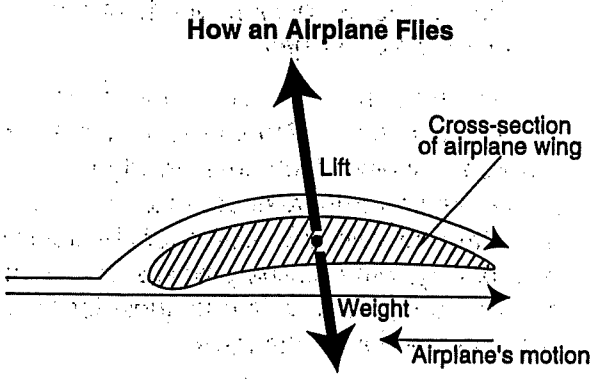
SCIENCE PRACTICE TEST

Directions: Use 35 minutes to answer the following 16 questions. You may fill in the circles next to the correct answers or write your answers in boxes or on lines as indicated.

Question 1 refers to the following paragraph and diagram.

Newton's third law of motion states that when one object exerts a force upon another object, the second object exerts an equal force on the first, in the opposite direction. An airplane in motion changes the speed and direction of the air, exerting a force on it. The opposing force of the air keeps the airplane aloft.



1. What vertical force holds the airplane up?

   - A. lift
   - B. Newton's third law
   - C. weight
   - D. air resistance

2. Sleep may have evolved in humans for several reasons. First, people were unable to hunt, gather food, or travel in the dark. Second, sleep provides an opportunity to repair our body's cells, especially those in the brain. Third, our body temperature is lower during sleep, which conserves energy. Fourth, during deep sleep the pituitary gland releases a growth hormone, so sleep may play a role in growth.

   Which of the following is the best title for this paragraph?

   - A. "Sleep and Growth"
   - B. "Our Brains During Sleep"
   - C. "Why We Sleep"
   - D. "The Role of Deep Sleep"

3. You MAY use your calculator on this question.

   A scientist shines a laser through six beakers, each containing a different liquid substance, and measures the laser beam's angle of refraction. The scientist records her measurements for liquids A–E in the table below; her measurement for liquid F is lost.

Liquid	Angle of Refraction (degrees)
A	15
B	32
C	12
D	47
E	15
F	?

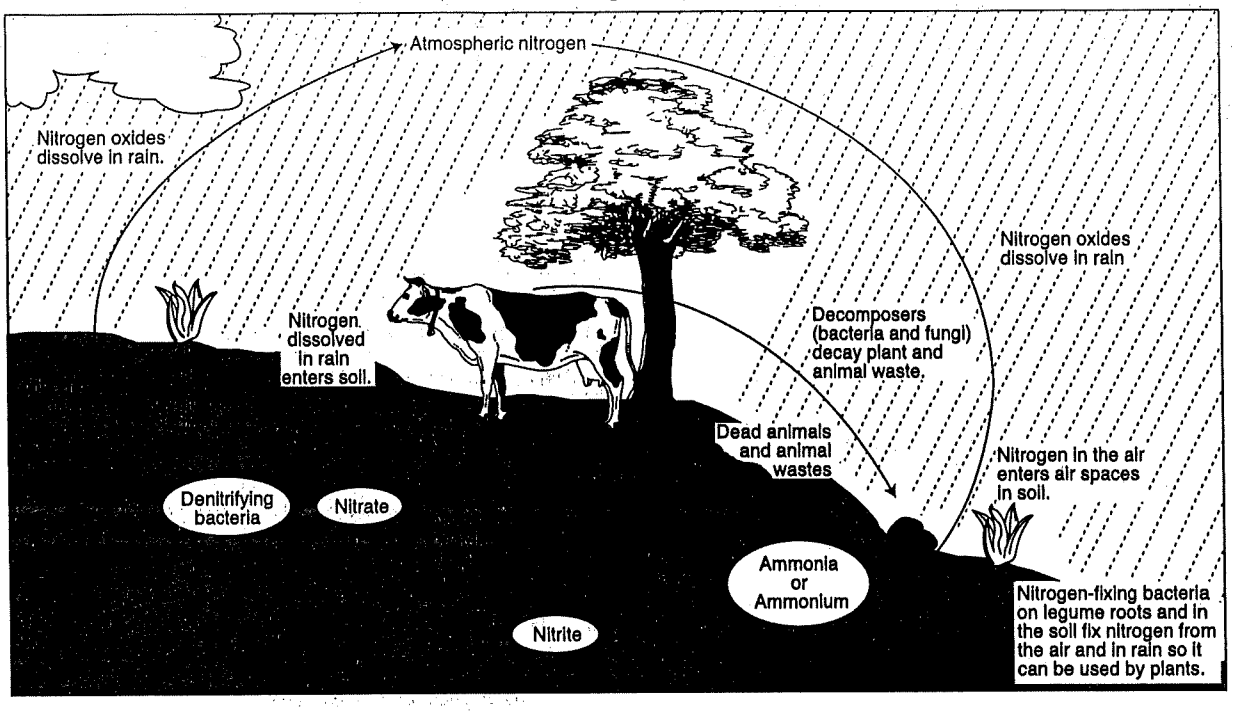
However, the scientist recalls that the mean of all six angle measurements was 23 degrees. What must the laser beam's angle of refraction through liquid F have been?

