Longitudinal Study of American Youth

TENTH GRADE SCIENCE

Public Opinion Laboratory
Northern Illinois University
DeKalb, Illinois

Fall 1987

INTRODUCTION

This booklet contains questions about science for you to answer. You will be able to answer some of the questions quickly and others will require more thought. Please do not feel discouraged if you are not absolutely sure of an answer. Some questions will ask about things you have covered in class, but others will not. Please do your best to answer each question. If you are not sure of the answer, read the question again, and make your best guess.

MARKING YOUR ANSWERS

Each question is followed by a set of possible answers labeled A, B, C, etc. Read each question carefully, then choose the *one* answer you think is the best, and darken in the letter on your *Answer Sheet* next to the number for that question. Be sure to mark only *one* letter for each question. Do not skip any questions.

The following is an example of a question. Look at the top of your *Answer Sheet* to check your answer.

Example: An apple is a :

(A) mineral **(C)** fruit

(B) animal **(D)** vegetable

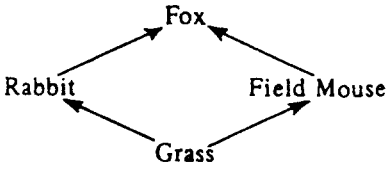
The correct answer is (C). This answer has been blackened in on your *Answer Sheet,* just as you are to do for each question.

Do not make any stray marks on your *Answer Sheet.* Do all of your calculations on the Question Booklet, and use the *Answer Sheet* only to record your answers.

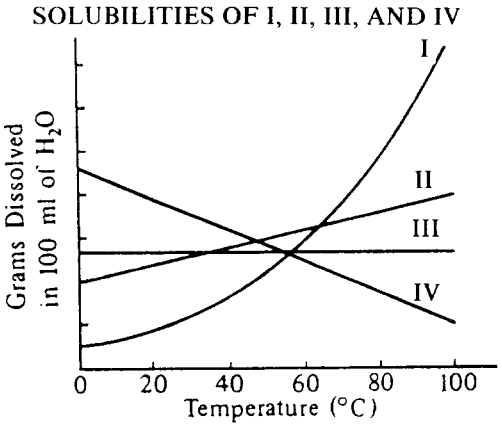
If you have any questions while taking this test, raise your hand, and the person giving the test will come to your seat to help you.

1. Which of the following animals is probably well adapted to a hot, dry environment?
   (A) A rabbit with small ears and fur that is brown in summer and white in winter
   (B) A rodent that sleeps underground during the day
   (C) A white fox with long fur, small ears, and a bulky body
   (D) A long-legged bird that has dark feathers and eats snails and small fish N424301

2. Which of the following is NOT an accurate statement with regard to the drinking of alcoholic beverages?
   (A) Alcohol is a major source of energy for the body.
   (B) Alcohol slows down sensory perception and reflexes.
   (C) Alcoholics are people who are addicted to alcohol.
   (D) Excessive use of alcohol can cause liver disease. N419201



3. With respect to the field mouse in the food web above, what is the fox considered?
   (A) A predator **(B)** A producer **(C)** A prey **(D)** A decomposer N418401



4. According to the graph above, which of the chemicals is most soluble in water at 90° C?
   (A) I **(C)** III
   (B) II **(D)** IV N427501

5. Acid rain is the result of the combination of pollution in the air and precipitation. Environmental action groups are advocating the control of acid rain by what means?
   (A) Prohibiting industrialization wherever crops are grown
   (B) Requiring workers to wear protective clothing
   (C) Requiring industries to install antipollution filters and other devices
   (D) Requiring that new industries locate in areas of low precipitation N424701

6. A weather report will often have statements like "There is a 20% chance of rain tomorrow." What is meant by this forecast?

   (A) In the past, when conditions were similar, it rained the next day about 20% of the time.

   (B) It will rain 20% of the time during the day.

   (C) If it rains tomorrow, we are likely to have about 20/100 inches of rain.

   (D) Weathermen are right about 20% of the time in making such forecasts.

   (E) It will rain over 20% of a given region, for example, a city or a county. N409501

