

Longitudinal Study of American Youth

SCIENCE

(Form T)

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.

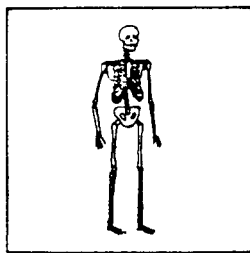
MARKING YOUR ANSWERS

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.

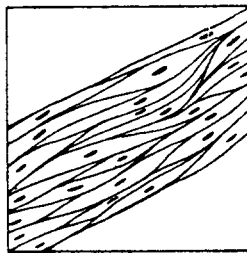
Do not make any stray marks on your *Answer Sheet*. Do all of your calculations on the Question Booklet, and use the *Answer Sheet* only to record your answers.

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.

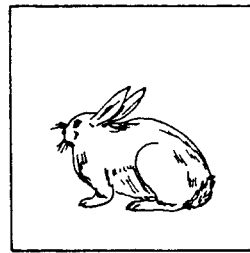
1. Look at the pictures below, then answer the question.



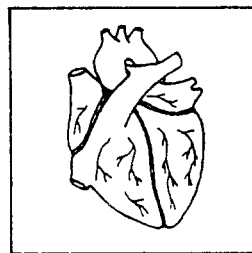
A



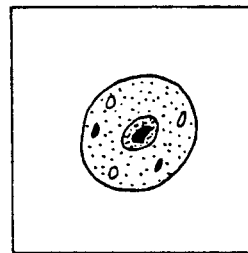
B



C



D



E

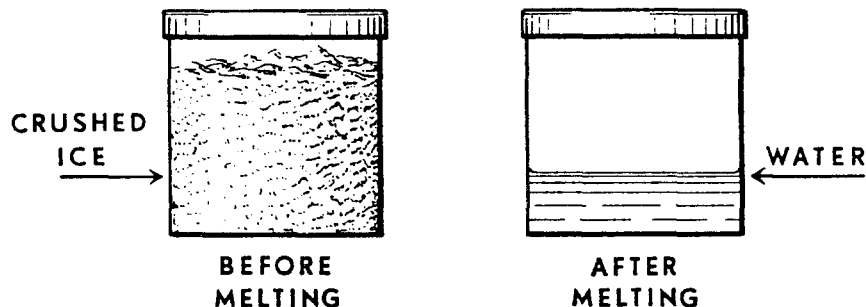
Which one of the following best shows the order of these pictures from simplest to most complex?

- (A) A B C D E
(B) E B D A C

- (C) E A D B C
(D) C A B D E

- (E) A C E D B

2. 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.



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

- (A) The weight was the same. (C) The weight was less.
 (B) The weight was more. N405101
3. The atomic age has produced tools that have been particularly useful in understanding the biological process of photosynthesis. Which of the following are of most use to researchers in studying this process?
- (A) Radioactive isotopes (C) X-ray machines
 (B) CAT scanners (D) Laser beams N427901
4. A student was asked to find the percentage of diseased elm trees in a large forest where Dutch elm disease was found. Rather than count every elm tree, the student selected a few representative areas, counted the number of normal and diseased trees, and estimated the number for the entire forest. Which of the following conditions must be met if this technique is to be valid?
- (A) The samples must be restricted to areas where no trees other than elm trees are growing.
 (B) The samples must be sufficiently large.
 (C) All the sampling must be done by the same person.
 (D) The sampling must be repeated over a period of several months. N425401
5. Air in the hydraulic brake lines of cars can lead to improper functioning of the brake pedal. Which of the following is the kinetic molecular theory statement that explains this phenomenon?
- (A) The particles in a gas are farther apart than the particles in a liquid are.
 (B) The particles in a gas are in constant motion.
 (C) The particles in a liquid are held in rigid geometrical arrays.
 (D) The more energetic liquid particles can escape the attractive forces among them and become gas particles. N437401
6. 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
7. Which of the following is the most important cause of the seasons in the temperature 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