Write your answer in the box below.

Questions 4 through 6 are based on the following information and graphic.

The processes that circulate nitrogen between the atmosphere, land, and organisms are called the nitrogen cycle.

The Nitrogen Cycle



4. Nitrogen-fixing bacteria are found both in the soil and on the roots of legumes like peas and beans. From where do these bacteria get nitrogen?

   ○ A. ammonia and ammonium
   ○ B. the air and rainwater in the soil
   ○ C. animals and animal wastes
   ○ D. animal wastes and decaying plants

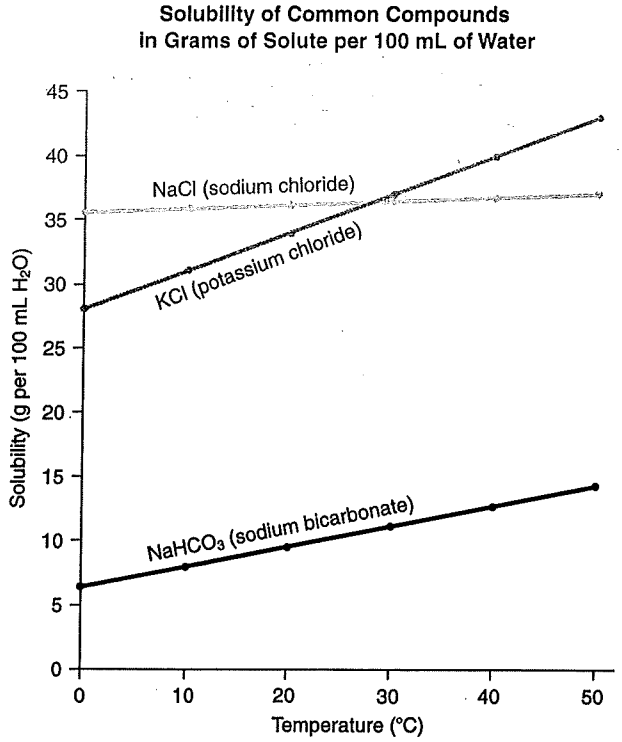
5. Which of the following statements is a conclusion about the nitrogen cycle rather than a detail in the diagram?

   ○ A. Nitrogen oxides dissolve in rainwater.
   ○ B. Nitrogen-fixing bacteria are found both in the soil and on the roots of legumes.
   ○ C. The recycling of nitrogen through the biosphere involves many complex processes.
   ○ D. Nitrite bacteria turn ammonia and ammonium into nitrites.

6. To increase the nitrogen content of the soil, many farmers spread synthetic fertilizers containing nitrogen compounds. What might an organic farmer, who does not use synthetic fertilizers, do to improve the fertility of the soil?