7. Which of the following best explains why marine algae are most often restricted to the top 100 meters in the ocean?

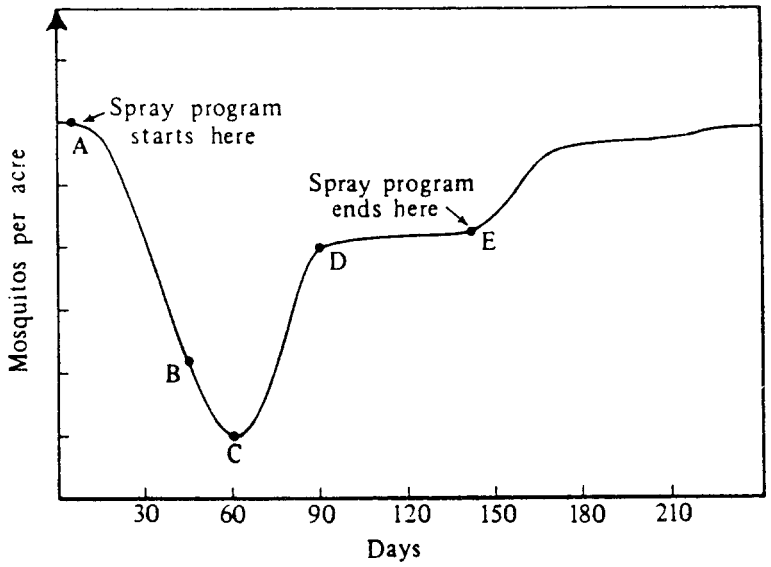
   (A) They have no roots to anchor them to the ocean floor.

   (B) They are photosynthetic and can live only where there is light.

   (C) The pressure is too great for them to survive below 100 meters.

   (D) The temperature of the top 100 meters of the ocean is ideal for them. N432901

▶ **Questions 8-9.** A swamp near a camp was sprayed with pesticide at weekly intervals over several months in an attempt to eliminate the mosquito population. Daily counts of population size yielded the information shown in the graph below.



8. Which of the following most likely accounts for the decreasing effectiveness of the campaign as time progressed?

   (A) Mosquito larvae gradually acquired a resistance to the pesticide.

   (B) Mosquitoes naturally resistant to the pesticide lived and reproduced resistant offspring.

   (C) The pesticide was used too infrequently.

   (D) Each member of the population developed a natural resistance when first exposed to the pesticide. N437201

9. What portion of the graph represents the greatest increase in the number of resistant mosquitoes?

   (A) AB **(B)** BC **(C)** CD **(D)** DE N437202

10. A formula for copper nitrate is $Cu(NO_3)_2$. For every copper atom in this compound, the number of oxygen atoms is

(A) 1
(B) 2
(C) 3
(D) 5
(E) 6

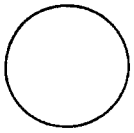
N411401

11. It has been found that certain DDT insecticides become *less* effective as they are used over a period of time primarily because

(A) insects use DDT in their metabolism and adapt to it in their environment
(B) surviving insects reproduce and pass on to their offspring genes for resistance
(C) DDT acts as a fertility drug
(D) DDT accumulates in food chains

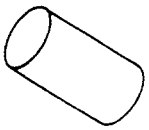
N428301

12. The shape of the Earth's shadow during an eclipse of the Moon indicates that the shape of the Earth CANNOT be which of the following?

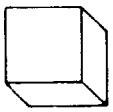


(A) A Sphere

(C) A Cone



(B) A Cylinder



(D) A Cube

N435101

13. Recently, some forests were cleared in the Himalayan Mountains. What could have happened as a result of this clearing?

(A) Colder weather in the hills
(B) Less rain on the plains below
(C) Floods on the plains below
(D) Snow in the mountains
(E) Warmer weather in the hills

N407701

14. Which of the following statements correctly describes one of the connections between science and technology today?

(A) Technological progress requires little input from science.
(B) Technology involves the practical applications of scientific knowledge.
(C) Workers in science use the laws and principles discovered by workers in technology.
(D) Technology is the part of science that deals with mechanical problems.

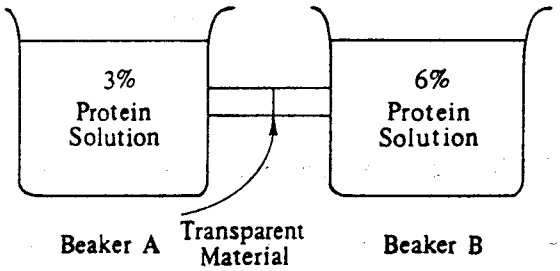
N425201

15. The ores of many metals are sulfides of the metals. In the refining process these ores are "roasted," that is, the sulfur is combined with oxygen, liberating the metal or its oxide (e.g., $CuS + O_2 \rightarrow Cu + SO_2$). This process is most likely to result in which of the following?

(A) Acid rain
(B) Aging of lakes
(C) Depletion of the ozone layer
(D) Lead poisoning

N429701

The figure below shows two beakers interconnected by a tube that is partitioned by transparent material permeable to water but impermeable to protein. Beaker A contains a 3 percent protein solution and beaker B a 6 percent protein solution.



16. The function of what structure in living cells is represented by the transparent material in the experiment diagrammed above?

(A) The cell membrane
(B) Cytoplasm
(C) Nucleus
(D) The cell wall

N434202

17. Why are environmental-protection groups often opposed to the burning of coal to produce electricity?

(A) Power plants using coal require a great deal of space.
(B) Coal is in limited supply.
(C) The burning of coal releases pollutants into the air.
(D) Coal is more expensive to burn than wood.

