When *Rodney's Magazine* came out with the story, George fully expected convulsions of the earth, falling meteors, suspension of traffic in the streets, and a general strike. But nothing happened. A few of his friends mentioned it, but that was all. For several days he felt let down, but then his common sense reassured him that people couldn't really tell much about a new author from a short piece in a magazine. The book would show them who he was and what he could do. It would be different then. He could afford to wait a little longer for the fame which he was certain would soon be his.

1. George wonders whether he would "have to go around in smoked glasses and false whiskers" (lines 38–39) because:
   - A. famous authors have to protect their privacy from admiring strangers.
   - B. a disguise would help him gather information for a new book.
   - C. if he were going to be a famous writer, he had better look the part.
   - D. people he had offended might otherwise confront him.

2. According to George's description, the process of writing a novel:
   - F. was similar to being overwhelmed by an alien spirit.
   - G. was a time filled with unspoken rage.
   - H. was best carried out during times when other people were asleep.
   - J. could only be performed when he was physically exhausted.

3. By saying to Foxhall Edwards that "There are better ways to write a book, but this, God help me, is mine, and you'll have to learn to put up with it," (lines 74–75) George sought to:
   - A. reassure Foxhall that the next book would, in fact, be completed.
   - B. emphasize that the process, though difficult, could not be avoided.
   - C. rebuke Foxhall for not having enough faith in his new project.
   - D. suggest that his own approach to writing was really superior to other approaches.

4. Information in the passage indicates that the public's initial response to George's story in *Rodney's Magazine* was:
   - F. sour.
   - G. tepid.
   - H. enthusiastic.
   - J. emotional.

5. According to the passage, Foxhall Edwards' belief in George's ability was important primarily because:
   - A. George needed a friend he could confide in.
   - B. *Home to Our Mountains* required extensive revision.
   - C. George needed a friend he could look up to.
   - D. Foxhall restored George's faith in his own work.

6. What was George's ultimate response to his story's publication in *Rodney's Magazine*?
   - F. He refused to accept that the story had few readers.
   - G. He expected that fame would come eventually anyway.
   - H. He convinced himself that he had never wished for fame.
   - J. He lost confidence in himself as a writer.

7. As it is used in the passage, the word *wooing* (line 15) means:
   - A. courting.
   - B. confusing.
   - C. admiring.
   - D. bothering.

8. The fact that George "sometimes trembled" (lines 29–30) when he thought of his novel's publication suggests that he:
   - F. secretly disliked Foxhall's suggestions.
   - G. was eager to meet the people back in his home town.
   - H. worried that some people would be hurt by his novel.
   - J. feared that critics would denounce his novel.

9. George's estimation of his novel's achievement can best be described as:
   - A. vain but bitter.
   - B. proud but concerned.
   - C. modest but hopeful.
   - D. angry but resigned.

10. The first paragraph suggests that, just prior to the moment at which this passage begins, George has most likely been:
    - F. wandering in dazed excitement after learning that his book would be published.
    - G. walking off nervous tension brought on by working on his second novel.
    - H. trying to find his way home from his book publisher's office.
    - J. in a joyous dream state as a result of being relieved of his financial difficulties.

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Passage II

SOCIAL SCIENCE: The following passage is excerpted from the text *A Short History of Western Civilization*, written by John B. Harrison, Richard E. Sullivan, and Dennis Sherman. (©1990 by McGraw-Hill, Inc.; reprinted by permission of McGraw-Hill, Inc.)

Italy emerged from World War I battered and humiliated. Although it was one of the victorious Allies, Italy's armies had made a poor showing, and Italy had realized few of the grandiose ambitions for which it had entered the war. In the Paris peace settlements, Italy had been awarded the adjacent Italian-speaking areas of Austria-Hungary but had been denied further acquisitions east of the Adriatic and in Asia and Africa, some of which it ardently desired. These frustrations were severe blows to Italian national pride.

Italy's weak economy emerged from the war acutely maladjusted. The national debt was huge and the treasury empty. The inflated currency, together with a shortage of goods, raised prices ruinously. Hundreds of thousands of demobilized veterans could find no jobs. In the summer of 1919, there was widespread disorder. Veterans began seizing and squatting on idle, and sometimes on cultivated, lands. Sit-down strikes developed in the factories. During the winter of 1920–1921, several factories were seized by the workers, and Marxism seemed to be gaining strength. The Italian government, torn by factions, seemed too weak to prevent the disorder and protect private property. Although the strife diminished and the Marxist threat waned before the end of 1921, the landlords and the factory owners were thoroughly frightened. Many of them, and indeed many small-business and professional people, longed for vigorous leadership and a strong government. The vigorous leader who stepped forward was Benito Mussolini. The strong government was his Fascist dictatorship.