   ○ A. switch to crops requiring more potassium
   ○ B. compost with plant and animal wastes
   ○ C. plant more nonleguminous plants
   ○ D. switch to crops requiring more nitrogen

Question 7 refers to the following graph.



7. Which of the following statements is supported by the information in the graph?

   ○ A. About 15 grams of sodium bicarbonate will dissolve in 100 mL of water at 10°C.
   ○ B. About 30 grams of potassium chloride will dissolve in 100 mL of water at 30°C.
   ○ C. Sodium chloride shows the greatest increase in solubility with increase in temperature.
   ○ D. For the three compounds shown, solubility increases as temperature increases.

8. Directions: Following the scientific method, a researcher conducted an experiment using houseplants. Match each action the scientist took to the step in the scientific method below.

Step of the scientific method	The scientist's action
Step 1. Formulate a question about a phenomenon	
Step 2. Collect data	
Step 3. Form a hypothesis	
Step 4. Test the hypothesis through an experiment	
Step 5. Draw a conclusion	

a. For 6 weeks, the scientist used water at 75 degrees to water plants in Group A and used water at 55 degrees to water plants in Group B. He recorded their growth during this period.
b. The scientist wondered whether water at different temperatures might affect houseplants differently.
c. The scientist researched the growth rate of plants at various greenhouses, some of which use cool water and some of which use warm water to water their plants.
d. At the end of 6 weeks, the plants in Group A were, on average, 2" taller than plants in Group B. The scientist interpreted this to mean that warm water is better for plants than cool water.
e. The scientist guessed that warm water might be better for plants than cool water.

9. Atoms are composed of protons (positive charge), neutrons (no charge), and electrons (negative charge). Because an atom has an equal number of protons and electrons, it has a total charge of zero.

   What would happen if an atom lost an electron?

   ○ A. Its charge would become positive.
   ○ B. Its charge would become negative.
   ○ C. Its charge would remain neutral.
   ○ D. Its neutrons would gain a positive charge.

10. Weathering is the breaking down of rock by rain, frost, wind, and other elements. No transport is involved in weathering. The weathered rock remains in place. Weathering can be physical, involving abrasion—the wearing away of a surface—or changes in temperature; it can be chemical, involving chemical reactions; or it can be organic, involving the action of living things.

    Which of the following is an example of physical weathering?

    - ○ A. the cracking of granite from the expansion of freezing water
    - ○ B. the breakdown of calcite by reaction with acids in fertilizer
    - ○ C. the transport of sand by the wind
    - ○ D. the breakdown of crumbling rock in the soil by burrowing worms

11. When removed from the body, large organs live only a few hours or days under cold conditions. Therefore, organ transplants must be performed quickly. Many organs go to waste because the organ cannot be transported to an appropriate patient in the short time available. Unfortunately, it is not yet possible to freeze large organs to preserve them for a longer period. That's because they contain many different types of cells, all of which react differently to freezing. Some cells are even destroyed by the ice crystals that form during freezing.

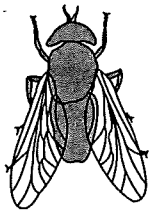
    Which of the following studies is most likely to yield information that might help solve the specific problem of freezing whole organs for transplant?

    - ○ A. how the time it takes to locate patients who need organs can be decreased
    - ○ B. how the time it takes to transport organs to their destinations can be decreased
    - ○ C. how special fluids keep insects alive during subfreezing weather
    - ○ D. how radioactive isotopes can be used to diagnose the condition of donated organs

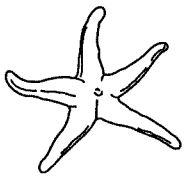
12. Most animals have bodies that exhibit either bilateral symmetry or radial symmetry. If you drew a straight line down the middle of an animal exhibiting bilateral symmetry, the two sides would be mirror images of one another. Such animals have a front end and a rear end. On the other hand, an animal exhibiting radial symmetry has a body consisting of similar parts arranged around a center.

    Circle the image of the animal(s) below displaying a radially symmetrical body plan.