8. 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

9. Which of the following is the best way to induce an electrical current in a coil of wire?

- (A) Heating the coil uniformly
- (B) Surrounding the coil with oil
- (C) Pounding the coil with a hammer.
- (D) Rotating the coil in a magnetic field
- (E) Stroking the coil with a piece of cat's fur

N407901

10. 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

11. Which statement best describes how the earth's rocks change over billions of years?

- (A) Large rocks break up into smaller and smaller pieces, until most of the whole surface is sand.
- (B) Grains of sand form together into larger and larger pieces until most of the surface is solid rock.
- (C) Large rocks break up and are eventually formed back into rocks, and so on over and over again.
- (D) Large rocks and sand stay side by side with very little change.

N407801

12.

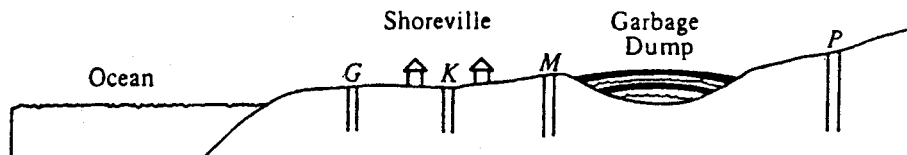
Tube Number	Tube Contents	Iodine Test	Benedict's Test	Biuret Test
1	Sugar	Brown	Green, Orange	Blue
2	Starch	Blue-Black	Blue	Blue
3	Protein	Brown	Blue	Purple
4	Egg White	Brown	Blue	Purple
5	Water	Brown	Blue	Blue

Based on the results of the investigation shown above, egg white contains which of the following?

- (A) Sugar only
- (B) Starch only
- (C) Protein only
- (D) Sugar, starch, and protein

N426901

13.



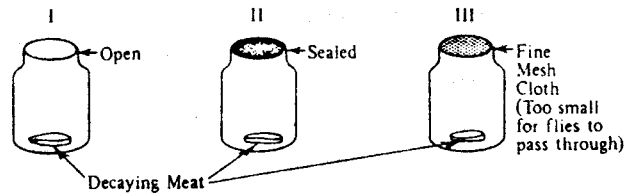
The city of Shoreville is considering drilling a well as a source of drinking water at locations *G*, *K*, *M*, or *P*, shown above. Which of the well sites would be the best choice for the benefit of the community?

- (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

14. Which of the following best explains why logs can be floated down a river?
- (A) Wood has a lower mean density than water and so will remain only partly submerged in the water.
 - (B) The buoyant force of the water on the logs is less than the weight of the logs.
 - (C) River water has a greater density than pure water because river water contains many dissolved minerals.
 - (D) Logs are not porous and so they cannot absorb any water.
- N422301
15. Karen has found a gray rock. Which of the following would be of LEAST help to her in determining whether it is a limestone (carbonate) rock?
- (A) Finding fossils in the rock
 - (B) Checking the hardness of the rock
 - (C) Placing some acid on the rock
 - (D) Measuring the volume of the rock
- N420301
16. A science class experimented on twenty mice to see if eating sugar causes cavities in their teeth. A special food which was half sugar was fed to the mice for a year. Sixteen of the twenty mice got cavities in their teeth. Which one of the following procedures would have improved the experiment?
- (A) Feeding the mice more sugar
 - (B) Repeating the experiment over again in the same way and comparing the results
 - (C) Having another group of mice that didn't get any sugar and comparing the two groups
 - (D) Keeping the experiment going until all the mice had cavities
- N408401
17. It is often said that more people of the world could be fed with available food if people ate more organisms on the lower end of a food chain. What is the biological basis for this claim?
- (A) Certain organisms are more nutritious than others.
 - (B) The Earth contains less biomass at lower levels.
 - (C) Agricultural pests and bacteria would have less opportunity to destroy food.
 - (D) There is a loss of potential energy at each transfer from the producers to higher-order consumers of a food chain.
- N426801
18. How do air masses that form over oceans during the winter compare with air masses that form over continents during the winter?
- (A) The air masses that form over oceans are colder and drier than air masses that form over continents.
 - (B) The air masses that form over oceans are colder and wetter than air masses that form over continents.
 - (C) The air masses that form over oceans are warmer and drier than air masses that form over continents.
 - (D) The air masses that form over oceans are warmer and wetter than air masses that form over continents.
- N408201
19. 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
20. Boston is a city at sea level and Denver is over 5,000 feet above sea level. Which of the following is true when 1 liter of pure water is heated to boiling in Denver?
- (A) The boiling point is lower than in Boston.
 - (B) The boiling point is higher than in Boston.
 - (C) It takes longer to heat the water to boiling than in Boston.
 - (D) It takes more energy to heat the water to boiling in Boston.
- N437301

