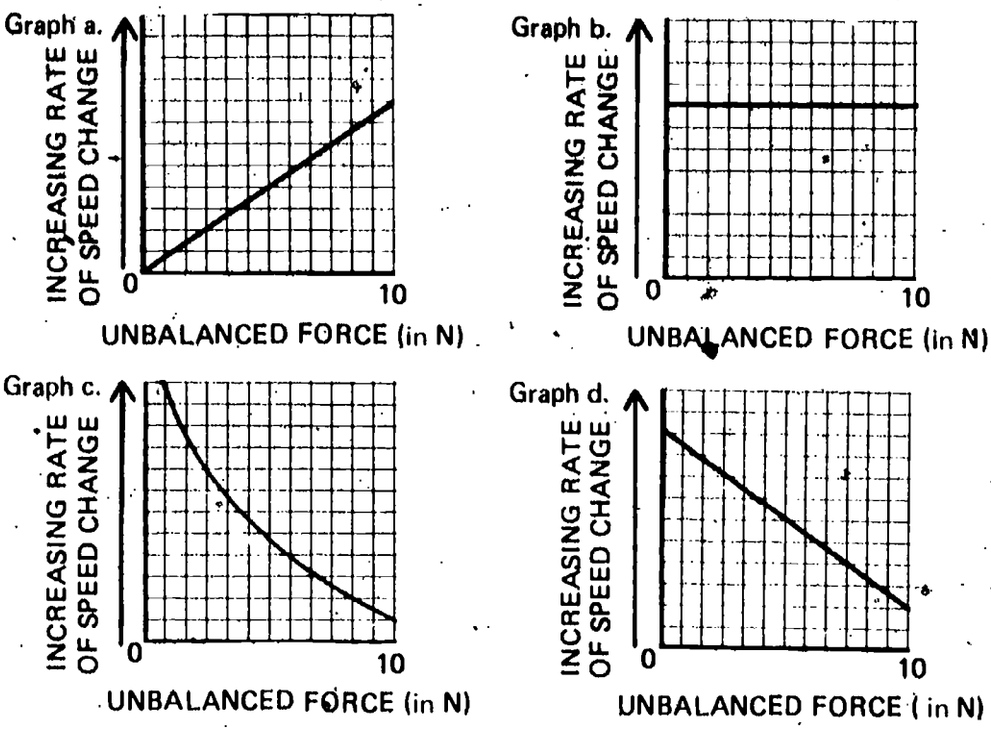


Graph d.



If you used your force measurer to apply different forces to a water 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.

WU
02-Core-8C



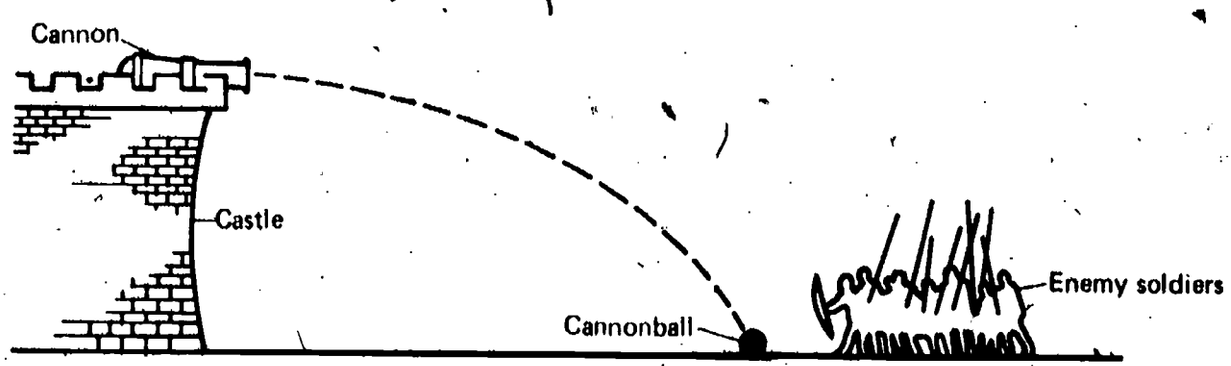
In early times, stones were used to attack castles. These stones were fired from a catapult. Suppose that two identical stones, a and b, were fired. The catapult used to throw stone a exerted its launching force for a shorter length of time than the catapult used to thrown stone b.

WU
02-Core-9C

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

The diagram below shows a cannon placed on top of a castle wall. The cannon is fixed so that it can fire only straight ahead. Suppose you fire the first shot and the cannonball falls short of the enemy soldiers.

WU
02-Core-10C

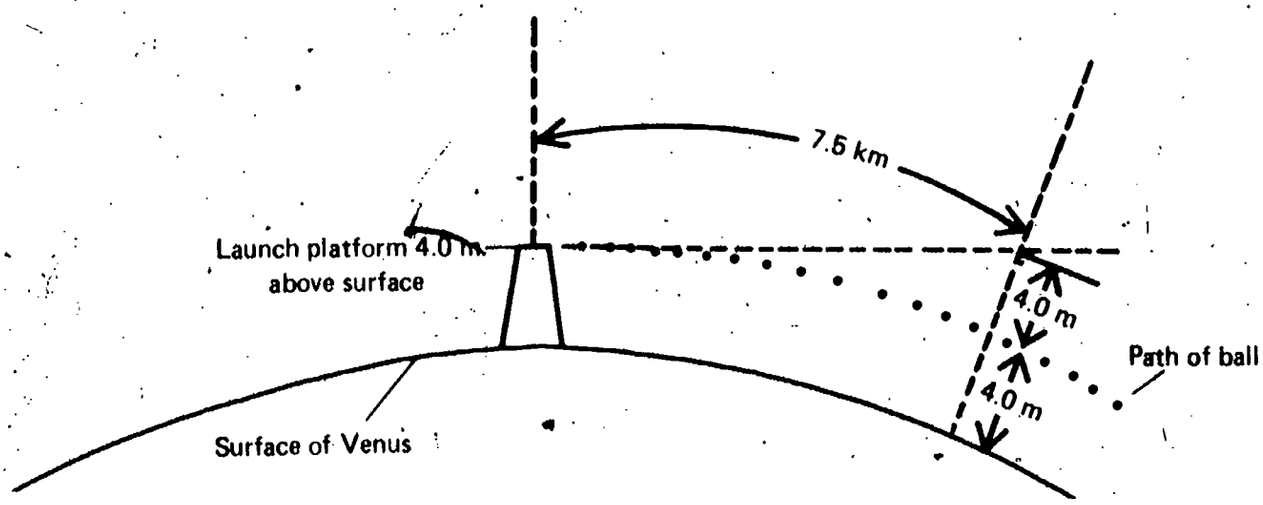


1. What can you do to increase the firing range of the cannon?
2. Explain why this would have the desired effect.

WU 02-Core-11C	In the activity in which you investigated the effect of the sideward force on the fall time of a ball, one ball always fell straight down. What was the purpose of using this ball that always fell straight down?

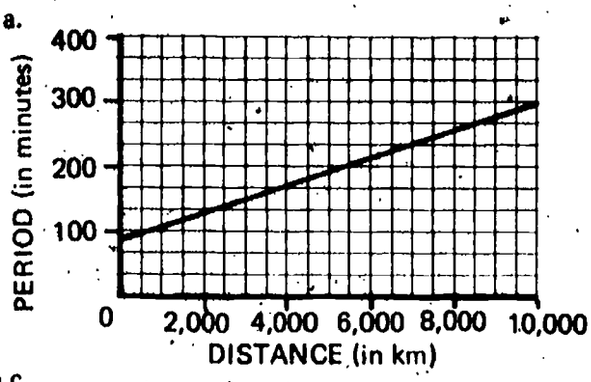
WU 02-Core-12C	Suppose that two early Roman soldiers conducted an experiment. At the same time as one soldier fired a stone horizontally from a catapult (a stone thrower), a second soldier dropped a small coin from the same height as the catapult. 1. If the ground was flat, would the stone or the coin hit the ground first? 2. Explain your answer.

WU 02-Core-13C	The sketch below shows an imaginary launching site on the planet Venus. An object dropped near the surface of the planet Venus falls 4.0 meters in 1 second. Use this information and the diagram below to determine the orbiting speed of a satellite near Venus's surface.

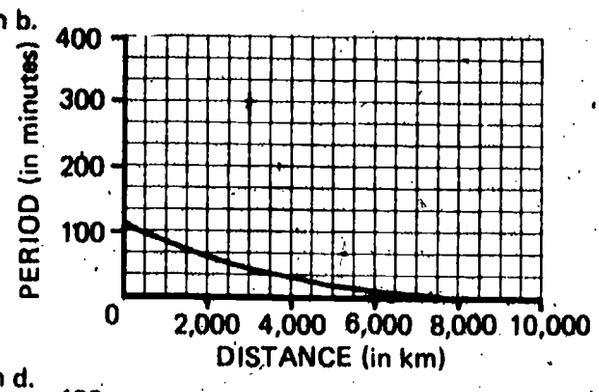


Which of the four graphs below best shows the relationship between the period of a satellite and the satellite's distance from the earth's surface? **WU 02-Core-14C**

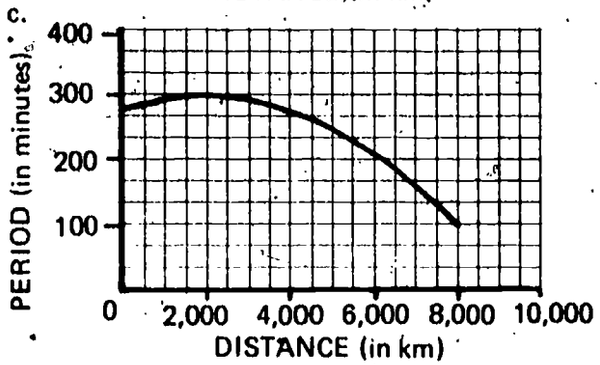
Graph a.