Mussolini was a dynamic organizer and leader. The son of a blacksmith, he became first a teacher and later a radical journalist and agitator. Before World War I he was a pacifistic socialist, but during the war he became a violent nationalist. After the war he began organizing unemployed veterans into a political action group with a socialistic and extremely nationalistic program. During the labor disturbances of 1919–1921, Mussolini stood aside until it became apparent that the radical workers' cause would lose; then he threw his support to the capitalists and the landlords. Crying that he was saving Italy from communism and waving the flag of nationalism, Mussolini organized his veterans into terror squads of black-shirted "Fascisti," who beat up the leaderless radical workers and their liberal supporters. He thereby gained the support of the frightened capitalists and landed aristocracy. By 1922 Mussolini's Fascist party was strong enough to "march on Rome" and seize control of the faction-paralyzed government. Appointed premier by the weak and distraught King Victor Emmanuel III, Mussolini acquired extraordinary powers. Between 1924 and 1926 Mussolini turned his premiership into a dictatorship. All opposition was silenced. Only the Fascist party could engage in organized political activity. The press and the schools were turned into propaganda agencies. The secret police were everywhere. Eventually, the Chamber of Deputies itself was replaced by Mussolini's handpicked Fascist political and economic councils.

Italy's economic life was strictly regimented, but in such a way as to favor the capitalistic classes. Private property and profits were carefully protected. All labor unions were abolished except those controlled by the Fascist party. Strikes and lockouts were forbidden. Wages, working conditions, and labor-management disputes were settled by compulsory arbitration under party direction. An elaborate system of planned economy was set up to modernize, coordinate, and increase Italy's production of both industrial and agricultural goods. The very complicated economic and political machinery that Mussolini created for these purposes was called the corporate state. On the whole there was probably a small decline in per capita income under Italian fascism despite some superficial gains. The budget was balanced and the currency stabilized. But Italy's taxes were the highest in the world, and labor's share of economic production was small.

Fascism, however, was primarily political in character, not economic. The essence of its ideology was nationalism run wild. Although Italy never became such a full-blown, viciously anti-Semitic police state as Germany, Mussolini understood the dynamic, energizing quality of militant nationalism. His writings and speeches rang with such words as *will*, *discipline*, *sacrifice*, *decision*, and *conquest*. "The goal," he cried, "is always—empire! To build a city, to found a colony, to establish an empire, these are the prodigies of the human spirit...We must resolutely abandon the whole liberal phraseology and way of thinking.... Discipline. Discipline at home in order that we may present the granite block of a single national will. War alone brings up the highest tension, all human energy and puts the stamp of nobility upon the people who have the courage to meet it."

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11. According to information presented in the passage, "grandiose ambitions" (line 4) refers to Italy's desire for:
    - A. territorial expansion.
    - B. complete victory at the end of World War I.
    - C. peace-time employment for all its veterans.
    - D. a supremely powerful army.

12. The passage suggests that Mussolini came to power in 1922 largely as a result of:
    - I. a desire for stability among property-owning middle classes.
    - II. a lack of strong opposition from the government in Rome.
    - III. his violent opposition to radical workers.
    - F. I and II only
    - G. I and III only
    - H. II and III only
    - J. I, II, and III

13. In which of the following ways does the passage support the theory that fascism arises after periods of diminished national pride?
    - A. It attributes the fascists' seizure of power from the King to Mussolini's abilities as a leader.
    - B. It demonstrates that Mussolini achieved national fame largely because of his eagerness to fight communism.
    - C. It shows a connection between the growth of the corporate state and Mussolini's rise to power.
    - D. It links Mussolini's ascendancy to the fact that Italy gained less than it hoped for after World War I.

14. The passage suggests that, during the disturbances of 1919–1921, "Mussolini stood aside until it became apparent that the radical workers' cause would lose" (lines 40–41) because he was:
    - F. secretly hoping the radical workers would win.
    - G. an opportunist, waiting for his chance to seize power.
    - H. unaware of the importance of the radicals' challenge.
    - J. basically a pacifist at that time in his life.

15. A dictatorship is commonly defined as a form of government that has absolute authority over its citizens. Which of the following statements from the passage supports the view that Mussolini's government was a dictatorship?
    - A. "Mussolini was a dynamic organizer and leader."
    - B. "All labor unions were abolished except those controlled by the Fascist party."
    - C. "Veterans began seizing and squatting on idle, and sometimes on cultivated, lands."
    - D. "The budget was balanced and the currency stabilized."

16. It can most reasonably be inferred from the passage that, to Mussolini, nationalism was primarily a:
    - F. way to protect Italy from German aggression.
    - G. method to bring economic prosperity to war-ravaged Italy.
    - H. powerful political tool.
    - J. threat to his rise to power.

17. The passage suggests that if the rights of factory workers in 1920 were compared to their rights in 1926, one could accurately say that:
    - A. while workers' per capita income rose, workers lost their rights to collective bargain.
    - B. labor's share of economic production grew.
    - C. workers' collective action was increasingly disallowed.
    - D. labor management disputes were completely suppressed.

18. The passage suggests that under the Italian fascists, economic rebuilding was:
    - F. undermined by labor disturbances.
    - G. resisted by the corporate state.
    - H. marred by excessively high taxation.
    - J. slowed by a failure to balance the budget.

19. Based on information in the passage, the "corporate state" can best be defined as a:
    - A. system of structuring government according to business practices.
    - B. series of economic programs aimed at ending an inflated currency.
    - C. negotiating team that arbitrated worker-management disputes.
    - D. complex, planned economy designed to maximize the production of goods.

20. The author most likely quotes Mussolini's words in the last paragraph (lines 86–95) for the purpose of:
    - F. illustrating the nationalistic element in his words.
    - G. praising his abilities as a public speaker.
    - H. condemning the ideas that Mussolini advances.
    - J. demonstrating the difference between Italian and German fascism.