21.



In 1668 Francesco Redi questioned the idea that flies arise spontaneously from decaying meat. To prove that flies come from the eggs laid by other flies, Redi placed decaying meat in clear containers similar to those pictured above. If Redi were correct, in which containers should he have expected to find fly larvae?

- (A) I only
 (B) I and II
 (C) I and III
 (D) II and III

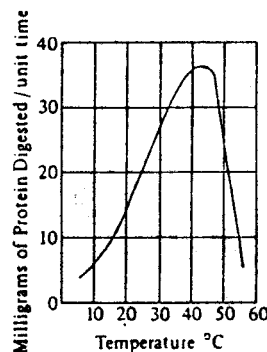
N425301

22. If a stone is a diamond, it can scratch glass. Stone B can scratch glass. Which of the following statements about stone B is true?

- (A) It is a diamond.
 (B) It is not a diamond.
 (C) There isn't enough information to tell whether or not it is a diamond.

N413301

23.



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

24. Which of the following is true of the process of respiration?

- (A) It is universal in animals and plants.
 (B) It is universal in animals but limited to a few plants.
 (C) It is universal in plants but limited to a few animals.
 (D) It is limited to vertebrate animals and green plants.

N420101

25. A student wanted to study the effect of heat on the growth of a particular type of plant. She placed one seedling in each of ten identical pots that contained the same type of soil, and she gave each pot the same amount of water. She then divided the pots into two groups. She placed one group on a window sill where it would be heated by the Sun and placed the other group in a closet on the cool (north) side of her house.

What was wrong with the design of her experiment?

- (A) The temperature difference between the two sets of seeds was not great enough to make a difference.
 (B) Seedlings require light to grow.
 (C) Both heat and light were different for the two groups.
 (D) One group of seedlings was cooler than the other.

N425801

26. 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

27. 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.

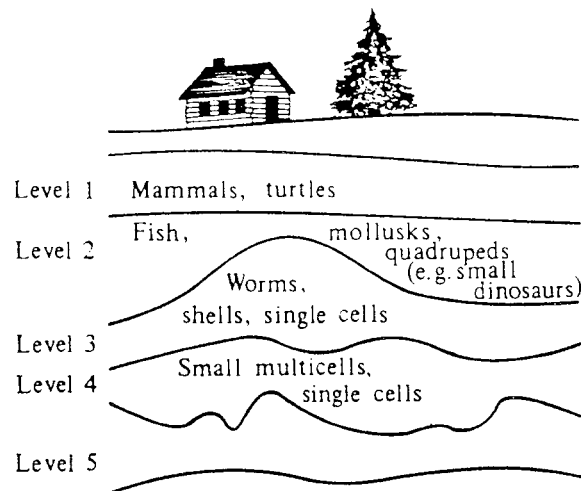
N424401

28. 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

29.



The drawing above shows a side view of rock layers containing various kinds of fossils. Which of the following can you conclude from the drawing?