N435201

18. What happens to the sulfur dioxide released by a factory's smokestacks?

(A) The sulfur dioxide stays in the air forever.
(B) The sulfur dioxide immediately falls to earth as dust.
(C) The sulfur dioxide eventually falls to earth as acid rain.
(D) The sulfur dioxide escapes from the atmosphere into space.

N405501

19. What is the most important advantage resulting from the orbiting space telescope?

(A) It is closer to the stars than are telescopes on the Earth's surface.
(B) It can remain stationary in space, thus focusing on a single object for a longer time.
(C) It is not affected by distortions caused when light passes through the Earth's atmosphere.
(D) It remains at a more constant temperature because of its position in space.

N417401

20. Lasers are used for many purposes. However, a laser would probably NOT be used for which of the following?

(A) Home heating
(B) Eye surgery
(C) Welding
(D) Entertainment

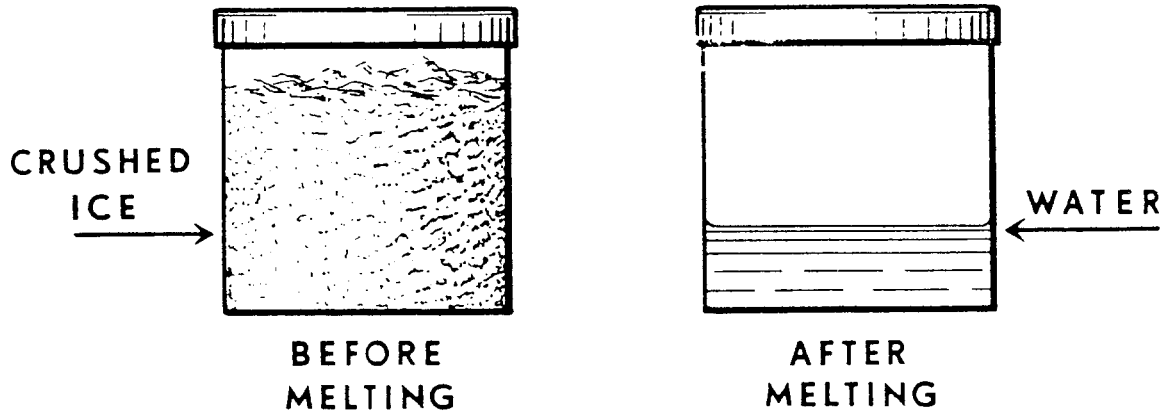
N432101

21. Iceland and Southern Greenland are about the same distance from the equator. Many more people live in Iceland where the climate is warmer. What is the best reason for the warmer climate in Iceland?

(A) Southern Greenland is more mountainous than Iceland.
(B) Iceland receives more sunlight than Southern Greenland.
(C) Ocean currents bring warmer water to the coast of Iceland.
(D) Iceland has more hot springs than Southern Greenland.

N410201

The can below was filled with crushed ice, sealed, and weighed. The ice was melted by slowly warming the can and its contents. No water vapor escaped, and no air entered the can.



22. The can was then weighed again. Which one of the following results would you expect to find?

(A) The weight was the same.

(B) The weight was more.

(C) The weight was less. N405101

23. A female white rabbit and a male black rabbit mate and have a large number of baby rabbits. About half of the baby rabbits are black, and the other half are white. If black fur is the dominant color in rabbits, how can the appearance of white baby rabbits best be explained?

(A) The female rabbit has one gene for black fur and one gene for white fur.

(B) The male rabbit has one gene for black fur and one gene for white fur.

(C) The white baby rabbits received no genes for fur color from the father.

(D) The white baby rabbits are result of accidental mutations. N424401

24. A chemist will frequently write a formula for some kind of matter. For example, H_2SO_4 is the formula for sulfuric acid. The numbers used in the formula stand for

(A) the number of isotopes in a mole of substance.

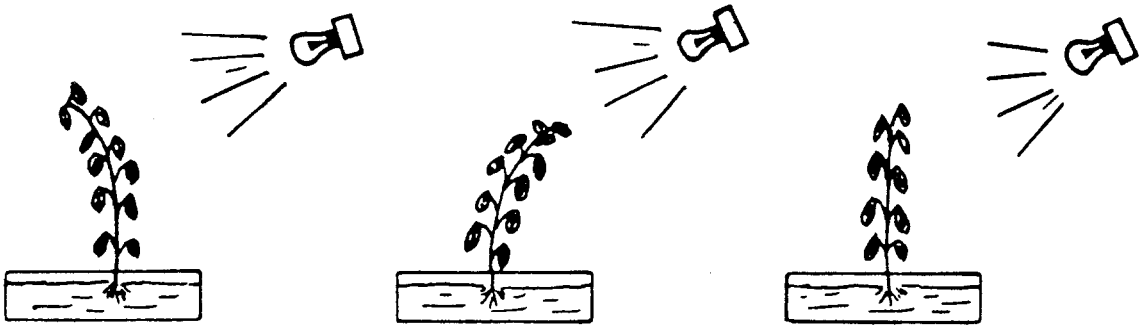
(B) the number of grams of each atom in a given molecule.