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Passage III

HUMANITIES: This passage is excerpted from the text *The Western Intellectual Tradition: From Leonardo to Hegel,* coauthored by J. Bronowski and Bruce Mazlish. (©1960 by J. Bronowski and Bruce Mazlish; reprinted by permission of HarperCollins Publishers.)

In the 500 years since Leonardo, two ideas about man have been especially important. The first is the emphasis on the full development of the human personality. The individual is prized for himself. His creative powers are seen as the core of his being. The unfettered development of individual personality is praised as the ideal, from the Renaissance artists through the Elizabethans, and through Locke and Voltaire and Rousseau. This vision of the freely developing man, happy in the unfolding of his own gifts, is shared by men as different in their conceptions as Thomas Jefferson and Edmund Burke. . . .

Thus the fulfillment of man has been one of the two most formative grand ideas. . . . Men have seen themselves entering the world with a potential of many gifts, and they have hoped to fulfill these gifts in the development of their own lives. This has come to be the unexpressed purpose of the life of individuals: fulfilling the special gifts with which a man is endowed.

The self-fulfillment of the individual has itself become part of a larger, more embracing idea, the self-fulfillment of man. We think of man as a species with special gifts, which are the human gifts. Some of these gifts, the physical and mental gifts, are elucidated for us explicitly by science; some of them, the aesthetic and ethical gifts, we feel and struggle to express in our own minds; and some of them, the cultural gifts, are unfolded for us by the study of history. The total of these gifts is man as a type or species, and the aspiration of man as a species has become the fulfillment of what is most human in these gifts.

This idea of human self-fulfillment has also inspired scientific and technical progress. We sometimes think that progress is illusory, and that the devices and gadgets which have become indispensable to civilized men in the last 500 years are only a self-propagating accumulation of idle luxuries. But this has not been the purpose in the minds of scientists and technicians, nor has it been the true effect of these inventions on human society. The purpose and the effect has been to liberate men from the exhausting drudgeries of earning their living, in order to give them the opportunity to live. From Leonardo to Franklin, the inventor has wanted to give, and has succeeded in giving, more and more people the ease and leisure to find the best in themselves, which was once the monopoly of princes.

Only rarely has a thinker in the last 500 years gone back from the ideal of human potential and fulfillment. Calvin was perhaps such a thinker who went back, and believed as the Middle Ages did, that man comes into this world as a complete entity, incapable of any worthwhile development. And it is characteristic that the state which Calvin organized was, as a result, a totalitarian state. For if men cannot develop, and have nothing in them which is personal and creative, there is no point in giving them freedom.

The second of the two grand formative ideas is the idea of freedom. We see in fact that human fulfillment is unattainable without freedom, so that these two main ideas are linked together. There could be no development of the personality of individuals, no fulfillment of those gifts in which one man differs from another, without the freedom for each man to grow in his own direction.

What is true of individuals is true of human groups. A state or a society cannot change unless its members are given freedom to judge, to criticize, and to search for a new status for themselves. Therefore the pressure of ideas has been toward freedom as an expression of individuality. Sometimes men have tried to find freedom along quiet paths of change, as the humanists did on the eve of the Reformation, and as the dissenting manufacturers of the eighteenth century did. At other times, the drive for freedom has been explosive: intellectually explosive in the Elizabethan age and the Scientific Revolution, economically explosive in the Industrial Revolution, and politically explosive in the other great revolutions of our period, from Puritan times to the age of Napoleon.

...Freedom is a supple and elusive idea, whose advocates can at times delude themselves that obedience to tyranny is a form of freedom. Such a delusion ensnared men as diverse as Luther and Rousseau, and Hegel and Marx. Philosophically, there is indeed no unlimited freedom. But we have seen that there is one freedom which can be defined without contradiction, and which can therefore be an end in itself. This is freedom of thought and speech: the right to dissent.

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21. The authors mention Calvin in the fifth paragraph (lines 49–58) in order to:
    A. introduce the topic of the Middle Ages.
    B. praise an unusual thinker.
    C. present a counterexample.
    D. illustrate a point made in the previous paragraph.

22. As it is used in line 25, the word *elucidated* means:
    F. decided.
    G. revealed.
    H. invented.
    J. judged.

23. The passage implies that, in the past 500 years, history has revealed two intellectual traditions that are:
    A. equally important, even though mutually exclusive.
    B. similarly important and closely tied together.
    C. only now being seen as particularly important.
    D. less important than freedom of thought and speech.

24. In the fourth paragraph (lines 33–48) the authors' point about "devices and gadgets" is that:
    F. technological progress is an illusion.
    G. all inventors attain self-fulfillment.
    H. these inventions have allowed people to work less.
    J. these inventions are a necessary evil.

25. The authors suggest that what was "once the monopoly of princes" (lines 47–48) was:
    A. the political power to create totalitarian states.
    B. a vast amount of wealth for personal use.
    C. leisure time for self-fulfillment.
    D. access to brilliant inventions to spur human progress.

26. The final paragraph indicates that the idea of freedom:
    F. must involve some element of political dissent.
    G. is actually a delusion.
    H. has, at times, been defined as obedience to tyranny.
    J. is sometimes seriously flawed.