- (A) Organisms at level 1 are older than those at level 2 because their fossils are smaller.
- (B) Organisms at level 2 are youngest because their fossils have shapes similar to those of modern organisms.
- (C) Organisms at level 4 are the oldest because they are in the lowest layer that contains fossils.
- (D) There are no organisms in level 5 because there has not been enough time for fossils to sink to that level.

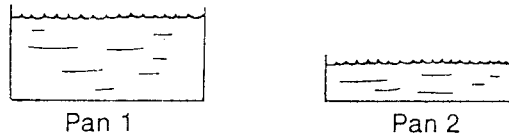
N423301

30. Methods that are recommended for the control of soil erosion include all of the following EXCEPT

- (A) plowing leftover plant stubble to clear the land.
- (B) using strip-cropping on cultivated land.
- (C) making terraces on cultivated slopes.
- (D) taking out of cultivation all areas with very steep slopes and planting grass or trees as cover.

N426601

► QUESTIONS 31-33: Two flames of the same size were used to heat the two pans of water shown below. Both pans were heated until they reached 90 degrees Celsius.



31. In which pan did the temperature reach 90 degrees first?

- (A) Pan 1
- (B) Pan 2
- (C) Both at the same time

N404901

32. To which pan was the most heat added?

- (A) Pan 1
- (B) Pan 2
- (C) Same amount was added to both

N404902

33. Which pan cooled down the fastest when the flame was turned off?

- (A) Pan 1
- (B) Pan 2
- (C) Both at the same time

N404903

34. Every year for seventy-eight years it has snowed on a mountain top on January 12. Next year on January 12,

- (A) it will snow for sure.
- (B) the chances are very good that it will snow.
- (C) the chances are 50-50 that it will snow.
- (D) the chances are poor that it will snow on January 12 seventy-nine years in a row.
- (E) it will not snow because the odds are against snowing seventy-nine years in a row on January 12.

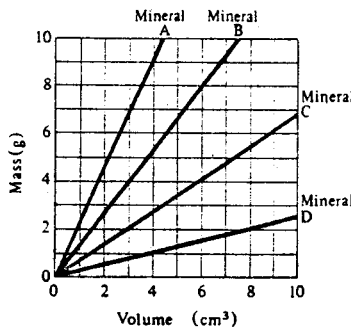
N409001

35. 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

► Questions 36-37 refer to the graph.



36. 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) A
- (B) B
- (C) C
- (D) D

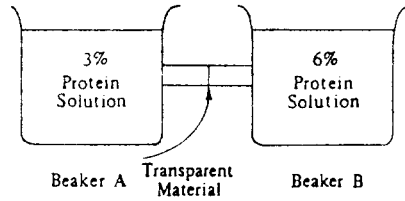
N436801

37. Water has a density of 1 gram per cubic centimeter. Which mineral(s) would float in water?

- (A) A only
- (B) D only
- (C) A and B only
- (D) C and D only

N436802

38.



The figure above 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.

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

39. 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

40. 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

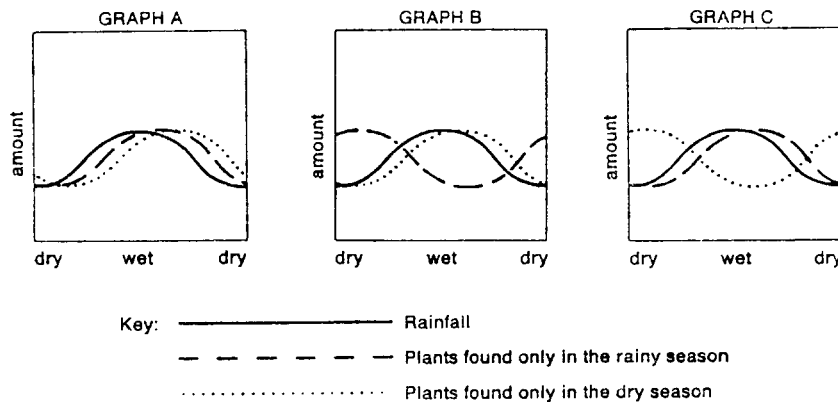
41. A scientist carried out an experiment, holding constant all variables except X and Y. After X was changed, Y was measured. According to the chart of results below, which statement is true about X and Y?