(C) the number of atoms of each element in a given molecule.

(D) the number of molecules of each component in a mole of H_2SO_4.

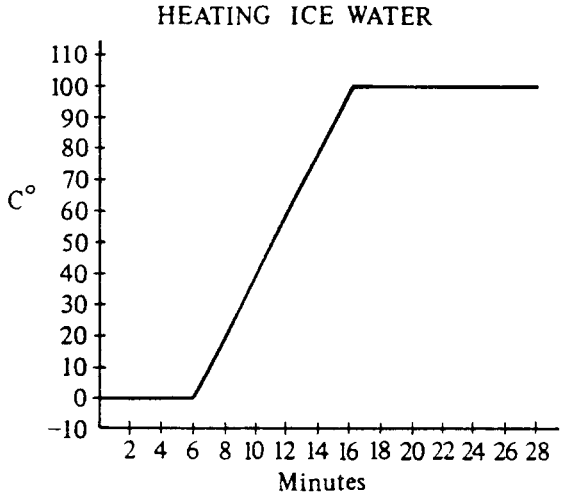
(E) the number of parts by weight of each material in a pound of substance. N411101

25. A teacher left a plant in a dark classroom during the school's ten day spring break. She placed a light near the plant, and she watered the plant well. When students returned to school after spring break, what do you think the plant looked like?



(A) (B) (C) N401201

▶ **Questions 26-27.** A beaker containing crushed ice and water is heated. The temperature of the beaker's contents is recorded every 30 seconds. A graph of the data appears below.



26. Approximately when does active boiling of the contents of the beaker occur?

(A) From the beginning of the process

(B) Between 2 and 6 minutes after the heating begins

(C) Between 6 and 16 minutes after the heating begins

(D) After approximately 16 minutes of heating

N418701

27. In the graph the temperature remains constant from 0 to 6 minutes and again after 16 minutes. During these two time periods, the heat energy was used to do which of the following?

(A) To heat the sides of the beaker

(B) To remove air molecules from the water

(C) To expand the distance between the molecules of water

(D) To change the state of matter in the beaker

N418702

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28. Which of the following best explains why insects or birds that are introduced to a new country often become pests in the new area?

(A) Their food supply in the new country is unlimited.

(B) The new country produces beneficial mutations.

(C) The predators of their former habitat are lacking in the new country.

(D) Competition among them increases.

N428001

29. Which of the following is the most important cause of the seasons in the temperate zones of the Earth?

(A) The Earth's axis is not at right angles to the plane of its orbit.

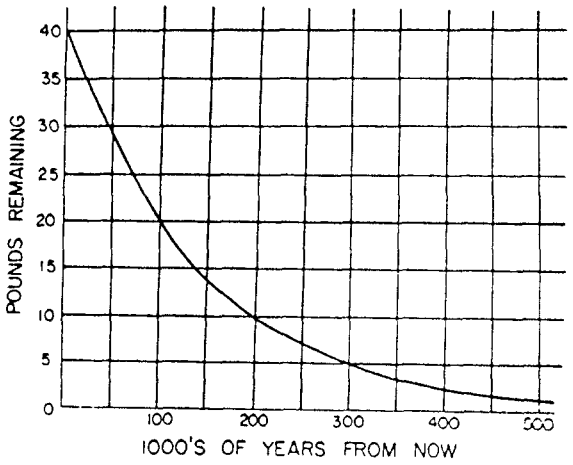
(B) The Earth is not always the same distance from the Sun.

(C) The Earth's speed is not constant during the year.

(D) The Earth's surface is mostly covered with water.

(E) The Earth is not a perfect sphere.

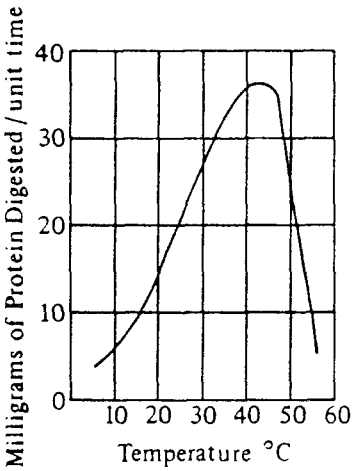
N408101



30. A radioactive substance decays into another element. The curve in the graph above shows how much of the radioactive substance remains over time. From the graph, estimate the *half-life* of the substance.