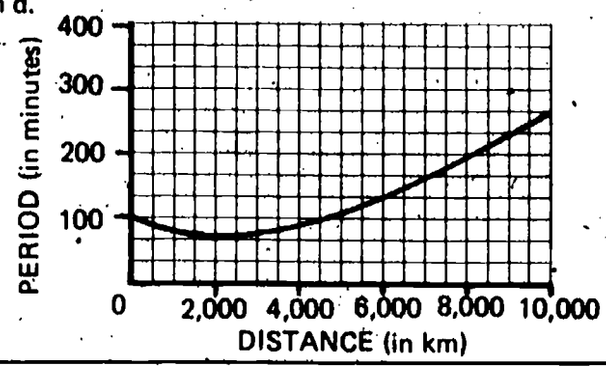
Graph b.



Graph c.

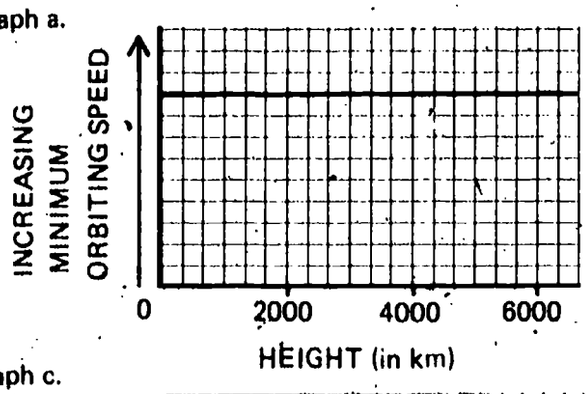


Graph d.

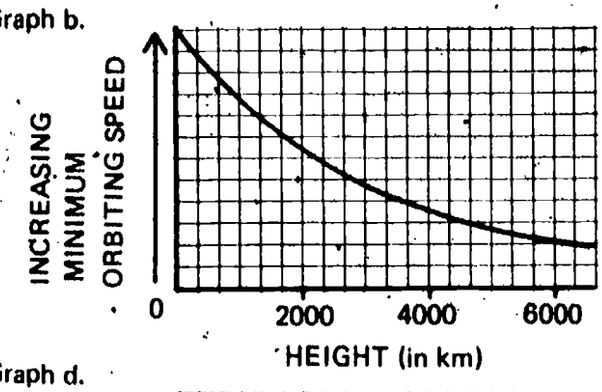


Select the graph below which best shows how the minimum orbiting speed of a satellite changes as the satellite gets farther from the earth's surface. **WU 02-Core-15C**

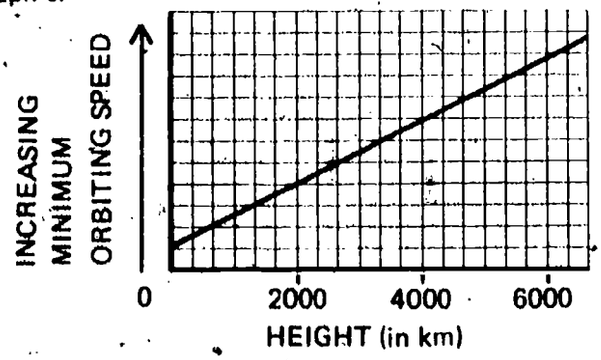
Graph a.



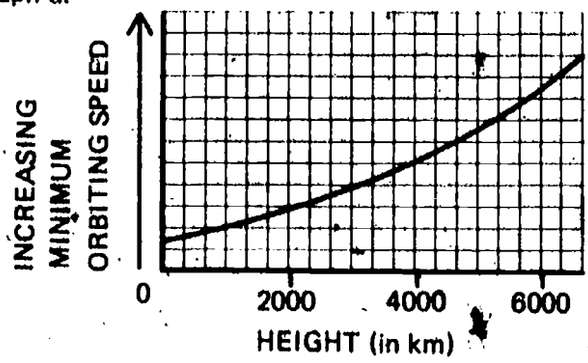
Graph b.



Graph c.



Graph d.

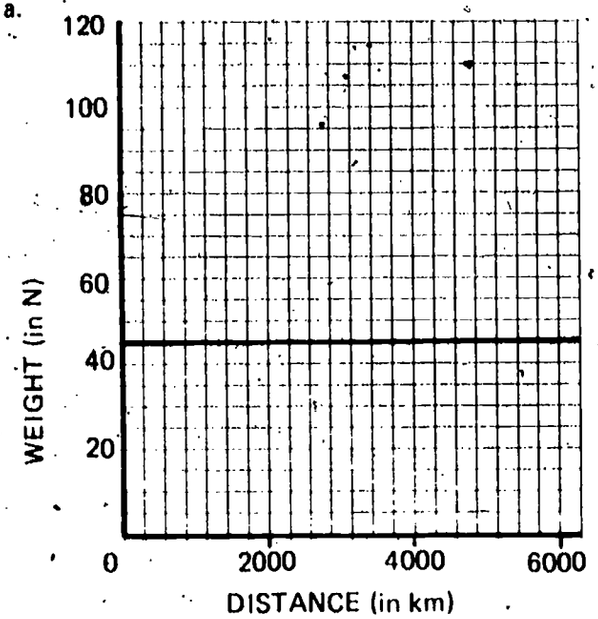


A rocket is launched from earth to Mars. What are two forces that slow down the rocket as it leaves the earth? **WU 02-Core-16C**

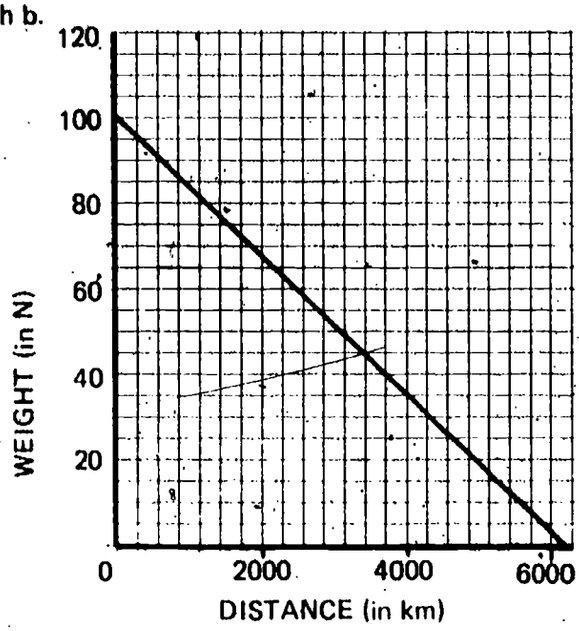
WU 02-Core-17C

Which of the graphs below best shows how the weight of an object changes as its distance above the earth's surface increases?

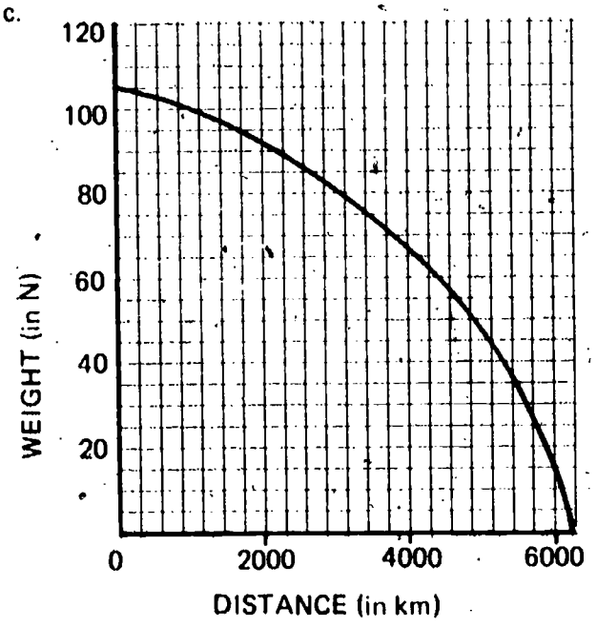
Graph a.



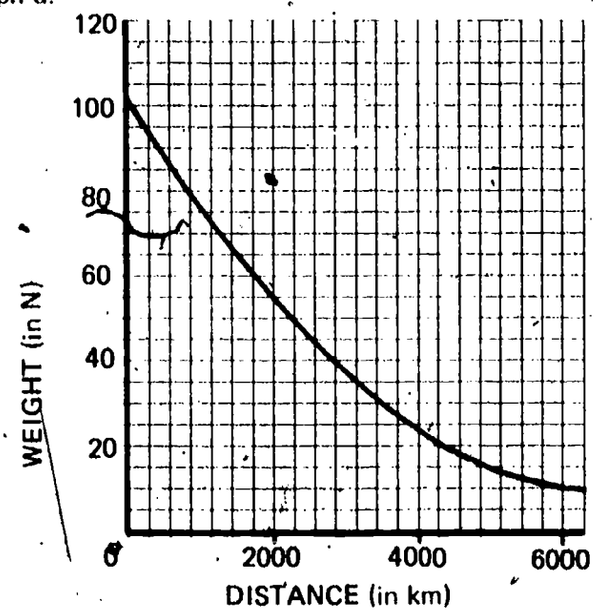
Graph b.



Graph c.



Graph d.



WU 02-Core-18C

An unmanned rocket carries an instrument to measure the force of gravity as the distance from the earth increases. The rocket radios its data back to earth.

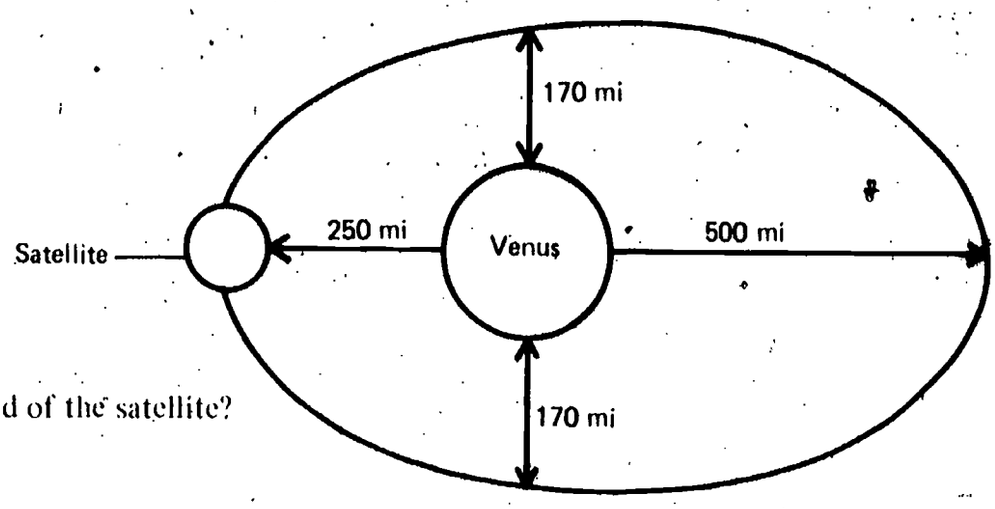
1. At what distance from the earth would the rocket signal that the force of gravity is zero?
2. Explain your answer.