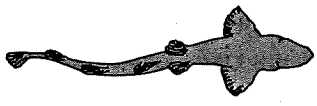
    A. salt marsh greenhead fly

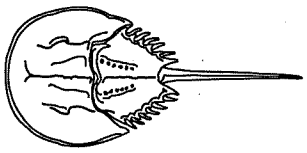
    B. sea star

    C. dogfish

    D. horseshoe crab

13. Hydrogen peroxide molecules are composed of two hydrogen atoms and two oxygen atoms. Water is also composed of hydrogen and oxygen, but water has one fewer oxygen atom than hydrogen peroxide does. Which of the following statements best describes the chemical reaction shown in the equation below?

    $$2H_2O_2 \rightarrow 2H_2O + O_2$$

    - ○ A. Hydrogen peroxide is being made out of water and air.
    - ○ B. Hydrogen peroxide is decomposing into pure water.
    - ○ C. Hydrogen peroxide is decomposing into water and oxygen.
    - ○ D. Water and oxygen are combining to make hydrogen peroxide.

Question 14 refers to the following chart.

Melting and Boiling Points

Element	Melting Point, F	Boiling Point, F
Mercury	-38	675
Bromine	19	138
Iron	2,795	5,184
Carbon	6,420	8,720
Gold	1,945	5,379

14. Which of the following statements is supported by the information in the chart?

- ○ A. Mercury and bromine are liquids at room temperature.
- ○ B. Iron has a higher melting point than carbon.
- ○ C. Iron has a higher boiling point than gold.
- ○ D. Mercury, bromine, iron, carbon, and gold are all metals.

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15. In 1969, the U.S. Surgeon General announced that infectious bacterial diseases would soon become a thing of the past because antibiotic drugs had become so effective against them. However, since that time, strains of disease-causing bacteria that are resistant to antibiotics have evolved. Some types of pneumonia and gastrointestinal infections are now untreatable by antibiotics. About 17 million people worldwide still die annually from infectious diseases.

Which of the following best explains why the U.S. Surgeon General's prediction was wrong?

- ○ A. Antibiotic drugs are not effective against most disease-causing bacteria.
- ○ B. Infectious diseases are also caused by viruses and parasites.
- ○ C. Infectious diseases have remained a problem outside the United States.
- ○ D. Bacteria quickly evolved resistance to antibiotic drugs.

16. A student did an experiment to see how far a ball would roll on different surfaces. She made five different ramps, each with a different surface: a plain pine board, a painted board, a board covered with sandpaper, a board covered with artificial turf, and a board covered with shag carpet. She set up his experiment on a smooth, level floor. To make the ramps, she raised one end of each board with a book. She collected four copies of the science textbook her class was using and set up four of the ramps with these books. She couldn't find a fifth copy of the book, so she used a thinner science study guide to set up the fifth ramp. She rolled a tennis ball down each ramp and measured how far the ball traveled each time. Then she compiled his data and drew conclusions.

Why was the student's experiment flawed?

- ○ A. The student should have used a ball with a smooth surface rather than a tennis ball.
- ○ B. The student should have used books of the same height for all of the ramps.
- ○ C. The student should not have used sandpaper as one of the surfaces.
- ○ D. For a control, the student should have rolled the ball across a piece of wood that was level.

Directions: Read the article and respond to the writing prompt below. Type your response on a computer, if one is available. If you do not have access to a computer, write your response neatly on paper. This task may require approximately 10 minutes to complete.

1 A local candy company has had great success with its new neon candy bars. The neon candy bars are featured in a range of five bright colors. They were designed to entice children with their visual appeal and have been selling extremely well since their release.

2 Recently, the company has been flooded with complaints that children are experiencing extreme hyperactivity shortly after consuming the neon candy bars. The company's original candy bars have not generated similar complaints. The only differences between the original candy bars and the new neon candy bars are the neon color of the bar, increased sugar content, and a design change on the outside of the packaging.