(A) 50,000 years
(B) 100,000 years
(C) 250,000 years
(D) 500,000 years
(E) 1,000,000 years

N411901



31. The graph above shows how temperature affects the rate of digestion of a protein by an enzyme. Based on the information above, which of the following is true?

(A) Digestion of this protein is equally effective at 35°C and 55°C.
(B) Any enzyme will digest this protein at 40°C.
(C) This enzyme is most effective for digesting this protein between 35°C and 45°C.
(D) An increase in temperature always increases the rate at which this protein is digested.

N427101

32. Concern has been expressed about the greenhouse effect of carbon dioxide, CO_2, on the Earth's atmosphere. The CO_2 allows sunlight to penetrate to the surface but blocks long-wave infrared radiation from escaping to space. If we continue to burn fuels at an increasing rate, all of the following are likely to occur EXCEPT:

(A) Atmospheric CO_2 will increase.
(B) Less heat will be trapped in the atmosphere.
(C) Sea levels will rise.
(D) The antarctic ice sheet will become smaller.

N437101

33. Two astronauts walking on the moon are trying to communicate with each other. Which one of the following ways of communicating will *not* work for them?

(A) Ringing a bell
(B) Flashing a light
(C) Using a radio
(D) Waving

N406901

34. At the present time, where does most of the energy used in this country come from?

(A) Nuclear reactors
(B) Hot springs
(C) Falling waters
(D) Solar batteries
(E) Burning of fuels

N406501

35. The burning of fossil fuels has increased the carbon dioxide content of the atmosphere. What is the most immediate effect that this increasing amount of carbon dioxide is likely to have on our planet?

(A) A warmer climate
(B) A cooler climate
(C) Decreased relative humidity
(D) Increased relative humidity

N428401

36. A paper manufacturing company in your area produces large amounts of sulfuric acid as a waste by-product. In spite of efforts to carefully dispose of the waste, some of the acid continually escapes recovery and pollutes a nearby river, affecting wildlife and recreation. The company employs many area residents. Which of the following solutions to help stop the pollution would be preferred by the community?

(A) Moving the company to a more isolated area and giving the workers the option to move
(B) Adding a substance to the escaping acid to neutralize it
(C) Adding an acid with a higher pH to the escaping acid
(D) Storing the escaping acid in large holding tanks and then taking it to an industrial waste landfill

N429601

$$2Na + S \rightarrow Na_2S$$

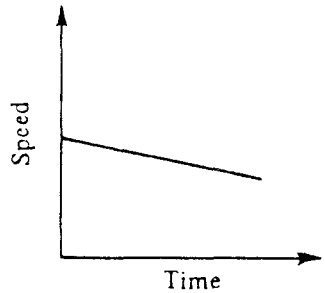
37. The mass of 1.0 mole of sodium, Na, is 23.0 grams. The mass of 1.0 mole of sulfur is 32.1 grams. Approximately what mass of sodium is required to react completely with 32.1 grams of sulfur in the reaction above?

(A) 11.5 grams
(B) 23.0 grams
(C) 32.0 grams
(D) 46.0 grams

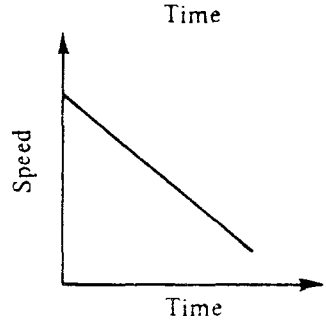
N433901

38. The following graphs represent the speeds of four identical cars over time. If the scales on each graph are the same and each car continues its motion as suggested by the graph, which car will reach a speed of zero in the shortest time?

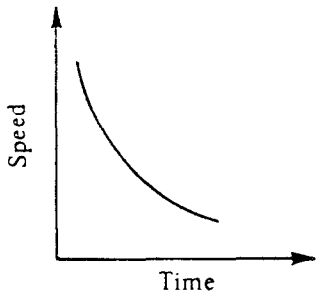
(A)



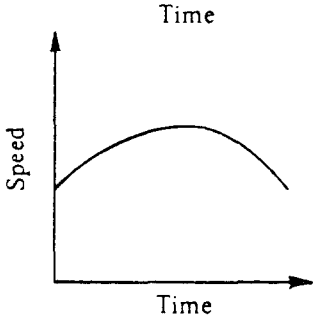
(B)



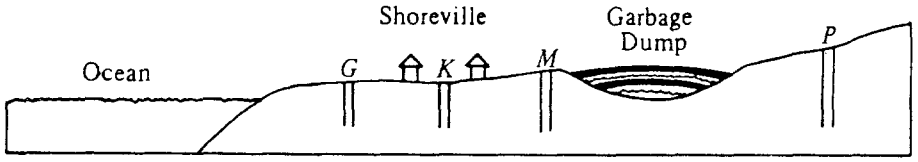
(C)



(D)



N428901



39. The city of Shoreville is considering drilling a well as a source of drinking water at locations *G, K, M,* or *P,* shown above. Which of the well sites would be the best choice for the benefit of the community?