27. Which of the following opinions concerning "the self-fulfillment of the individual" (line 21) would the authors most likely reject?
    A. Self-fulfillment requires a degree of leisure.
    B. Self-fulfillment is a praiseworthy but unreachable goal.
    C. Self-fulfillment is an ideal shared by diverse thinkers.
    D. Self-fulfillment means pursuing one's creative potential.

28. One of the points that the authors seek to make in the passage is that freedom is:
    F. essential if societies are to progress.
    G. the product of stable societies only.
    H. a prerequisite for world peace.
    J. most quickly attained through revolution.

29. According to the passage, Luther, Rousseau, Hegel, and Marx have in common that they were:
    A. misled by a false idea of freedom.
    B. believers in unlimited freedom.
    C. supporters of the right to dissent.
    D. opponents of tyranny.

30. The authors' attitude toward intellectual, economic, and political revolutions is best characterized as:
    F. detached.
    G. concerned.
    H. suspicious.
    J. approving.

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Passage IV

NATURAL SCIENCE: The passage below is excerpted from book #2942 *Violent Storms,* by Jon Erickson. (©1988 by TAB Books, a Division of McGraw-Hill, Inc., Blue Ridge Summit, PA, 17294-0850. 1-800-233-1128)

Tornadoes have long been an enigma, striking sporadically and violently, generating the strongest of all surface winds, and causing more deaths annually in the United States than any other natural phenomenon other than lightning. It is estimated that tornadoes can generate a maximum wind speed of 300 miles per hour, based on analysis of motion pictures and damage to structures.

Tornadoes are formed in the updrafts of a thunderstorm or are associated with hurricanes when they pass over land. They are tightly wound vortexes of air, rarely more than several hundred feet across. They rotate in a counterclockwise direction in the Northern Hemisphere and a clockwise direction in the Southern Hemisphere. Drawn by the greatly reduced atmospheric pressure in the central core, air streams into the base of the vortex from all directions. The air then turns abruptly to spiral upward around the core, and finally merges with the airflow in the parent cloud at the upper end of the tornado. The pressure within the core might be as little as 10 percent lower than the surrounding atmosphere, which would be equivalent to a sudden drop in pressure from that at sea level to an altitude of 3000 feet.

The vortex frequently becomes visible as a wide, dark funnel cloud hanging partway or all the way to the ground. A funnel cloud can only form if the pressure drop in the core reaches a critical value, which depends on the temperature and humidity of the inflowing air. As air flows into the area of lower pressure, it expands and cools, causing water vapor to condense and form water droplets.

Sometimes, no condensation cloud forms, and the only way a tornado can reveal itself is by the dust and debris it carries aloft over land or water spray over the ocean. In that case, it becomes a waterspout, which often frequent the Florida coast and the Bahamas.

The funnel is usually cone shaped, but short, broad, cylindrical pillars up to a mile wide are formed by very strong tornadoes, and often, long, ropelike tubes dangle from the storm cloud. Over the tornado's brief lifetime, usually no more than a few hours, the size, shape, and color of the funnel might change markedly, depending on the intensity of the winds, the properties of the inflowing air, and the type of ground over which it hovers. The color varies from a dirty white to a blue gray when it consists mostly of water droplets, but if the core fills with dust, it takes on the color of the soil and other debris. Tornadoes are also noisy, often roaring, like a laboring freight train or a jet plane taking off. The sound results from the interaction of the concentrated high winds with the ground.

The world's tornado hot spot, with about 700 tornadoes yearly, is the United States, particularly the central and southeastern portions of the country, known as *tornado alley*. The states most frequently visited by tornadoes are Texas, Arkansas, Oklahoma, Kansas, Nebraska, and Missouri, with a high occurrence of tornadoes continuing on up into Canada.

Tornadoes develop in the spring and to a lesser extent in the fall, when conditions are ripe for the formation of tornado-generating thunderstorms. These conditions include a highly unstable distribution of temperature and humidity in the atmosphere, strong cold fronts that provide the lift needed to start convection, and winds in the upper atmosphere favorable for the formation of strong updrafts.

For a tornado to form, the air in the updraft must begin to rotate. This is accomplished by a wind shear where the wind speed increases with height and veers from southeast to west. Once rotation begins, the tornado builds down toward the ground, although not all tornadoes actually reach the ground. When on the ground, the tornado funnel sucks up air at its lower end, like the hose of a vacuum cleaner.

Tornadoes are steered by the jet stream, and generally travel in a northeasterly direction for about 5 to 15 miles. Their forward ground speed is normally slow enough (30 to 60 miles per hour) for them to be outrun by an automobile, although this is not always a recommended practice because of the unpredictable nature of tornadoes, which often hop about from place to place. Members of NOAA's National Severe Storms Laboratory at the University of Oklahoma actually chase tornadoes in vehicles carrying an instrument package known as TOTO which stands for Totable Tornado Observatory. This package is placed in the path of the tornado. TOTO is equipped to measure a tornado's behavior such as wind speed, wind direction, atmospheric temperature and pressure, and electric field strength.

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31. The author refers to tornadoes as *vortexes of air* (line 11) to emphasize the fact that the air is:
    - A. moving downward.
    - B. expanding.
    - C. dispersing.
    - D. whirling.