- (A) As X increases, Y increases in the same proportion.
- (B) As X increases, Y decreases in the same proportion.
- (C) X and Y are not related.

Trial	X	Y
1	0.5	16.0
2	2.0	4.0
3	6.0	1.3

N434001

42.



There are some places in the world where rainfall is seasonal. Several months of rain are followed by a long dry period. In these places, some plants are found only in the rainy season, while others are found only in the dry season. Which one of the graphs above best shows the relationship between the rainfall and the two kinds of plants?

- (A) Graph A
- (B) Graph B
- (C) Graph C

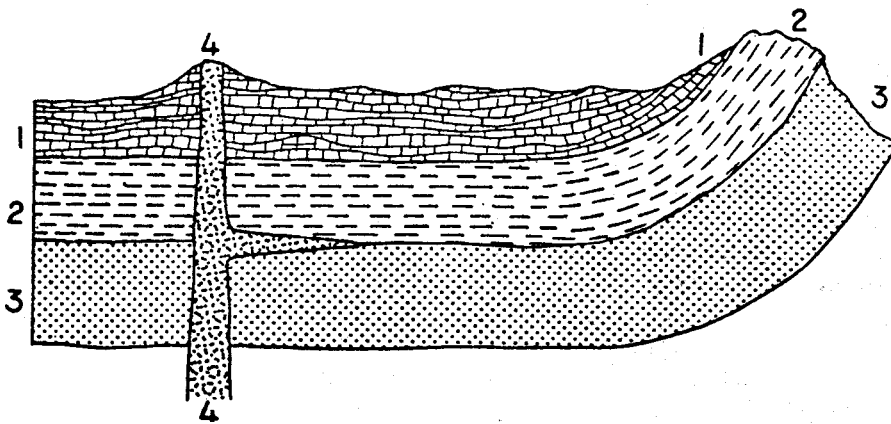
N409601

43. 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

44.

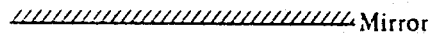


This diagram represents a cross-section of one part of the earth's crust. Layers 1, 2, 3 and 4 are each different kinds of rock. The layers curve up on the right side of the diagram. How can the curve of Layer 2 be explained?

- (A) Layer 2 is sedimentary rock which was formed by sediment collecting on an underwater hillside.
- (B) Layer 2 was probably flat once, but it has been bent by huge earth forces.
- (C) There must be something wrong with the diagram because all rock layers are flat and level.

N407302

45.



Objects are placed in front of an ordinary mirror at points I, II, and III as shown in the diagram above. Which of the objects can be seen in the mirror by a person at point P?

- (A) I only
- (B) II only
- (C) II and III only
- (D) I, II, and III

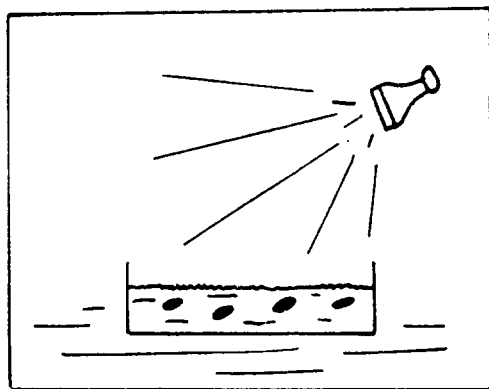
N430601

46. Which of the following produces the antibiotic penicillin?

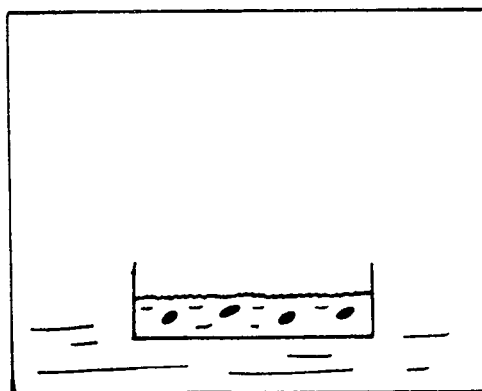
- (A) Protists
- (B) Molds
- (C) Protozoa
- (D) Algae