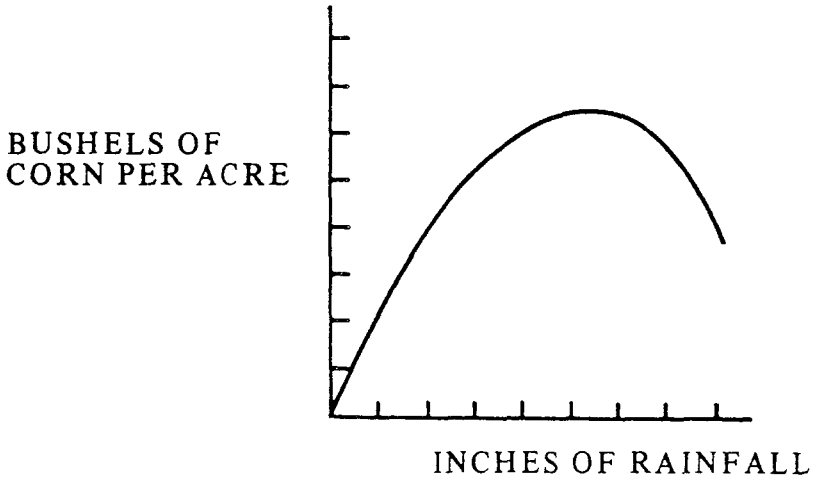
(A) Location *P,* because there is less chance of contamination and therefore it would be safer.

(B) Location *K,* because it is closer to Shoreville and therefore waterlines would be cheaper to construct.

(C) Location *G,* because there would be more water and it would serve more people.

(D) Location *M,* because buying the land would be easier and less expensive. N417901

40. Which one of the following is the best conclusion you can make from this graph?



(A) The more rain there is, the better the corn will grow.

(B) Corn needs rain to grow, but too much rain is harmful.

(C) Different kinds of corn need different amounts of rain to grow best.

(D) Corn can grow well even if there is no rain. N408801

A medical researcher wanted to find out what caused a certain disease. She gathered the following information from different places in the world.

	Major Type of food	Type of Area	Mosquitoes	Disease
Country 1	Fish only	City	Yes	Yes
Country 2	Meat and vegetables	Farmland	No	No
Country 3	Fish and rice	City	No	Yes
Country 4	Fish only	Farmland	Yes	Yes

41. Which one of the following would be best for the researcher to study more closely in order to find the cause of the disease?

(A) Major type of food

(B) Type of area

(C) Mosquitoes

(D) Swamps N411201

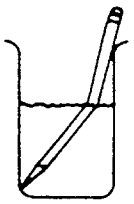
▶ **Questions 42-45.** Scientific discoveries in one area can often be applied to other areas. Is each of the following an example of this process?

42. Solid state research for small computers was applied in developing better television sets. **(A)** Yes **(B)** No N407401

43. Research for space exploration was applied in developing many new types of medical equipment, such as heart pacemakers. **(A)** Yes **(B)** No N407402

44. Research in developing plastics was applied in developing synthetic blood vessel replacements. **(A)** Yes **(B)** No N407403

45. Laser research was applied in developing a superior method of eye surgery. **(A)** Yes **(B)** No N407404



46. When one looks at a pencil half-submerged in a glass of water, the pencil may appear bent as shown above. Which of the following helps to explain this effect?

(A) Part of the pencil is wet and part is dry.

(B) There is a difference in temperature between the air and the water.

(C) Light changes direction as it passes from water to air.

(D) Water reflects more light than air does. N431401

47. Which of the following is NOT an example of a chemical change?

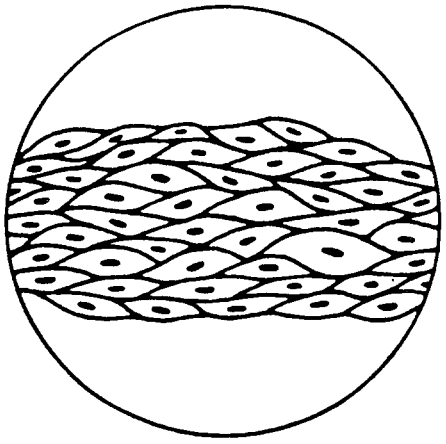
(A) A log burning

(B) A nail rusting

(C) An ice cube melting

(D) An apple rotting N420201

A group of cells looks like this under a microscope.



48. These cells all work together to do the same thing. A group of cells like this is called

(A) a tissue.

(B) an organism.

(C) an organ.

(D) a system. N405001

49. When phosphorus, P_4, is exposed to air, it reacts with oxygen, O_2, to form an oxide, P_4O_{10}. Which one of the following represents the balanced equation for the reaction?