WU 02-Core-19C

Define the term *period* of a satellite.

The diagram below shows the planet Venus and one of the recently launched Venus probes (satellite). The probe is 20 feet in diameter, rotates on its axis once every 30 minutes, and orbits Venus every 75 minutes, as shown below.

WU
02-Core-20C



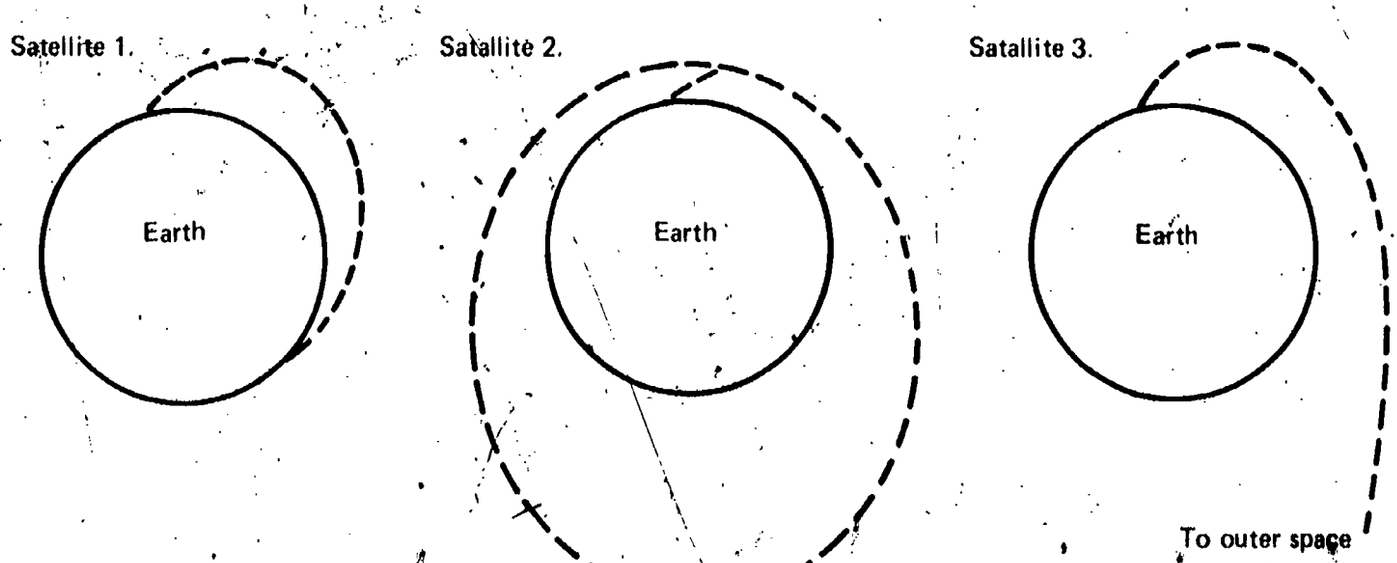
Which of the following is the period of the satellite?

a. 250 miles
b. 170 miles
c. 30 minutes
d. 75 minutes
e. 500 miles

Three different satellites follow the paths shown in the diagrams below. For each diagram, select the statement that best describes the speed of the satellite. Write the number of the satellite on your paper and after it the letter of the matching statement.

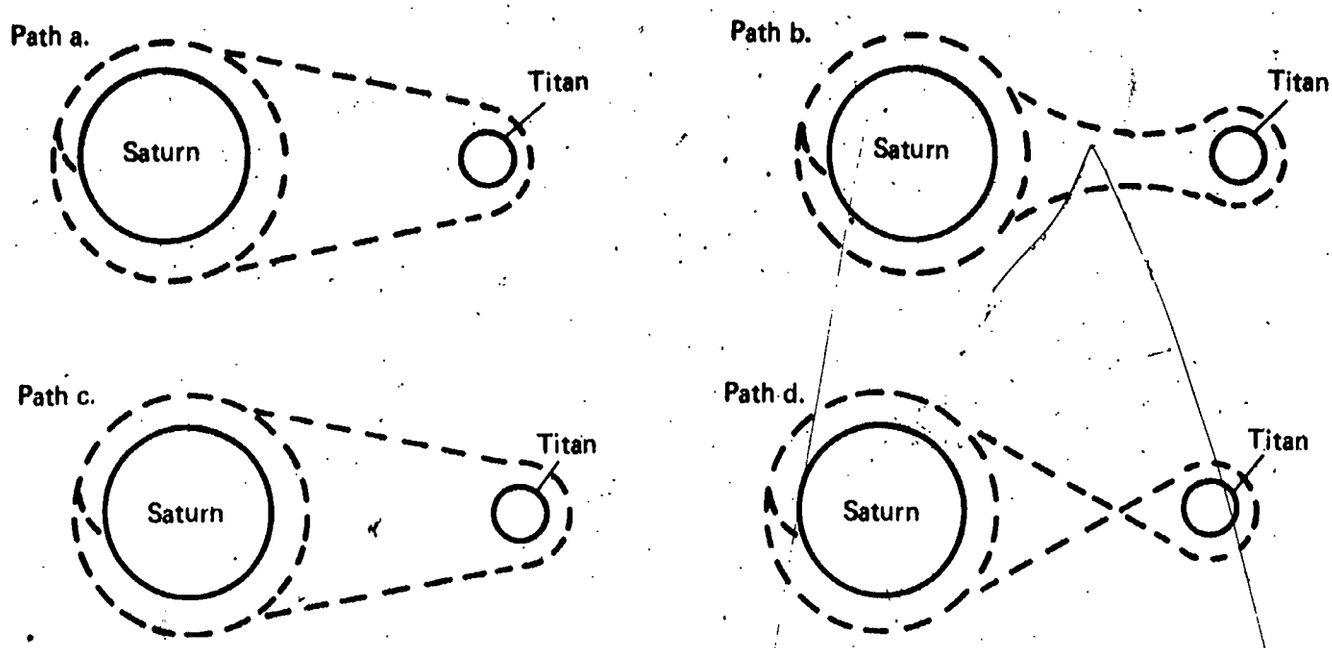
WU
02-Core-21C

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



WU 02-Core-22C

The diagrams below represent possible paths for a rocket flight from the planet Saturn to its moon Titan and back to Saturn. Select the diagram which shows a free-return path.



WU 02-Core-23C

A rocket from the earth is to orbit the moon.

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

WU 02-Core-24C

In one of the early lunar flights, an astronaut reported a problem with the heat shield. Why does a spacecraft have a heat shield?

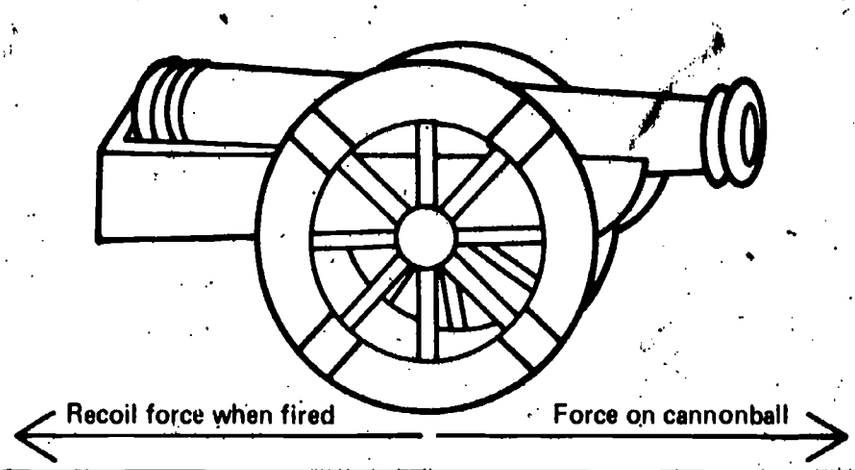
WU 02-Core-25C

When returning to earth from a moon trip, a spacecraft must slow down before it hits the earth's surface. Even if no retro-rockets are fired, a spacecraft slows down as it nears the earth's surface.

1. What, other than retro-rockets, causes a spacecraft to slow down as it nears the earth but before the parachutes open?
2. Explain how this acts to slow the spacecraft.