3 The candy company's development team has been debating what could be causing the hyperactivity. Developer A suggests that the type of food coloring used in the neon candy bars is causing the hyperactivity and a new type of food coloring should be explored. This claim has a basis in a study conducted a few years earlier that showed a competitor's candy bar increasing hyperactivity when the same food coloring was used.

4 Developer B doesn't believe that the food coloring responsible. She suggests that the increased sugar content of the neon candy bars is to blame for the hyperactivity the children are experiencing. While there is little scientific evidence linking sugar to hyperactivity, many parents of hyperactive children claim that sugar makes their children's behavior problems worse.

5 Developer C believes it is the new ink used on the packaging. On some items, the ink can leak through the thin wrapper and affect the product. The new design incorporates neon colors, and the ink used to produce those colors is made of harsher chemicals than were previously used.

Write a Short Answer Response

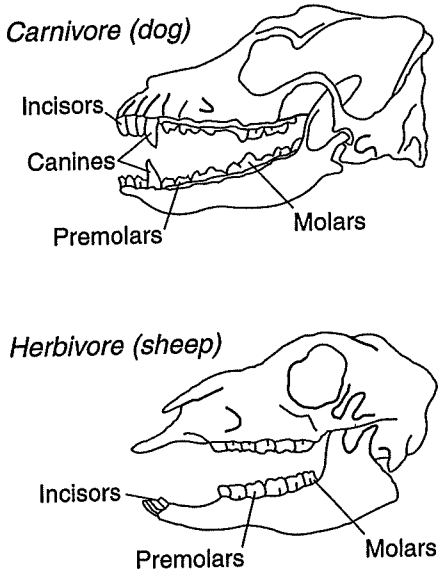
As part of an experiment conducted by the candy company, a group of children is given a new candy bar formulated with less sugar than the neon candy bars. This group of children experiences extreme hyperactivity. What could be causing the hyperactivity? Using information from the passage, suggest a hypothesis in answer to this question. Cite specific information from the passage as support for why your suggestion is plausible.

Directions: Use 35 minutes to answer the following 16 questions. You may fill in the circles next to the correct answers or write your answers in boxes or on lines as indicated.

Question 17 refers to the following paragraph and diagram.

Herbivores are animals that eat only plants; carnivores are animals that eat animals. Typical herbivore and carnivore teeth patterns are shown below.

Typical Teeth Patterns in Carnivores and Herbivores



17. What is the most notable difference between the dog's teeth and the sheep's teeth?

- ○ A. The dog has fewer teeth than the sheep does.
- ○ B. The dog has molars and the sheep does not.
- ○ C. The dog has incisors and the sheep does not.
- ○ D. The dog has canines and the sheep does not.

Question 18 refers to the following chart.

The Five Largest Asteroids

Name	Average distance from sun (Earth = 1)	Time to orbit sun
Ceres	2.77	4.6 years
Pallas	2.77	4.6 years
Vesta	2.36	3.6 years
Hygeia	3.13	5.5 years
Interamnia	3.06	5.4 years

18. Which of the following statements is supported by the information in the chart?

- ○ A. Pallas is further away from the sun than Hygeia is.
- ○ B. Of the five largest asteroids, Vesta has the longest orbital period.
- ○ C. The five largest asteroids are all farther from the sun than Earth is.
- ○ D. Of the five largest asteroids, only Interamnia takes more than five years to orbit the sun.

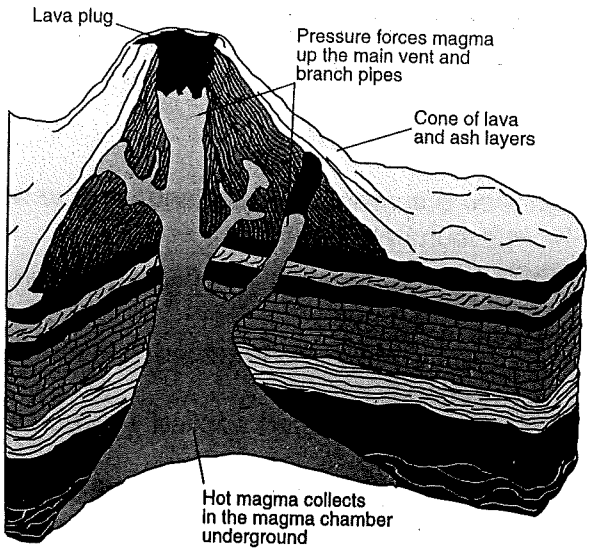
19. The American lobster, *Homerus americanus,* is typically bluish-green to brown in coloration. However, a rare genetic mutation, estimated to occur in 1 in 2 million lobsters, can result in a bright blue-colored shell. In 2011, 220 million pounds of lobsters, typically weighing 1–9 pounds each, were caught; two blue lobsters were reported in that time.