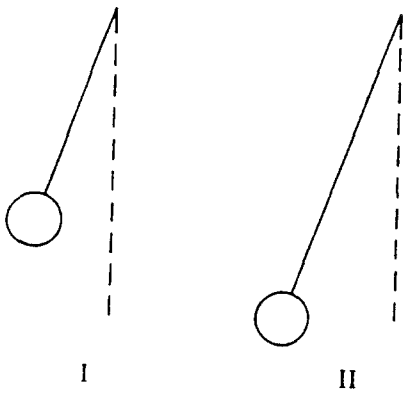
(A) $P_4 + O_2 \rightarrow P_4O_{10}$

(B) $P_4 + 10\ O_2 \rightarrow P_4O_{10}$

(C) $4\ P_4 + 5\ O_2 \rightarrow P_4O_{10}$

(D) $P_4 + 5\ O_2 \rightarrow P_4O_{10}$ N411801

The bobs of two pendulums shown below have the same masses and volumes. The string of pendulum I is 100 centimeters long and the string of pendulum II is 150 centimeters long.



50. If a student holds each bob at its starting angle of 20°, and then releases both bobs simultaneously, how does the period (time for one complete swing) of pendulum I compare with the period of pendulum II?

(A) The period of pendulum I is greater.

(B) The periods of pendulums I and II are the same.

(C) The period of pendulum II is greater. N424901

51. The fact that much of the world's oil supply is found under desert areas should lead one to conclude which of the following about what that land once was?

(A) It was radioactive.

(B) It was rich in vegetation.

(C) It was very mountainous.

(D) It was mined for minerals. N417701

52. A student is doing a project on the effect of a magnet on the picture on a television screen. The student uses only a strong bar magnet, and later writes the following four statements. Which of the following statements does NOT describe an observation?

(A) The magnet distorts the picture when held near the front of the screen.

(B) Electrons are attracted by the magnet as they travel through the tube.

(C) Opposite ends of the magnet produce opposite directions of distortion on the screen.

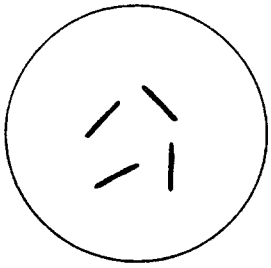
(D) The magnet has no effect on the volume of sound. N425901

53. Which of the following objects has the greatest density?

	Mass of Object	**Volume of Object**
(A)	11.0 grams	24 cubic centimeters
(B)	11.0 grams	12 cubic centimeters
(C)	5.5 grams	4 cubic centimeters
(D)	5.5 grams	11 cubic centimeters

N426201

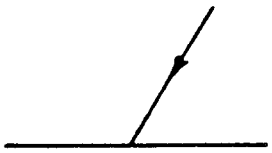
A student collected a sample of pond water and looked at it through a microscope. The figure below shows four microorganisms that she saw in one microscopic field of view.



54. If the diameter of the field of view is 500 microns, approximately how long is one of these organisms?

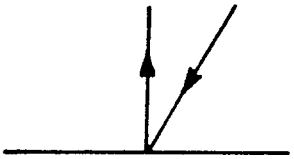
(A) 1,000 microns
(B) 400 microns
(C) 100 microns
(D) 20 microns

N436901

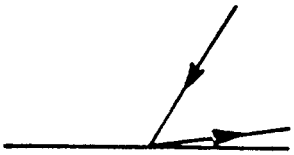


55. A ray of light shines on a mirror at the angle shown above. Which diagram shows what will happen to the light after it strikes the mirror.

(A)



(B)



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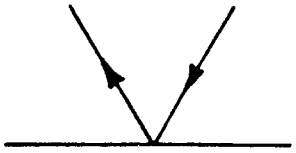

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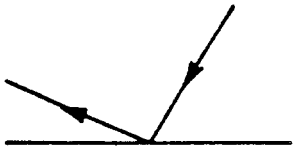

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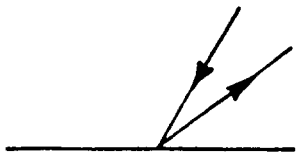


N407201

▶ **Questions 56-57.** Beaker I contains 200 milliliters of water and beaker II contains 400 milliliters of water. Both beakers are initially at 25° C.

56. If the two beakers are heated at the same constant rate for 2 minutes, how will the temperature of the water in them compare?

(A) It will be higher in beaker I than in beaker II.
(B) It will be higher in beaker II than in beaker I.
(C) It will be the same in both beakers.