N419101

47. Look at the two pictures below.



LIGHT



DARK

Seeds from the same package are planted in two boxes. The boxes contain the best kind of soil and enough water for growth. One container has light shining on it, and the other is in the dark. What will happen to the seeds?

- (A) Only the seeds in the light will start to grow.
- (B) Only the seeds in the dark will start to grow.
- (C) The seeds in both pictures will start to grow.
- (D) The seeds will not start to grow in either one.

N406001

48. Elements with chemical characteristics most similar to those of sodium are listed in what part of the periodic table?

- (A) Immediately to the right of sodium in the same row
- (B) Immediately to the left of sodium in the same row
- (C) Above and below sodium in the same column
- (D) On the far right of the periodic table

N419601

49. The new product Super Plant Food has been advertised. Claims have been made that Super Plant Food will cause plants to grow to giant sizes. Directions on the label of this new product say: "Simply add 1 teaspoon of Super Plant Food powder to each gallon of water used to water your seeds or growing plants. Plants watered with Super Plant Food solution will grow faster and become twice as large as normal plants."

Suppose you wish to test scientifically the claims of the makers of Super Plant Food. Which of the following experiments would best test whether Super Plant Food helps the growth of bean plants?

- (A) Place 1 bean seed in each of two identical pots of soil. Water each pot with the same amount of Super Plant Food solution each day.
- (B) Plan 10 bean seeds in a pot of soil. Water with the same amount of Super Plant Food solution each day.
- (C) Plan 10 bean seeds in each of two identical pots of soil. Water one pot with a cup of Super Plant Food solution each day, and water the other pot with a cup of water each day.
- (D) Place 100 bean seeds on a sponge. Keep the sponge moistened with Super Plant Food solution.

N421301

50. Adele decided to try Super Plant Food solution on her potted begonia plants. She placed 5 begonias on a table near a window and watered each plant daily with the same amount of Super Plant Food solution. After two weeks, Adele was amazed to see that all of the begonia plants were bending over in the same direction. Adele believed that the Super Plant Food caused the bending. How could she test this?

- (A) Leave 2 similar begonia plants in the window. Water one with Super Plant Food solution as before and water one without Super Plant Food.
- (B) Leave the original 5 plants where they are, continue to water with the same amount of Super Plant Food solution, and observe for two more weeks.
- (C) Leave the original 5 plants where they are and double the amount of Super Plant Food solution used in watering them for two more weeks.
- (D) Place 5 similar begonia plants in a dark closet and water them with plain water each day for two weeks.

N421302

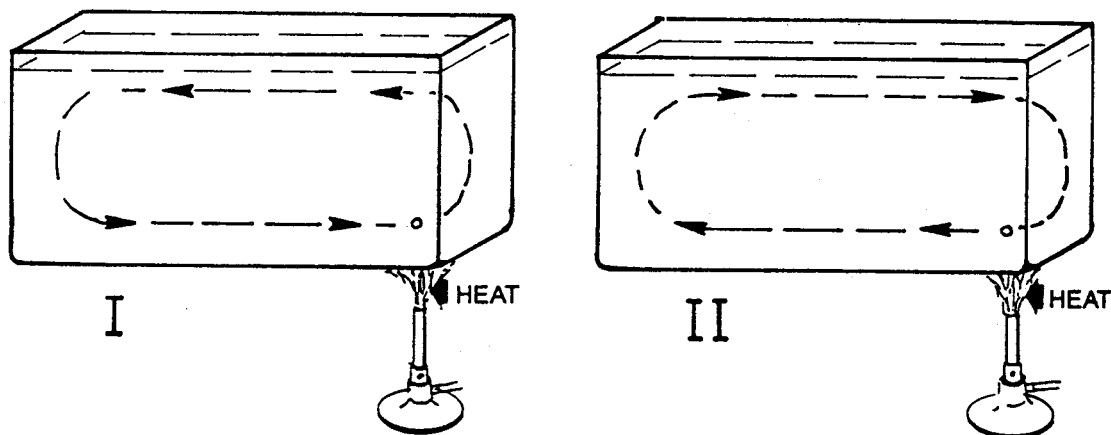
51. Which of the following objects has the greatest density?