In 2011, the experimental probability of catching a blue lobster was [Select...] the estimated probability of a lobster having the blue mutation.

- greater than
- approximately the same as
- less than

Question 20 is based on the following diagram.

Structure of a Volcano



20. Based on the diagram, what causes a volcano to erupt?

- A. Pressure builds up inside the magma chamber and vent.
- B. Magma flows down toward the underground chamber.
- C. The lava plug at the top of the main vent wears away.
- D. The lava plug at the top of the main vent collapses inward.

21. In a chemical reaction, the atoms of the reactants are rearranged to form products with different chemical and physical properties. A catalyst is a substance that speeds the rate at which a chemical reaction takes place. The catalyst itself is unchanged at the end of the reaction. In which of the following reactions is a catalyst at work?

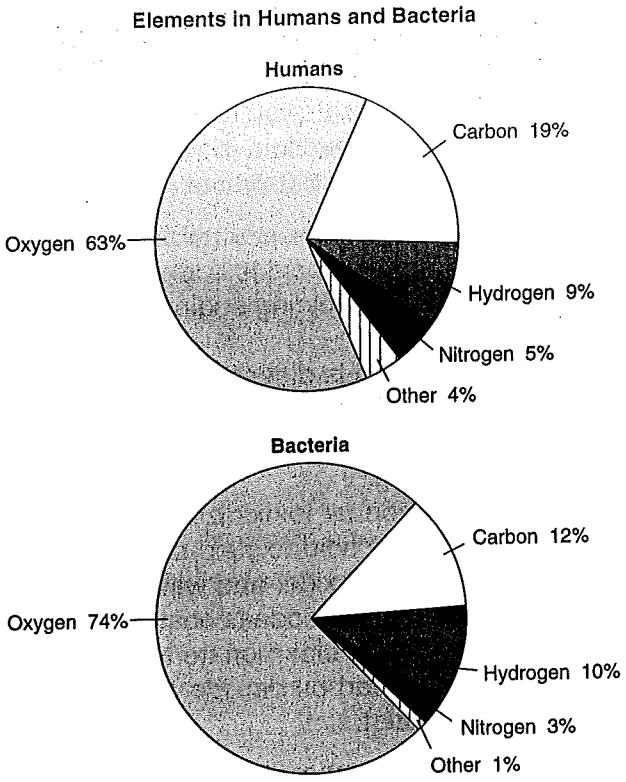
- A. when an acid is neutralized, as when hydrochloric acid is added to sodium hydroxide yielding sodium chloride and water
- B. when food is digested, as when an enzyme in saliva called ptyalin breaks down starch into sugars without itself changing
- C. when copper is oxidized by combining with nitric acid to yield copper nitrate, nitrogen dioxide, and water
- D. when baking soda is heated, causing the sodium bicarbonate to break down, yielding carbon dioxide gas as a byproduct

22. For five years, researchers at the University of Wisconsin Medical School ran an experiment in which they evaluated the hearing of 3,753 people between the ages of 48 and 92. Of the group, 46 percent were nonsmokers, 30.3 percent were former smokers, and 14.7 percent still smoked. The scientists found that smokers were nearly 1.7 times as likely as nonsmokers to suffer hearing loss. The study suggests that age-related hearing loss might be preventable.

Which of the following statements is most likely to have been the researchers' hypothesis?