32. The inspection of films showing the action of tornadoes allowed researchers to determine that tornadoes:
    - F. are often accompanied by lightning.
    - G. gain maximum size when they pass over land.
    - H. are caused by the updrafts of thunderstorms.
    - J. reach wind speeds of up to 300 miles per hour.

33. The passage suggests that the direction of a tornado's rotation is influenced chiefly by:
    - A. whether a hurricane or a thunderstorm has caused it to form.
    - B. the difference in pressure between air in the core and air in the surrounding atmosphere.
    - C. the direction of the airflow in its parent cloud.
    - D. where the tornado is located on the earth's surface.

34. Researchers often have difficulty getting TOTO to record the information they need. Based on the information in the last paragraph, this is most likely true because:
    - F. no scientific instruments can withstand a tornado's force.
    - G. it is difficult to predict precisely the path a tornado will take.
    - H. tornadoes' characteristics vary too much to accurately measure.
    - J. the majority of tornadoes occur over water and are thus unapproachable.

35. Based on information in the passage, if a tornado is to form, which of the following must occur first?
    - A. Powerful updrafts and wind shear
    - B. Movement of the funnel toward the ground
    - C. Movement of air up the funnel from the ground
    - D. Uniform distribution of temperature and humidity in the atmosphere

36. The expression *wind shear* (line 69) means that, while gaining altitude, wind:
    - F. direction changes, while wind speed stays the same.
    - G. speed changes, while wind direction stays the same.
    - H. speed and wind direction both change.
    - J. is sucked up the lower end of a funnel.

37. The passage suggests that it should be possible to predict when tornadoes are likely to form if:
    - A. certain key atmospheric conditions are known.
    - B. "tornado alley" can be accurately identified.
    - C. the movement of warm fronts can be predicted.
    - D. TOTO's readings are accurate.

38. According to the passage, a condensation cloud is created when:
    - F. water vapor entering the funnel is affected by changes in air pressure.
    - G. the funnel passes over a body of water.
    - H. cool air rushes into the funnel and immediately forms droplets.
    - J. dust and debris are sucked into the funnel.

39. The main purpose of the third and fourth paragraphs (lines 25–37) is to describe:
    - A. how funnels are formed.
    - B. how a condensation cloud is formed.
    - C. the main factors that make tornadoes visible.
    - D. how funnel clouds can vary in color, shape, and size.

40. Information in the passage indicates that all tornadoes:
    - F. are colored by the dust and debris they carry.
    - G. touch Earth's surface.
    - H. occur in the spring.
    - J. are steered by the jet stream.

DO NOT TURN THE PAGE UNTIL TOLD TO DO SO.
DO NOT RETURN TO A PREVIOUS TEST.

END OF TEST 3

STOP

SCIENCE TEST

35 Minutes—40 Questions

Directions: Each of the following seven passages is followed by several questions. After reading each passage, decide on the best answer to each question and fill in the corresponding oval on your answer sheet. You are allowed to refer to the passages while answering the questions. You are NOT permitted to use a calculator on this test.

Passage I

Medical researchers and technicians can track the characteristic radiation patterns emitted by certain inherently unstable isotopes as they spontaneously decay into other elements. The half-life of a radioactive isotope is the time necessary for one-half of its nuclei to decay. The decay curves of isotopes $^{90}_{39}Y$ and $^{91}_{39}Y$ are graphed below as functions of the ratio of N, the number of nuclei remaining after a given period, to N_0, the initial number of nuclei.

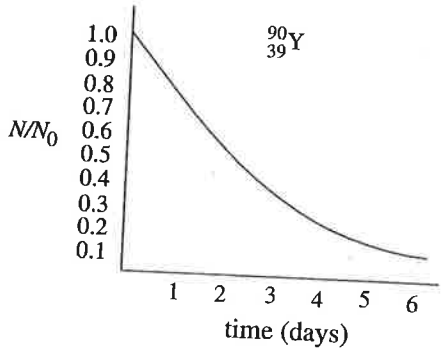

Figure 1

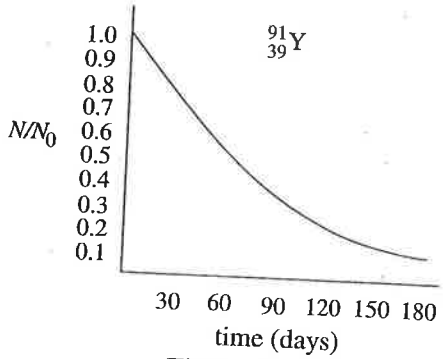

Figure 2

1. The half-life of $^{90}_{39}Y$ is approximately:
   - **A.** 2.7 days.
   - **B.** 5.4 days.
   - **C.** 27 days.
   - **D.** 58 days.