N423901

57. If both beakers of water are heated to boiling, which of the following will be true for the contents of the beakers?

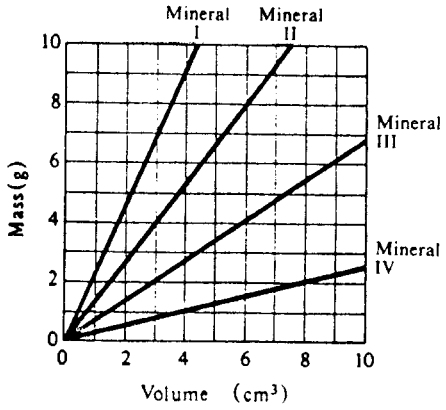
(A) Beaker I will have a greater amount of heat energy per gram of water.
(B) Beaker II will have a greater amount of heat energy per gram of water.
(C) Both beakers will have the same amount of heat energy per gram of water.

N423902

58. The volume of water put into a tank is equal to the rate of flow multiplied by the time it flows. An equation that shows this relationship is

(A) volume = rate × time.
(B) rate = volume × time.
(C) time = rate × volume.
(D) time = rate/volume.
(E) volume = time/rate.

N409301



59. If you wish to obtain a sample of the mineral that has the greatest mass for a given volume, which of the minerals should you select?

(A) I **(B)** II **(C)** III **(D)** IV

N436801

▶ **Questions 60-65.** Can each of the following statements be used to describe weather?

60. The wind speed is 15 miles per hour. **(A)** Yes **(B)** No N406801

61. Sunrise occurred at 7:45 A.M. **(A)** Yes **(B)** No N406802

62. The rainfall yesterday was 2 inches. **(A)** Yes **(B)** No N406803

63. The air is very dry today. **(A)** Yes **(B)** No N406804

64. Today is the first day of spring. **(A)** Yes **(B)** No N406805

65. The average yearly temperature is 15 degrees Celsius. **(A)** Yes **(B)** No N406806

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66. If energy is added to ordinary ice, the ice melts. Which one of the following statements is TRUE?

(A) When ice melts, a chemical change occurs.
(B) Liquids are always more stable than solids.
(C) The energy content of the ice is higher than the energy content of the water.
(D) Molecules in the ice are arranged in a more orderly way than molecules in the water.

N411701

67. Why will discharge of sewage wastes into lakes and rivers having abundant varieties of fish eventually eliminate much of the fish population?

(A) The waters will be excessively heated by thermal pollution.
(B) The waters will become turbid, making it hard for the fish to find their prey.
(C) The number of spots where fish can lay their eggs will be reduced.
(D) The amount of oxygen available will be markedly reduced.

N424501

68. Ten grams of A is added to 8 grams of B, and the container is capped. In the resulting chemical reaction, all of A and all of B are used to produce 6 grams of C and a certain amount of D. Chemicals A, B, C, and D are the only chemicals involved in this reaction. How much D is produced?

(A) Less than 12 grams
(B) 12 grams
(C) More than 12 grams
(D) It depends on what the chemicals are. N411601

69. When the Moon, the Earth, and the Sun are in the same line, as shown below, which of the following could occur?

(A) An eclipse of the Sun could occur.
(B) An eclipse of the Moon could occur.
(C) The Moon could be pulled out of its orbit toward the Sun.
(D) The spin of the Earth could be speeded up.

N414401

70. Due to the expansion of our universe, the wavelengths of the light from the most distant stars are shifted to longer wavelengths. A combination of which two of the following instruments could be used to measure this property of the distant stars?

I. Telescope
II. Microscope
III. Spectrometer
IV. Thermometer

(A) I and II
(B) I and III
(C) II and III
(D) III and IV N418001

71. The data below were obtained by placing a cup of water in a freezer and measuring the temperature of the water every minute.

Time in Minutes	Temperature in Degrees Celsius
0	20°
1	10°
2	0°
3	0°
4	0°
5	0°
6	0°
7	0°
8	-10°
9	-20°
10	-23°

What happened between minute 2 and minute 7?

(A) The water got cooler.
(B) The ice got cooler.
(C) The water froze.
(D) The ice melted. N427201

WHEN YOU HAVE FINISHED

Please check to make sure you have marked *one* answer for each question. When you have checked your answers place your *Answer Sheet* inside the front cover of the test booklet. All of the booklets will be collected at the same time after everyone is finished. Please sit quietly while others are completing their work.

LONGITUDINAL STUDY OF AMERICAN YOUTH
10TH GRADE SCIENCE TEST
FALL 1987

tudent's Name

XAMPLE: Ⓐ Ⓑ ● Ⓓ

CORRECT MARK
Ⓐ Ⓑ Ⓒ ● Ⓔ

INCORRECT MARKS
⊗ ⊘ ⊘ ⊘ ⊖

- Use black lead No. 2 pencil.
- Make heavy marks the full length of the boxes.
- Make only one mark per question.
- Erase cleanly any unintended marks.

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FOR LSAY USE ONLY

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1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9