WU 02-Exc 3-1-1C

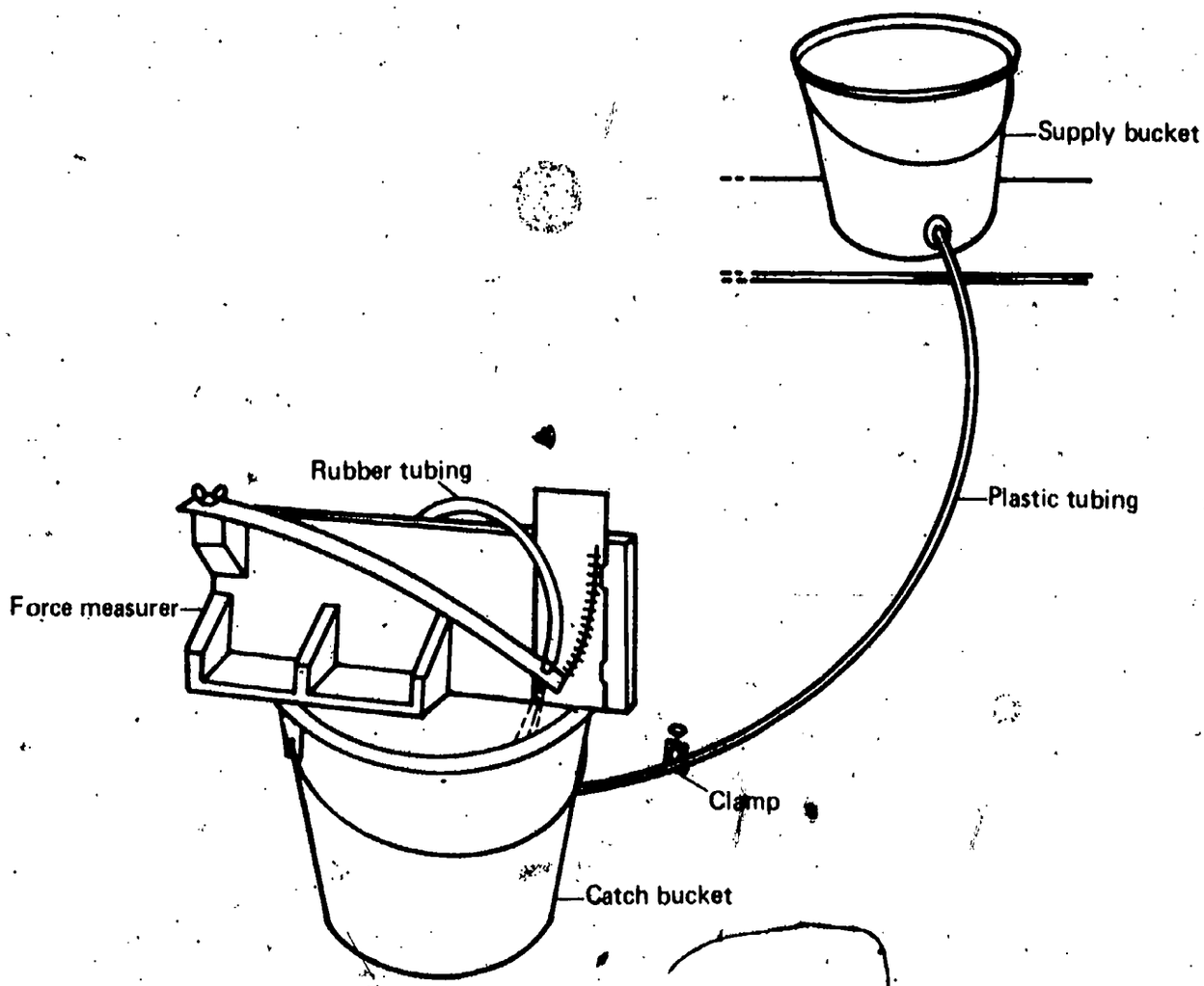
During Fourth of July festivities, a cannon was used to celebrate. The man in charge of the cannon noticed that there was a backward movement when the cannon was fired. Explain why there is a backward force on the cannon. See the illustration on the next page.



Max set up the equipment shown below. He found that when he used water and a flow rate of 6 ml per second, the force from the jet was 7 units. Suppose he now repeated the experiment, using alcohol and the same flow rate of 6 ml per second.

WU
02-Exc 3-1-2C

1. When Max used alcohol, would his force measurement be more than 7 units, less than 7 units, or exactly 7 units? (Note that 6 ml of alcohol weighs less than the 6 ml of water.)
2. Explain your answer.



WU 02-Exc 3-2-1C	A very high-speed racing car, the rocket car, ejects 0.02 kg of mass per second. The mass is thrown out from the rocket car at 200 m per second. What is the thrust (force) of the rocket car?
WU 02-Exc 3-2-2C	Prior to the moon flights, one of the problems encountered by the space engineers was the production of rockets which could produce a large enough thrust (force). What are two ways that the engineers can increase the thrust of rockets?
WU 02-Exc 3-2-3C	The rockets that took the astronauts to the moon were built to burn their fuel in several stages. Explain why the rockets were built to burn their fuel in several stages.
WU 02-Exc 4-1-1C	In the past, many incorrect ideas were accepted for long periods of time. For example, for hundreds of years people believed that smoking tobacco was completely harmless. In recent years, it has been discovered that tobacco smoke is dangerous, especially when inhaled. Select the best reason why this incorrect idea lasted so long. a. The greatest thinkers are alive today. b. The old idea was not tested by performing controlled experiments. c. People are smarter now than they were before. d. The first schools started about 200 years ago. e. The old idea explained the experimental observations just as well as the modern ones.
WU 02-Exc 4-1-2C	Select any of the variables listed below that affect the period of a pendulum. a. Timing device used b. Weight of the ball c. Time of day d. Length of the pendulum
WU 02-Exc 4-2-1C	Two students in a science class are arguing about the usefulness of two models for the same thing. One student argues in favor of the use of mathematical equations and formulas in the model. The other student prefers the model which is expressed only in words. Why is the model which uses mathematics more likely to be useful than the one which does not?

NASA scientists plan someday to place a satellite around the planet Saturn. They want the satellite to remain directly over the same spot on the planet's surface at all times. They have the following information about Saturn.

WU
02-Exc 4-3-1C

Time for Saturn to revolve around the sun	29.5 earth years
Time for Saturn to make one complete rotation on its axis	10.2 earth hours
Diameter of Saturn	7.01 of earth's diameter
Force of gravity at Saturn's surface	1.17 of earth's gravity

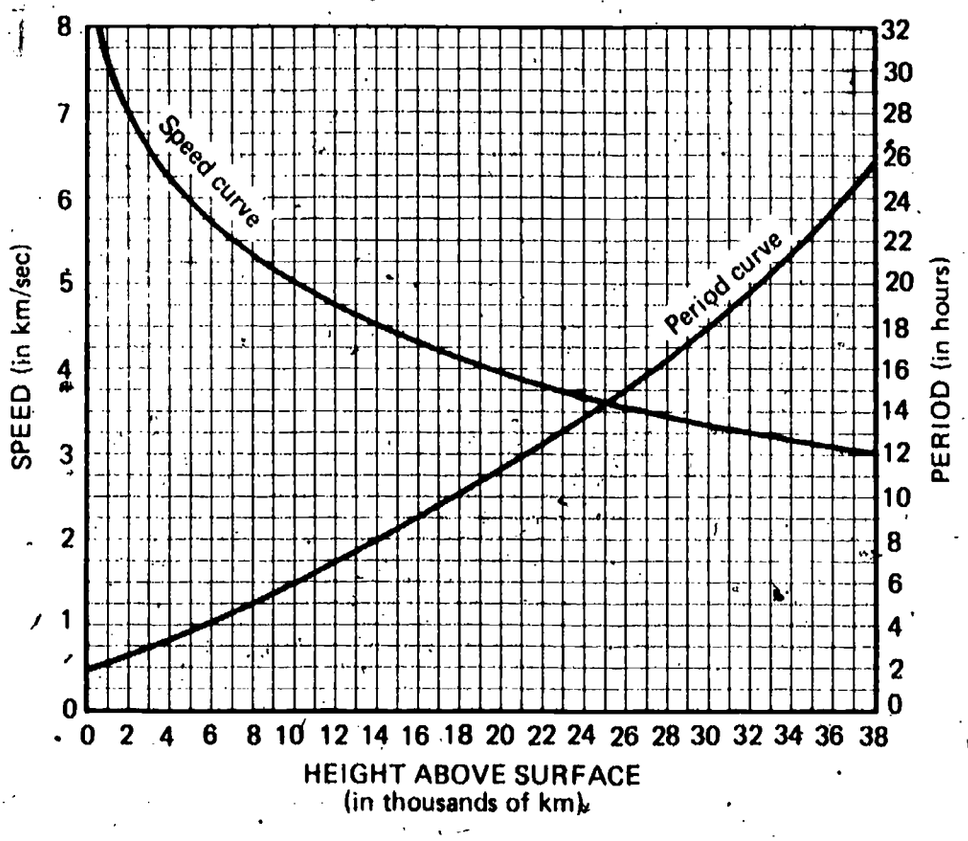
Which of the following gives the correct period for the satellite?

a. 29.5 earth years
b. 7.01 earth diameters
c. 1.17 earth gravity units
d. 10.2 earth hours

Two astronauts are conducting experiments in a satellite whose period is 8 hours. Use the graph below to determine the following information.

WU
02-Exc 4-3-2C

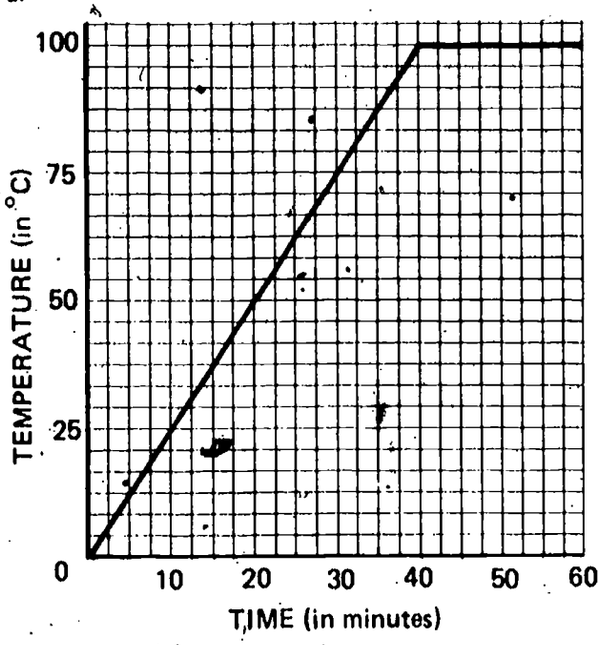
1. Height above surface
2. Orbital speed



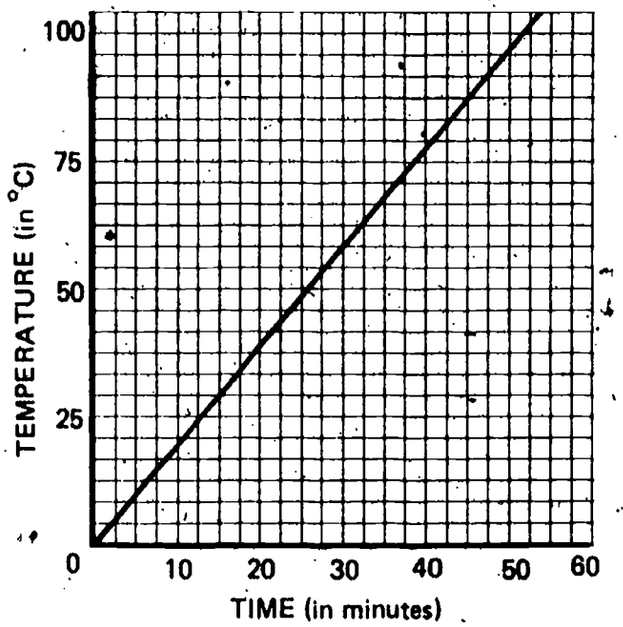
WU 02-Exc 4-4-1C

Ice has a freezing point of 0°C and a boiling point of 100°C. Suppose you heat solid ice until all of it has boiled away. Select the graph below that best shows how the temperature would change during the entire heating process.