2. What will the approximate ratio of $^{90}_{39}Y$ to $^{91}_{39}Y$ be after 2.7 days if the initial samples of the two isotopes contain equal numbers of nuclei?
   - **F.** 1:1
   - **G.** 1:2
   - **H.** 2:1
   - **J.** 10:1

3. When inhaled by humans, $^{90}_{39}Y$ accumulates in the gastrointestinal tract, whereas $^{91}_{39}Y$ accumulates in the bones. If the total amount of each isotope inhaled goes to the specified area, which of the following situations will exist three days after a patient inhales these substances, assuming none of the isotopes leave the specified areas due to physiological factors?
   - **A.** The amount of $^{91}_{39}Y$ in the gastrointestinal tract will be approximately equal to the total amount inhaled.
   - **B.** The amount of $^{90}_{39}Y$ in the bones will be approximately one-half of the total amount inhaled.
   - **C.** The amount of $^{90}_{39}Y$ in the gastrointestinal tract will be approximately one-half of the total amount inhaled.
   - **D.** None of the $^{91}_{39}Y$ inhaled will be left in the bones.

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4. Approximately how many $^{91}_{39}Y$ nuclei will exist after three half-lives have passed, if there are 1,000 nuclei to begin with?

F. 50
G. 125
H. 250
J. 500

5. Which of the following conclusions is (are) supported by the information given in the passage?

I. $^{90}_{39}Y$ is less stable than $^{91}_{39}Y$
II. Only one-quarter of the original amount of $^{90}_{39}Y$ will remain after 116 days.
III. $^{90}_{39}Y$ and $^{91}_{39}Y$ are both radioactive.

A. I only
B. III only
C. I and II only
D. I and III only

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Passage II

Recently, college teams from all over the country sent tennis players to participate in a series of experiments conducted by the physical education department of a major university. A variety of coaching methods was used to improve the players' serves, as described below.

Experiment 1

Two groups of 50 tennis players worked on the speed of their basic serves for two weeks. One group consisted solely of right-handed players; the other consisted solely of left-handed players. Half of each group watched videos of a right-handed tennis coach, while the other half watched videos of a left-handed coach. Each player was told to pattern his or her serve on that of the coach in the video. The players received no verbal or physical guidance. The average speed of each player's serve was measured at the beginning and end of the two-week period, and changes were recorded in Table 1.

Table 1

Players handedness	Coach 's handedness	Average change in speed (mph)
Right	Right	+5
Right	Left	+2
Left	Right	−1
Left	Left	+8

Experiment 2

For two weeks, a second group of 100 right-handed tennis players watched the same videos of the right-handed tennis coach. The coach also physically guided 50 of those players through the motions of the serve. Again, no verbal instruction was given during the experiment. The average speed and accuracy of each player's serves were recorded at the beginning and end of this two-week period. The results are recorded in Table 2.

Table 2

Guided	Average change in speed (mph)	Average change in accuracy
No	+5	+15%
Yes	+9	+25%

Experiment 3

For two weeks, a third group of 100 right-handed tennis players worked on their basic serves. 50 players received no verbal instruction; they watched the same video of the right-handed tennis coach, who also physically guided them through the motions of the serve. The other 50 players did not observe the video but received verbal instruction from the coach, who then physically guided them through the motions of the serve. The results are shown in Table 3.

Table 3

Guided plus	Average change in speed (mph)
Video	+7
Verbal coaching	+10

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6. Which of the following results would be expected if Experiment 3 were repeated using left-handed tennis players and a left-handed coach?
   - F. The average service accuracy of all the players would increase by at least 30%.
   - G. The average service speed of all the players would decrease slightly.
   - H. Verbal coaching would improve average service speed less than would watching the video.
   - J. The average service speed of the players who watched the video would increase by at least 8 mph.

7. Which of the following conclusions could NOT be supported by the results of Experiment 1?
   - A. Imitating someone whose handedness is the opposite of one's own will cause one's skills to deteriorate.
   - B. Left-handed people are better than right-handed people at imitating the movement of someone with similar handedness.
   - C. People learn more easily by observing someone with similar handedness than by observing someone with handedness opposite their own.
   - D. Right-handed people are better than left-handed people at imitating the movement of someone whose handedness is opposite their own.

8. Based on the result of Experiment 2, one could most reasonably generalize that:
   - F. instructional videos are more helpful for right-handed tennis players than is verbal instruction.
   - G. instructional videos are more helpful for left-handed tennis players than for right-handed tennis players.
   - H. physical guidance by a coach improves both speed and accuracy of service for right-handed tennis players.
   - J. physical guidance by a coach improves service accuracy for right-handed tennis players more than for left-handed players.

9. Suppose 50 left-handed tennis players watch a video of a left-handed coach and are also physically guided by that coach. The results of the experiments suggest that the players' average change in service speed will most closely approximate:
   - A. –1 mph.
   - B. +5 mph.
   - C. +8 mph.
   - D. +12 mph.

10. Taken alone, the results of Experiment 1 suggest that:
    - F. tennis players improve less by observing coaches whose handedness is the opposite of their own than by observing those with similar handedness.
    - G. right-handed tennis players are coached by left-handed coaches more frequently than left-handed players are coached by right-handed coaches.
    - H. right-handed coaches are better models for all tennis players than are left-handed coaches.
    - J. people learn much better from physical contact plus a visual stimulus than from the visual stimulus alone.