- A. Smoking has been shown to harm health in many different ways.
- B. People can reduce their chances of developing age-related hearing loss by not smoking.
- C. The University of Wisconsin study group consisted of 3,753 people between the ages of 48 and 92.
- D. Smokers were nearly 1.7 times as likely as nonsmokers to suffer hearing loss.

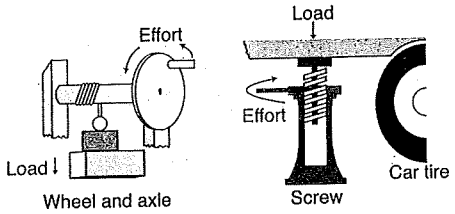
Question 23 refers to the following graphs.



23. What is one of the main differences between the composition of humans and that of bacteria?

- ○ A. Humans contain elements other than oxygen, carbon, nitrogen, and hydrogen and bacteria do not.
- ○ B. Humans contain a higher percentage of oxygen than bacteria do.
- ○ C. Humans contain a higher percentage of hydrogen than bacteria do.
- ○ D. Humans contain a higher percentage of carbon than bacteria do.

Question 24 refers to the following diagrams.



24. What do the wheel and axle and the screw have in common?

- ○ A. Both increase the effort needed to move a load.
- ○ B. Both involve effort applied with circular motion.
- ○ C. Both involve effort applied with horizontal motion.
- ○ D. Both involve effort applied with vertical motion.

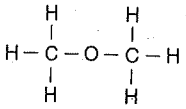
25. During various periods in Earth's history, average global temperatures have dropped, resulting in ice ages. During an ice age, glaciers cover large regions of Earth. Scientists disagree about what causes ice ages. One hypothesis suggests that there have been long term changes in Earth's orbit, causing the planet to periodically move farther from the sun. Another view proposes that a periodic increase in volcanic activity increases the dust in the atmosphere, blocking the sun's rays. Still another hypothesis suggests that changes in Earth's own radiant energy cause ice ages. And finally, other scientists propose that changes in the direction of ocean currents cause ice ages.

Which of the following statements is a fact and NOT an opinion or hypothesis?

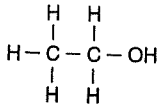
- ○ A. During an ice age, temperatures drop and ice covers vast areas of Earth.
- ○ B. Changes in Earth's orbit cause temperature fluctuations and ice ages.
- ○ C. Large amounts of volcanic dust blocking the sun's energy cause ice ages.
- ○ D. Changes in Earth's own radiant energy cause ice ages.

Question 26 refers to the following diagram.

Ether (C_2H_6O)



Ethanol (C_2H_5OH)



Key

C = Carbon

H = Hydrogen

O = Oxygen

26. What is the main difference between the hydrocarbons ether and ethanol?

- ○ A. Ether has carbon, hydrogen, and oxygen atoms, and ethanol has only carbon and hydrogen atoms.
- ○ B. Ether has three carbon atoms and ethanol has two carbon atoms.
- ○ C. Ether has one oxygen atom and ethanol has two oxygen atoms.
- ○ D. The arrangement of the carbon, hydrogen, and oxygen atoms in the two hydrocarbons is different.

27. In 1861, Charles Darwin, a naturalist who formulated the theory of evolution, remarked that the science of geology had made much progress in his lifetime. He wrote, "About thirty years ago there was much talk that geologists ought only to observe and not theorize; and I well remember someone saying that at this rate a man might as well go into a gravel-pit and count the pebbles and describe the colors. How odd it is that anyone should not see that all observation must be for or against some view if it is to be of any service!"

Which of the following statements best summarizes Darwin's view of the role of observation in science?

- ○ A. Observation is the best way to gather facts about any aspect of nature.
- ○ B. Observation is useful as long as it is supported by statistics.
- ○ C. Observation should be used only in the field of geology.
- ○ D. Observation is useful as long as the results are used to support or disprove a hypothesis.