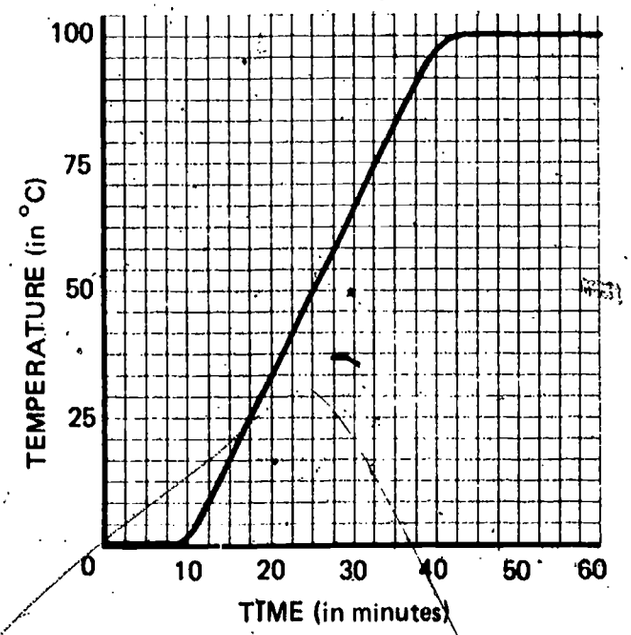
Graph a.



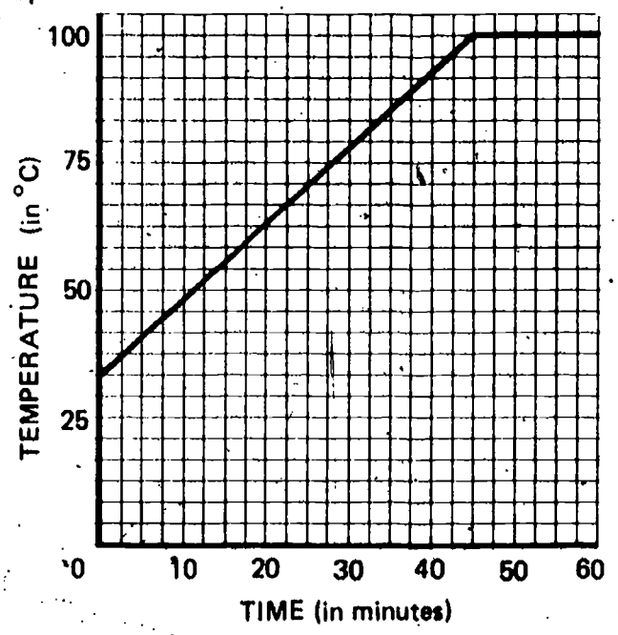
Graph b.



Graph c.



Graph d.

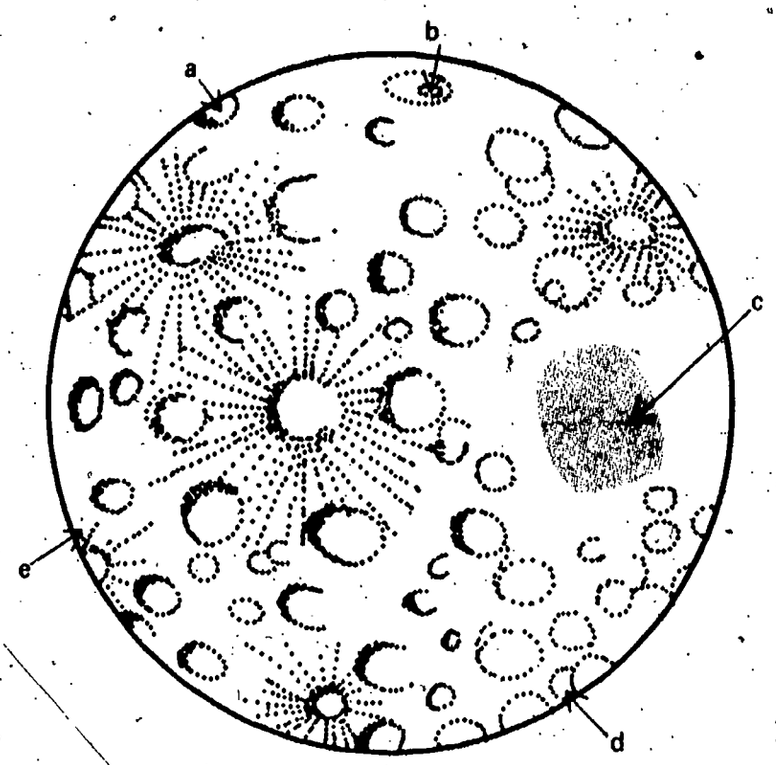


WU 02-Exc 4-4-2C

Large quantities of heat are produced when a spacecraft reenters the atmosphere. Explain why the spacecraft does not burn up from the heat generated during its reentry.

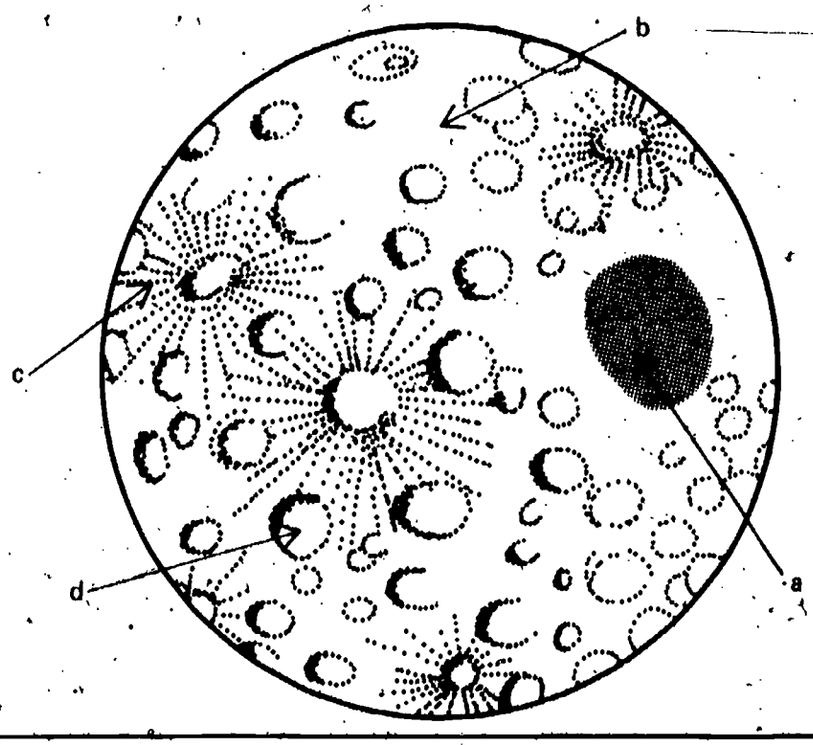
Several features of the lunar surface are pointed out in the diagram below. Write the letter of the arrow that points to a mare.

WU
03-Core-1C



Several features of the lunar surface are shown in the diagram below. Identify a ray by selecting the letter of the arrow which points to it.

WU
03-Core-2C

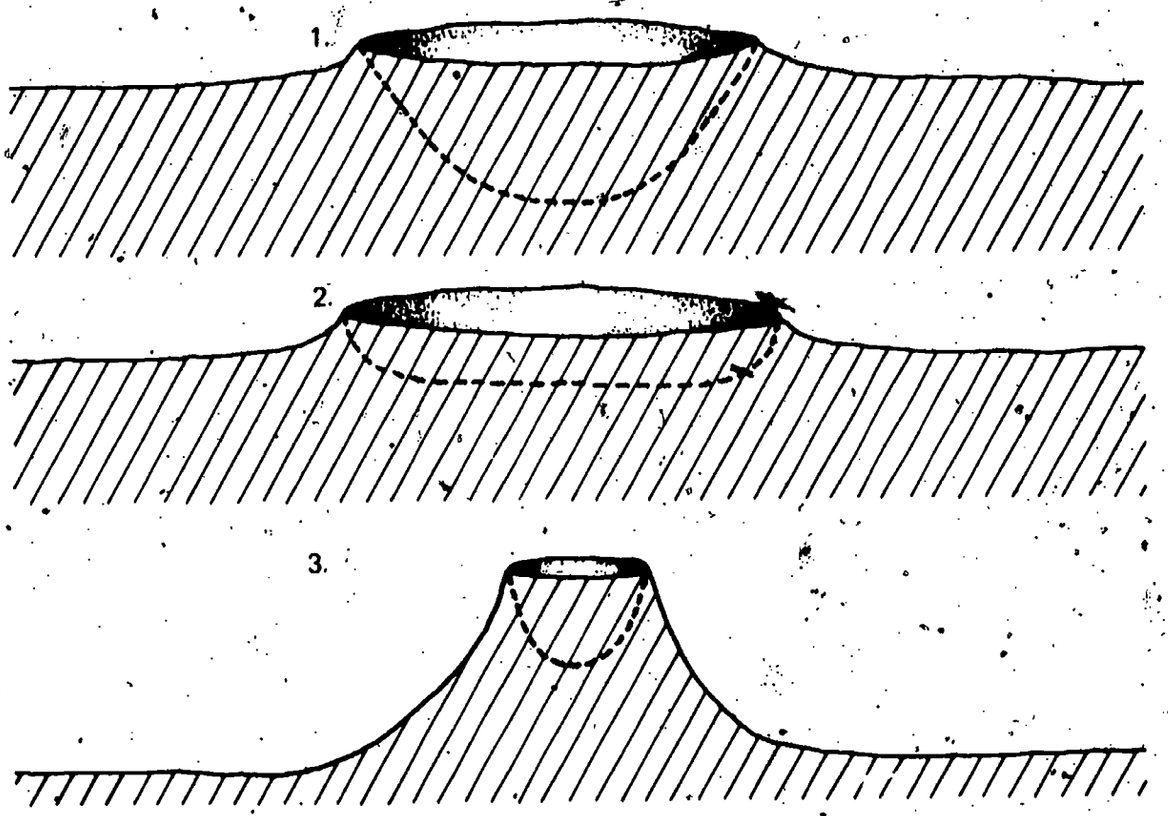


WU 03-Core-3C

Geologists are scientists who study the history and formation of rocks and minerals. Why are these scientists particularly interested in the origin of the moon's surface?