- Mass of Object**
 (A) 11.0 grams
 (B) 11.0 grams
 (C) 5.5 grams
 (D) 5.5 grams

- Volume of Object**
 24 cubic centimeters
 12 cubic centimeters
 4 cubic centimeters
 11 cubic centimeters

N426201

52.



Imagine a tiny particle of water in a tank being heated as shown. The particle would probably be moving

- (A) as shown in figure I.
 (B) as shown in figure II.
 (C) sometimes as shown in figure I and sometimes as shown in figure II.
 (D) very little or not at all.

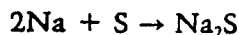
N407601

53. 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

54.



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

55. Five hundred cockroaches of one species were sprayed with a new insecticide. Twenty-four hours later nearly all the cockroaches were dead. A few, however, survived. This outcome illustrates which one of Darwin's key ideas?

- (A) All living things come from preexisting living things.
 (B) Animals adapt to new environments.
 (C) There is variation among individuals within a species.
 (D) New species develop from survivors.

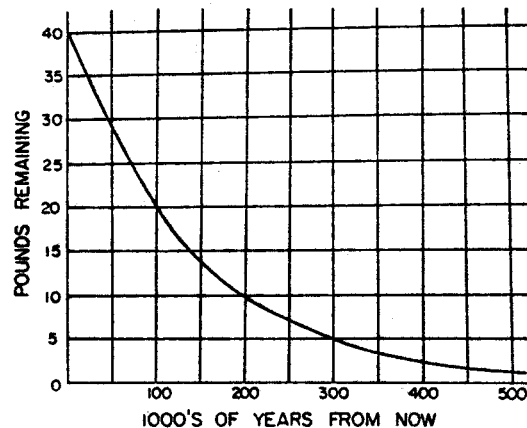
N418501

56. A formula for copper nitrate is $\text{Cu}(\text{NO}_3)_2$. For every copper atom in this compound, the number of oxygen atoms is

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

N411401

57. Look at the graph below.



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

58. An airport was built at the edge of a large city, despite the protests of those living in the neighborhood. They complained that the noise level would be hazardous to their health. During the first year of the airport's operation, the incidence of partial hearing loss in the region directly adjoining the airport rose 10 percent over that of the preceding year. Which of the following is a valid conclusion based on these data?

- (A) The protesters were correct. The increased noise had a harmful effect on the population.
 (B) The increase in hearing loss was not significant.
 (C) There may be a correlation between the noise and the increased hearing loss. Further study is appropriate.
 (D) There is no proof that the noise caused the hearing loss and therefore nothing can be done.

N428801

59. 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

60. Why do most schoolrooms have fluorescent light tubes rather than ordinary household light bulbs?

- (A) They are more soothing to the eyes.
 (B) They are better for helping children learn.
 (C) They are able to produce light that is more like natural sunlight.
 (D) They are more efficient and therefore cheaper to use.

N423701

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

SCIENCE TEST (FORM T)

Student's Name _____	CORRECT MARK (A) (B) (C) (●) (E)	<ul style="list-style-type: none"> 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.
	INCORRECT MARKS (X) (○) (∕) (⊖) (⊕)	

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