28. Directions: Match each process to an example of that process.

The four types of processes that create minerals in Earth's crust are called *magmatic, hydrothermal, metamorphic*, and *surficial*. Magmatic processes involve the heating and cooling of magma deep inside the Earth's mantle to form crystals. Hydrothermal processes are caused by the movement of water within Earth's crust. Metamorphic processes involve combinations of heat, pressure, time, water, and various solutions to change existing mineral deposits and form new ones. Surficial processes are physical processes that affect rock at Earth's surface or in the loose material—soil and dust—that covers Earth's crust.

Type of process	Example of process
Magmatic	
Hydrothermal	
Metamorphic	
Surficial	

a. Wind eroding away the softer components in sandstone
b. A gradual increase in temperature in the mantle, followed by a sudden drop in temperature
c. Movement of seawater through fractured rock underground
d. Fault lines fracturing rock into particles underground and then those particles undergoing great heat and pressure

Question 29 refers to the following graph.

Rainfall in 5 Cities in California, 2008–2010

	2008–2009 Rain (in.)	2009–2010 Rain (in.)
Crescent City	49.35	62.77
Eureka	29.75	44.51
Ukiah	22.68	40.52
Redding	23.71	30.45
Sacramento	16.33	20.74

Source: Golden Gate Weather Services

29. Which city had the median increase in rainfall between the two time periods displayed in the table? Write your answer in the box below.

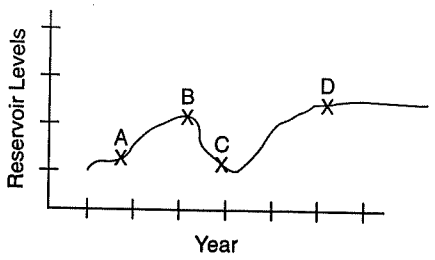
30. Brock's physics teacher has assigned everyone in his class the task of conducting an experiment. To write up their experiments, everyone must use the outline provided below.

Match each summary of the steps in Brock's experiment to the appropriate category in the experiment outline.

Experiment outline	Brock's steps
Step 1. Formulate a question about a phenomenon	
Step 2. Collect data	
Step 3. Form a hypothesis	
Step 4. Test the hypothesis through an experiment	
Step 5. Draw a conclusion	

a. Brock placed wooden cubes that were 1 cc, 10 cc, and 100 cc in water. He observed their buoyancy. Then he placed iron cubes of 1 cc, 10 cc, and 100 cc in water and observed their buoyancy.
b. Brock noted that ice floats in water, whether it is a small ice cube or a huge iceberg.
c. Brock said: "Since all wooden cubes float and all iron cubes sink, size does not affect the buoyancy of an object in water."
d. Brock asked, "Does size affect the buoyancy of an object in water?"
e. Brock thought: "For an object made of a given material, increasing the size of the object won't affect its buoyancy in water."

31. In 1993, after years of fluctuating water levels in their reservoir, the residents of Weyland County built a dam at one end of the reservoir to regulate and stabilize the water levels. Circle the X on the graph below that most likely represents 1993.



32. One property of a gas is that its molecules spread out to fill their container. Which of the following best illustrates this property of gases?

○ A. A teacher's perfume can be detected at the back of the classroom.
○ B. Rain puddles evaporate more quickly when the sun comes out.
○ C. Water is produced when hydrogen gas is burned in oxygen gas.
◎ D. Liquid oxygen is denser than gaseous oxygen.

Directions Read the article and respond to the writing prompt below. Type your response on a computer, if one is available. If you do not have access to a computer, write your response neatly on paper. This task may require approximately 10 minutes to complete.

Plants grow faster when humans talk to them, but it is not clear why. Some scientists have hypothesized that it is the actual air involved that makes the difference. When we speak, we exhale carbon dioxide. Increased levels of carbon dioxide improve a plant's ability to grow, so this may explain why talking helps plants. Others have hypothesized that the benefit to plants comes from the content of what is being said. They hypothesize that it is the words themselves and their positive meaning that increase a plant's growing ability.

Write a Short Answer Response

Describe an experiment that could be used to test the two hypotheses described above.

End of the *Science Test*

Answers and explanations begin on page 715.