WU 03-Core-4C

Below are three craters found 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.



WU 03-Core-5C

State the two variables that determine the size of a crater that is formed by a falling body.

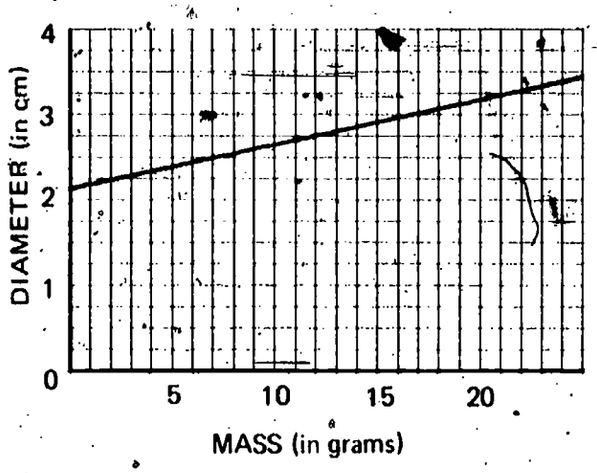
WU 03-Core-6C

Suppose you and a friend are on top of a very high cliff. You decide to see which of two equal sized objects, a rubber ball or a concrete ball, will reach the ground first if both are dropped at the same time from the same height.

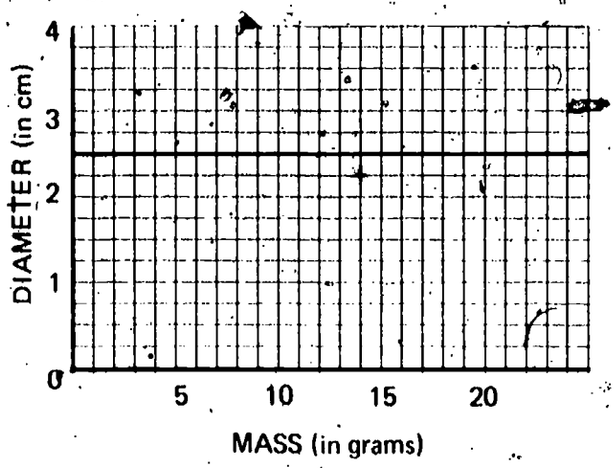
1. Which object would be traveling faster when it hit the ground?
2. Explain your answer.

Select the graph below that best shows how the diameter of a crater changes when balls of different masses but the same diameter are dropped into sand. **WU 03-Core-7C**

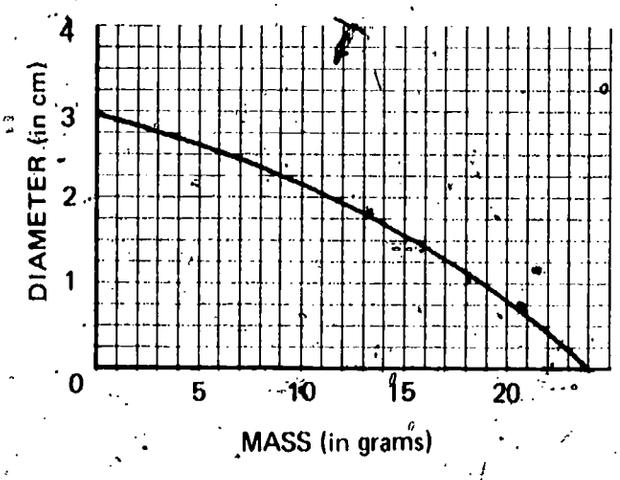
Graph a.



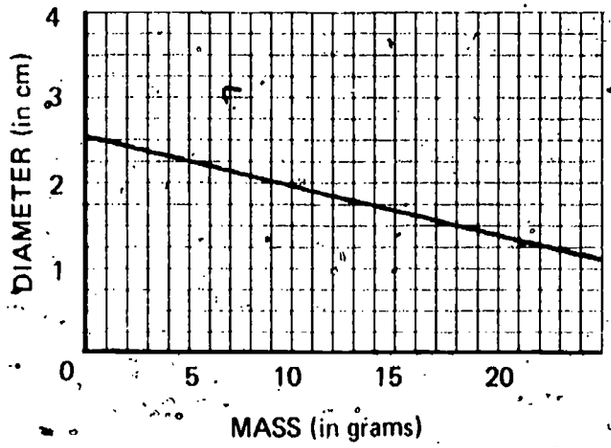
Graph b.



Graph c.



Graph d.

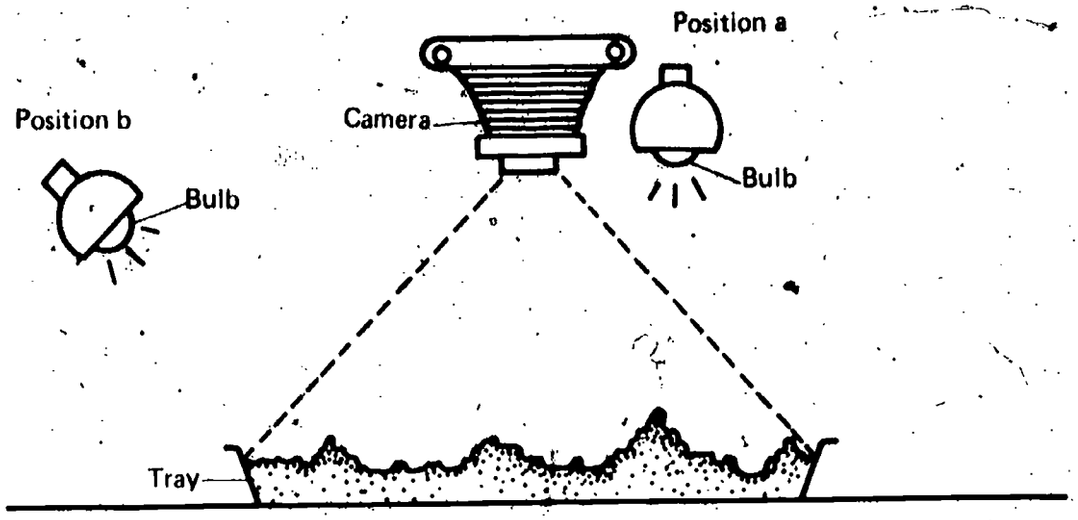


Recall your laboratory activity in which you formed craters with a tray of sand and different size balls. You changed the mass by using different balls. You also changed the distance of fall to give a different impact speed. Why did you change only one of these variables at a time? **WU 03-Core-8C**

Suppose that while performing an activity using balls and a sand tray to form craters, you noticed that the balls were of different diameters. Describe a plan to find the effect of changing the diameter of the falling body on the size of the craters it forms. Be sure to include in your plan the variables you would vary and those you would keep the same throughout the investigation. **WU 03-Core-9C**

WU 03-Core-10C

The diagram below shows two different positions to place a bulb while taking a photograph of your sand model of the moon's landscape.



1. If you want to get the most detail in your picture, which position of the bulb, a or b, would be more desirable?
2. Explain your answer.

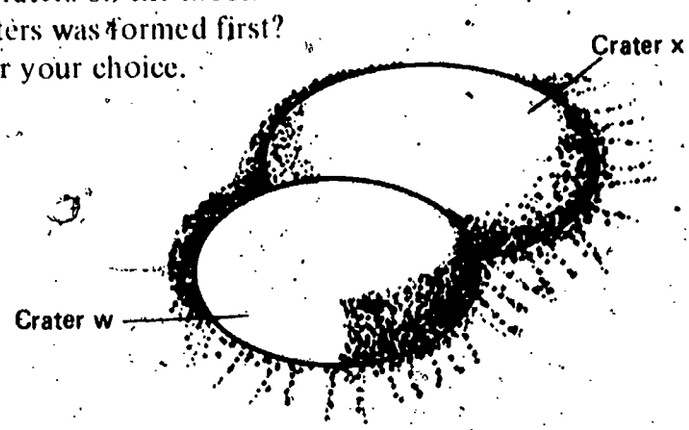
WU 03-Core-11C

When you look at the moon's surface with a high-power telescope, you see signs of erosion. Yet scientists know that there is no rain or wind on the moon. What causes the craters and cones on the moon to erode?

WU 03-Core-12C

The diagram below shows two craters on the moon's surface.

1. Which of the two craters was formed first?
2. Explain the reason for your choice.



WU 03-Core-13C

Today, the rottenstone-on-top-of-bentonite model for the moon's surface is used in place of the older sand model. The older sand model explained the shape and size of moon craters. Why was the model changed?

WU 03-Core-14C

Iggy, while visiting the moon, is inspecting 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.

The darkening of light-sensitive paper may be used to show the effect of sunlight on the moon's surface. You performed a test with light-sensitive paper in Activity 5-12. Which statement below describes the best conclusion that you can draw from the results of this experiment?

WU 03-Core-15C

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

One American astronaut hit a golfball on the surface of the moon.