11. What change in procedure would allow a researcher to best determine the effects of verbal instruction on the average service speed of tennis players?
    - A. Repeating Experiment 3 with left-handed players
    - B. Repeating Experiment 2 with an instructional audio tape instead of a video
    - C. Measuring the service speed of 100 tennis players before and after they listened to an instructional audio tape
    - D. Verbally coaching 50 left-handed and 50 right-handed tennis players and then measuring their service speed

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Passage III

The temperature of any stellar body causes it to emit a characteristic spectrum of radiation. The apparent color of the star corresponds to the wavelength at which most of its radiation is emitted. Stars are assigned to spectral classes according to these characteristic wavelengths, with O as the bluest/warmest and M as the reddest/coolest. The Hertzsprung-Russell (H-R) diagram below plots each known star within 5 parsecs of the Sun by spectral class and absolute magnitude. Absolute magnitude is a measure of luminosity as viewed from a distance of 10 parsecs. An absolute magnitude of +1.0 indicates maximum brightness. (1 parsec = 3.23 light years)

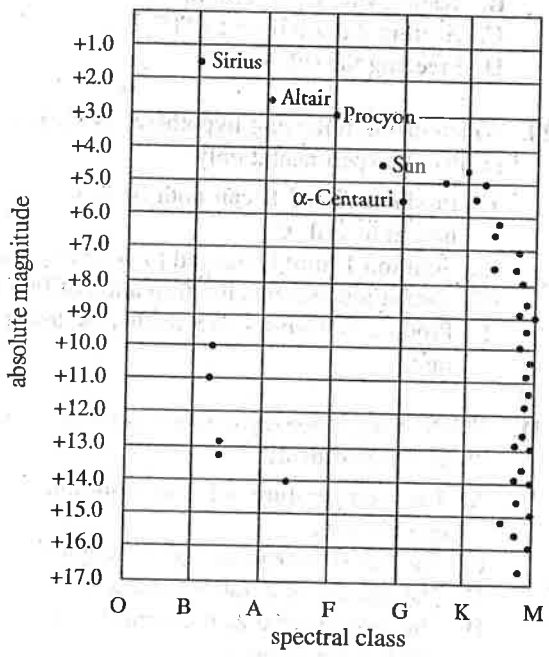

Figure 1

12. According to the data shown, most stars within 5 parsecs of the Sun have:

- **F.** a spectral class of M.
- **G.** an absolute magnitude of +11.0.
- **H.** a mass similar to that of the Sun.
- **J.** a bluish color.

13. According to the information given, which of the following stars—Sirius, Altair, and α-Centauri—is likely to be hotter than the Sun?

- **A.** Sirius, Altair, and α-Centauri
- **B.** Sirius and Altair
- **C.** Sirius
- **D.** α-Centauri

14. The faintest stars that are visible to the naked eye are of the 6th magnitude. On the basis of this information and the data given, which of the following conclusions is most likely to be valid?

- **F.** The majority of stars within 5 parsecs of the Sun are visible from a distance of 10 parsecs.
- **G.** The majority of stars within 5 parsecs of the Sun are not visible from a distance of 10 parsecs.
- **H.** Stars in spectral classes K and M are visible from a distance of 10 parsecs.
- **J.** Stars in spectral class B are visible from a distance of 10 parsecs.

15. The data given in the passage support which of the following conclusions?

I. α-Centauri is redder in color than Sirius.
II. The Sun has a higher surface temperature than does Altair.
III. If both the Sun and Procyon were viewed at a distance of 10 parsecs, the Sun would appear brighter.

- **A.** I only
- **B.** III only
- **C.** I and II only
- **D.** II and III only

16. In which of the following ways would a Hertzsprung-Russell diagram that included all of the known stars within 10 parsecs of the Sun differ from the one shown here?

- **F.** The number of points on the graph would approximately double, while the shape would remain the same.
- **G.** Most of the additional stars would fall in the portion of the graph between Sirius and α-Centauri.
- **H.** Most of the additional stars would be in spectral class M with an absolute magnitude of less than +16.0.
- **J.** It cannot be determined from the information given.

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Passage IV

The reaction of a certain cobalt complex with sodium nitrite ($NaNO_2$) can yield two different products. Product A is a light orange solid with a melting point measured at approximately 90.5° C; Product B is a dark pink solid with a melting point of 68° C. A series of experiments was performed to determine the reaction conditions that favor each product.

Experiment 1

Two separate solutions of the cobalt complex were prepared as follows. Solution 1 was acidified to pH 5.5; Solution 2 was made basic to pH 8.5. All other conditions were identical for the two solutions. When $NaNO_2$ was added to Solution 1, a dark pink solid with a melting point of 68° C was formed. Adding $NaNO_2$ to Solution 2 produced a white solid with a melting point of 81° C.

Experiment 2

Two separate solutions of the cobalt complex were prepared as above. After addition of $NaNO_2$, the solutions were heated to 110° C for 20 minutes. Solution 1 produced a dark pink solid with a melting point of 68° C. Solution 2 produced a light orange solid that melted at 91° C.

Experiment 3

Two separate solutions were prepared as in the previous experiments. After the addition of $NaNO_2$, each solution was treated with a small amount of citrate ion and then heated as in Experiment 2. Solution 1 remained a clear purple liquid. Solution 2 produced a light orange solid which melted at 90° C.

17. The experimental results indicate that Product B is most likely to form when one heats:

- **A.** a basic solution with added citrate ion.
- **B.** an acidic solution with added citrate ion.
- **C.** an acidic solution with no added citrate ion.
- **D.** a basic solution with no added citrate ion.