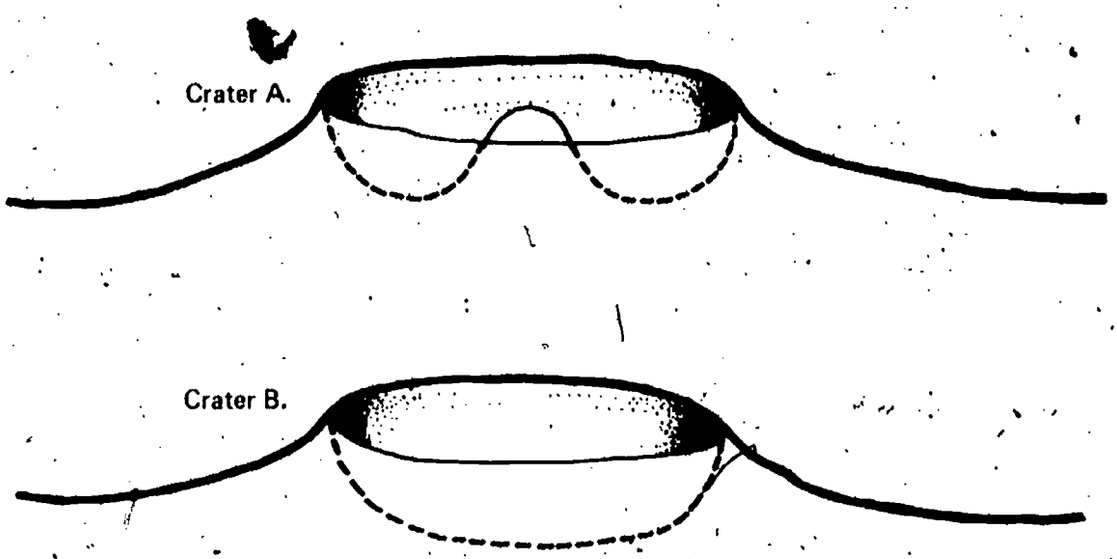
WU 03-Core-16C

1. If the ball had hit a rock, would it have bounced higher or lower than if it had hit a rock on earth?
2. State two reasons for the difference.

While riding in a lunar rover, a pair of astronauts noticed two craters like the ones shown in the diagram below. The moon surfaces in the areas where the craters were formed were the same. The dashed lines show the interiors of the craters.

WU 03-Core-17C

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



When water is dropped on a layer of bentonite, it produces a crater with a central peak. In what three ways could you increase the size of the model's central peak during the crater's formation?

WU 03-Core-18C

WU 03-Core-19C

Suppose an astronaut coming in for a landing on the moon's surface spots a cinder cone like the one drawn below. What is the most likely cause of this cinder cone?

WU 03-Core-20C

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

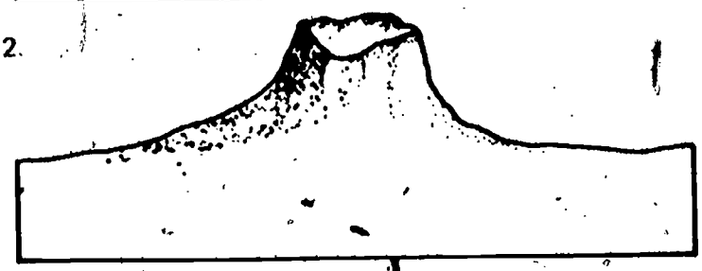
WU 03-Core-21C

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

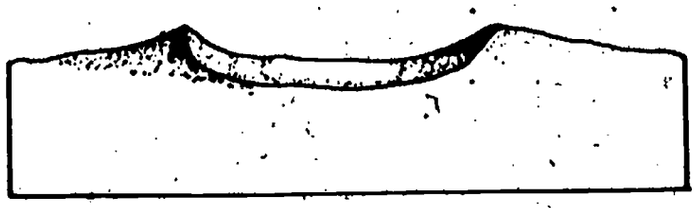
Feature

1.

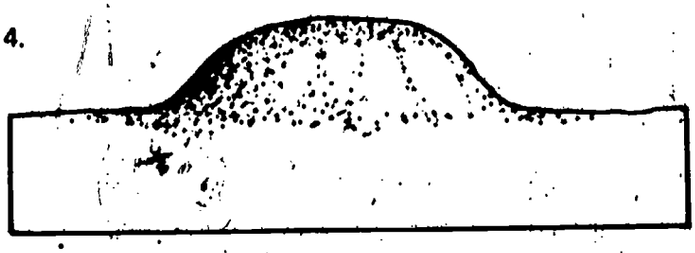
2.



3.



4.



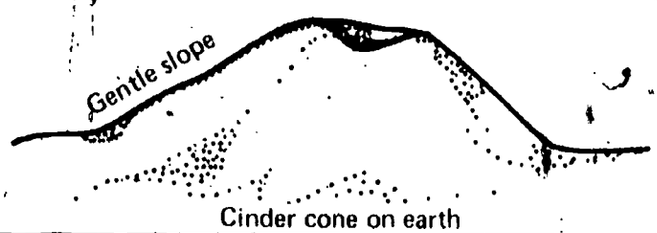
Probable Cause

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

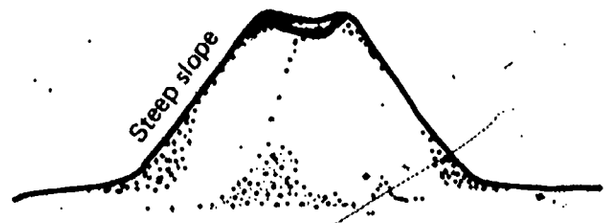
While walking over one of the unexplored areas on the dark side of the moon, an astronaut discovered a cinder cone whose features indicated that it was caused by volcanic activity. However, all cinder cones on earth which the scientists have observed have fairly gentle slopes, whereas the cones on the moon have steep slopes, as shown in the diagram below.

WU
03-Core-22C

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

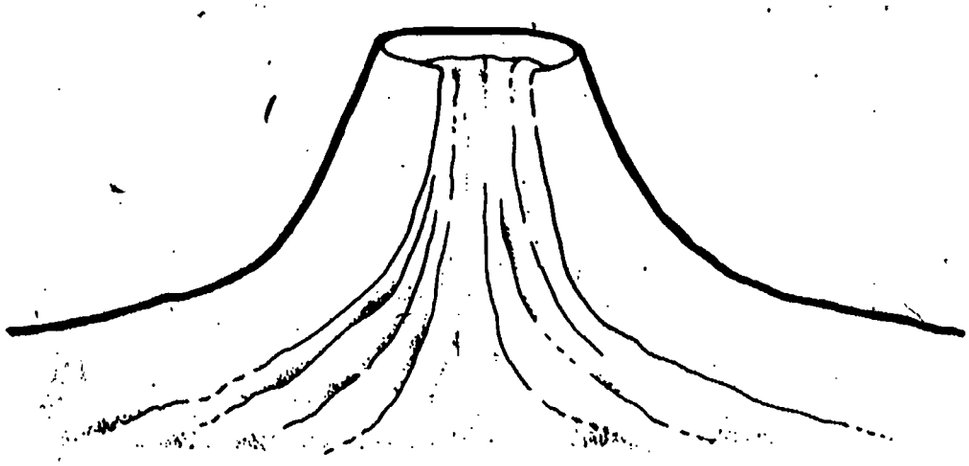


Cinder cone on moon

Use the diagram below to answer the questions that follow.

WU
03-Core-23C

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?



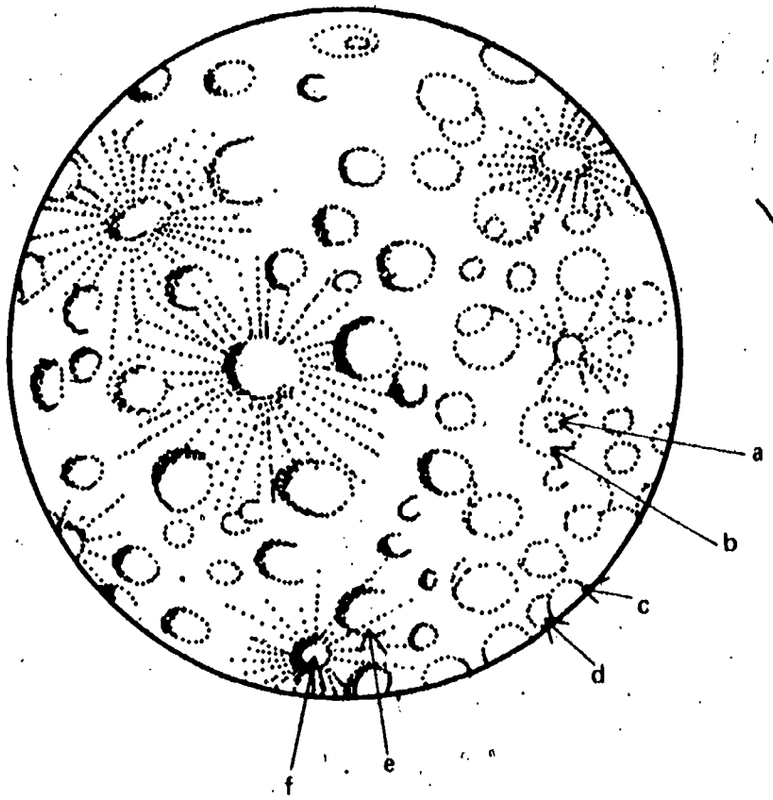
Wind and water on the earth's surface cause the surface of the earth to change. The moon's surface is not changed by wind and water. What three things may cause the moon's surface to change?

WU
03-Core-24C

WU
03-Core-25C

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

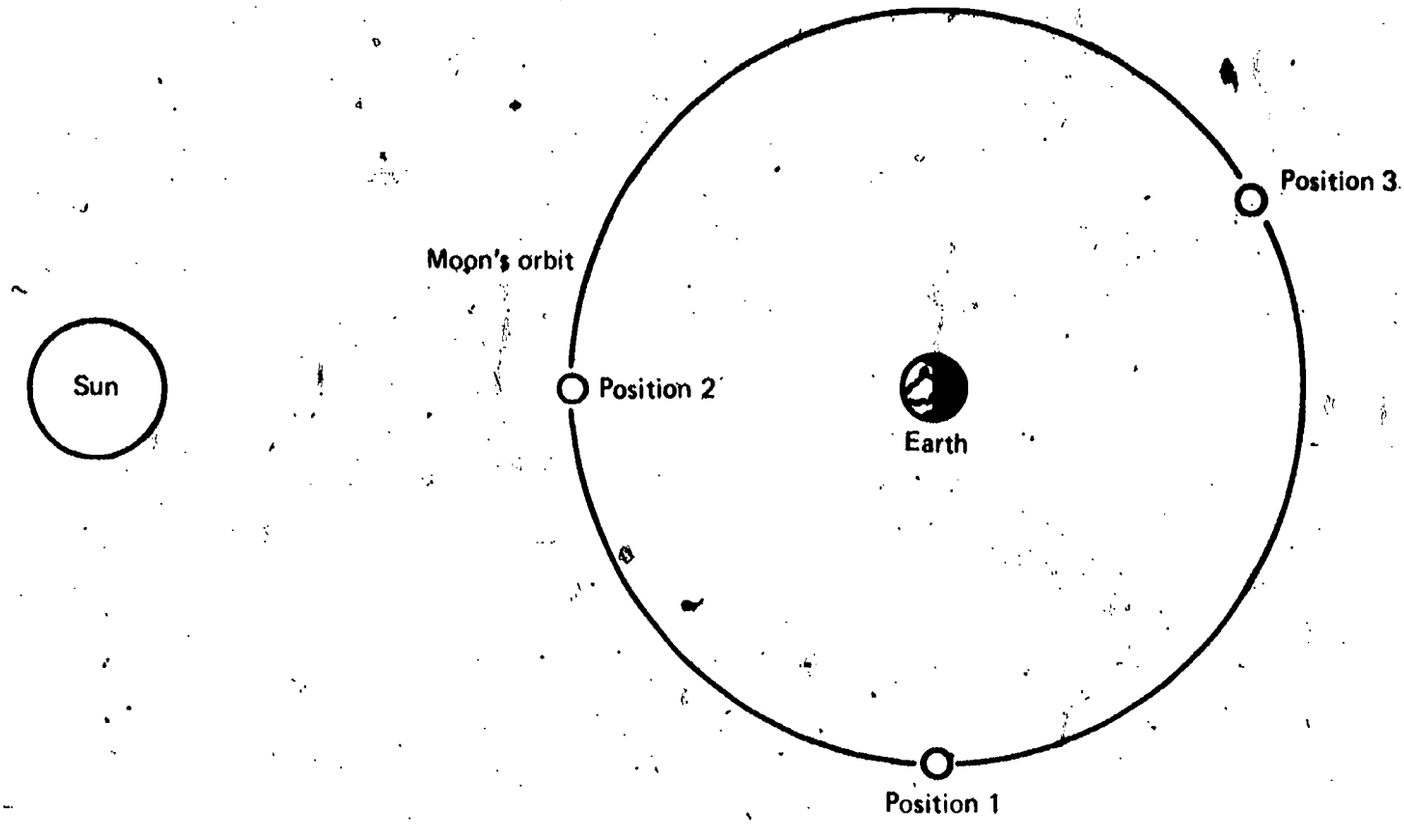
1. Indicate which of the two features in each of the following pairs is probably the older of the two features.
   (1) a or b
   (2) c or d
   (3) e or f
2. For each pair, state why you think the feature you selected is the older feature.



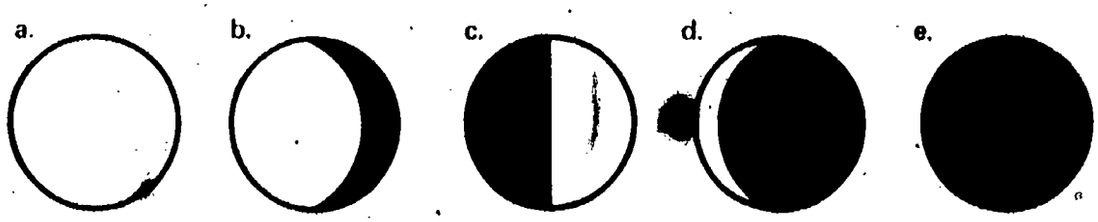
WU
03-Core-26C

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.

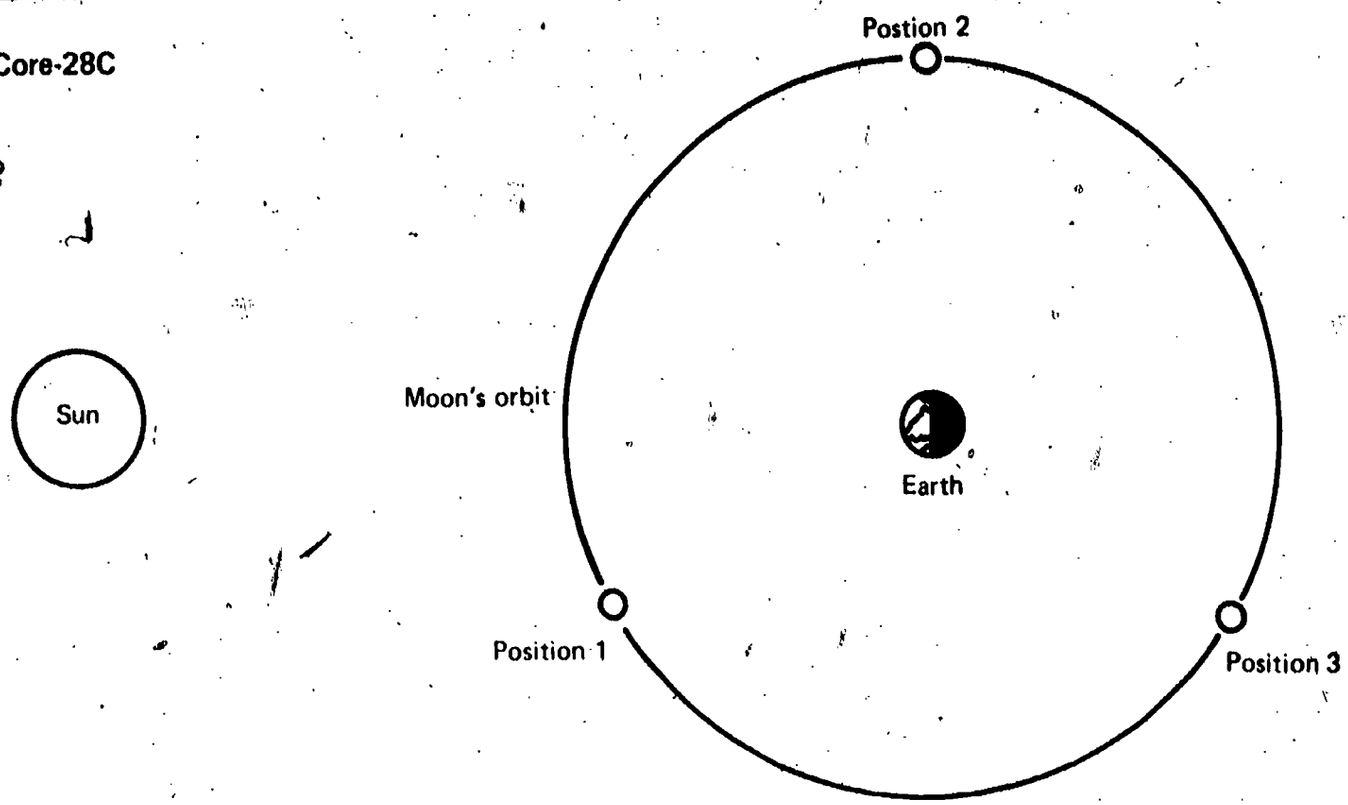
1. What fraction of the earth's surface would an observer on the moon see in a 12-hour period?
2. What fraction of the earth's surface would an observer on the moon see in a 6-hour period?



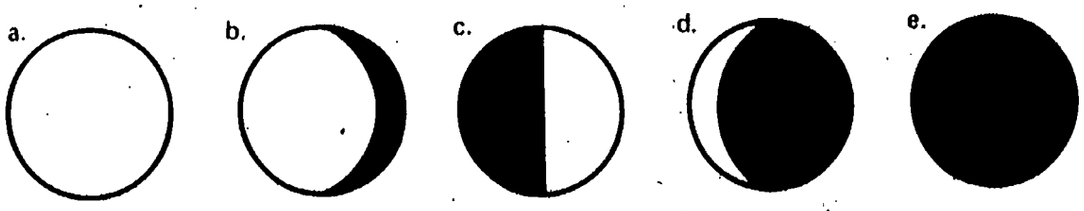
Use the sun-earth-moon model pictured above to determine how the moon would appear to an observer on earth who is facing the moon when the moon is in each of the three positions shown in the model. Write the number of the position and after it the letter of the diagram which shows the most likely appearance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



WU
03-Core-28C



Study the sun-earth-moon model shown above. 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.

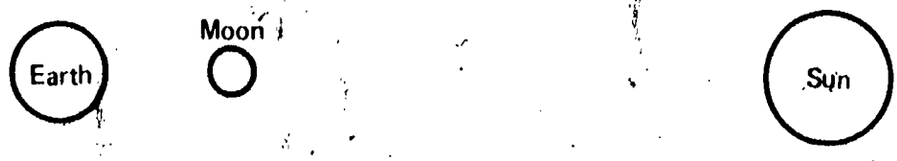


WU
03-Core-29C

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. Impossible for him to see the earth
b. Below the horizon
c. About halfway between the horizon and overhead
d. Directly overhead

The diagram below shows the positions of the sun, the moon, and the earth when there is a new moon. Why will an observer located on the earth see the moon's surface in this position dimly lighted rather than completely dark? **WU 03-Core-30C**



The moon revolves around the earth, but only one side of the moon is ever visible from the earth. Explain why. **WU 03-Core-31C**

In days, what is the period of the moon's revolution around the earth? **WU 03-Core-32C**

In days, what is the period of the earth's revolution around the sun? **WU 03-Core-33C**

Suppose you weighed a TV camera on the earth's surface and on the moon's surface. **WU 03-Exc 5-1-1C**

1. Would its 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?

Suppose you apply to go to the moon. In your moon flight application, you must state your weight on earth and your weight on the moon's surface. If your weight on earth is 90 lbs, what is your weight on the moon's surface? Show your work. **WU 03-Exc 5-1-2C**

1. Are the surface features of the far side of the moon very different from the surface features of the side of the moon that is visible from the earth? **WU 03-Exc 7-1-1C**
2. If so, describe the differences.