18. Which of the following conclusions is NOT supported by the experimental results?

- **F.** The formation of Product B is not affected by the presence of citrate ion.
- **G.** The formation of Product B is not affected by the heating of the solution.
- **H.** Products A and B form under different conditions.
- **J.** The formation of Product A is affected by the heating of the solution.

19. Which of the following additional experiments would yield the most useful data concerning the reaction conditions that favor each product?

- **A.** Varying the concentration of the solutions
- **B.** Testing with a pH level of 7.0
- **C.** Heating the solutions to 175° C
- **D.** Freezing the solutions

20. Which of the following hypotheses is supported by the results of Experiment 2 only?

- **F.** Products A and B can both be formed in solutions heated to 110° C.
- **G.** Solution 1 must be heated to yield any product.
- **H.** Citrate ion prevents the formation of Product A.
- **J.** Product B forms more readily at lower temperatures.

21. Which of the following conditions remain(s) constant in all three experiments?

- **A.** The temperature of the solutions during the experiments
- **B.** The initial amount of cobalt complex present
- **C.** The amount of citrate ion present
- **D.** The amount of cobalt complex and the amount of citrate ion present

22. It is suggested that Product B may react to form other, more readily dissolved compounds in the presence of certain ions. Such a hypothesis is best supported by the fact that:

- **F.** Product A forms at a different pH than Product B.
- **G.** Solution 2 yields a different color solid when heated.
- **H.** Product B is unstable in the presence of Product A.
- **J.** no solid forms in Solution 1 when citrate ion is added prior to heating.

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Passage V

Two scientists present various grounds for classifying the giant panda (*Ailuropoda melanoleuca*) as a raccoon or as a bear.

Scientist 1

Although the giant panda superficially resembles bears (*Ursidae*), many of its anatomical, behavioral, and genetic characteristics are closer to those of raccoons (*Procyonidae*). The bones and teeth of *Ailuropoda melanoleuca,* for example, are very similar in structure to those of the raccoon. While male bears can be up to 100% larger than females of the same species, male giant pandas and raccoons differ very little in size from females of their species. Like the raccoon, the giant panda has a friendly greeting that consists of bleating and barking. When intimidated, both animals cover their eyes with their front paws. Most bears do not exhibit these behaviors. Finally, *Ailuropoda melanoleuca* and *Procyonidae* have 21 and 19 pairs of chromosomes, respectively, while *Ursidae* have 36 pairs.

Scientist 2

Giant pandas should be classified as *Ursidae*. Research studies have shown that the ancestors of *Ailuropoda melanoleuca* had about 40 chromosomal pairs; geneticists theorize that the reduction occurred when the chromosomes underwent head-to-head fusion. Other research has shown that the DNA of the giant panda is far more similar to that of the *Ursidae* than to that of any other family. Furthermore, giant pandas and other bears are not only of similar size, but also have very similar body proportions and walk with the same pigeon-toed gait. Giant pandas display aggressive behavior in the same manner as do other bears, by swatting and trying to grab adversaries with their forepaws.

23. Which of the following, if true, would provide additional support for the hypothesis of Scientist 2?

A. The blood proteins of giant pandas are very similar to those of several bear species.
B. Giant pandas and raccoons have similar markings, including dark rings around their eyes.
C. Giant pandas have 21 pairs of chromosomes, while raccoons have only 19 pairs.
D. There is little difference in size between male and female giant pandas.

24. Scientist 1 and Scientist 2 would most likely agree on which of the following points?

F. Giant pandas should be classified in a separate family.
G. The giant panda should not be classified as a raccoon.
H. Raccoons and bears are physically and behaviorally very similar.
J. Animals should be classified into families based on their physical, behavioral, and genetic characteristics.

25. Which of the following characteristics would support the classification of a mammal as a member of the *Ursidae*?

I. 36 pairs of chromosomes and DNA similar to that of many bear species
II. Raccoon-like markings and 19 pairs of chromosomes
III. 62% greater average size among males than among females

A. I only
B. II only
C. I and III only
D. II and III only

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26. According to Scientist 1, which of the following is the giant panda most likely to do when frightened?

F. Bleat and bark
G. Cover its eyes with its paws
H. Swat and grab with its forepaws
J. Walk away pigeon-toed

27. According to Scientist 2, the giant panda should be classified as a bear because:

A. there is little disparity in the size of male and female giant pandas.
B. the greeting rituals of the giant panda resemble those of bears.
C. both bears and giant pandas are herbivorous.
D. the DNA of giant pandas is similar to that of bears.

28. Suppose that giant pandas have glandular scent areas. This fact could be used to support the viewpoint of:

F. Scientist 1, if it were also shown that raccoons also have glandular scent areas.
G. Scientist 2, if it were also shown that bears do not have glandular scent areas.
H. Scientist 1, if it were also shown that raccoons have a very poor sense of smell.
J. Scientist 2, if it were also shown that bears urinate to lay down their scent.

29. Which of the following arguments could Scientist 1 use to counter Scientist 2's claim about the behavior of giant pandas and bears?

A. The giant panda walks with a pigeon-toed gait.
B. Unlike most bears, but like raccoons, an aggressive giant panda bobs its head up and down.
C. The giant panda swats and grabs at its adversaries.
D. Unlike most bears, the giant panda has only 19 pairs of chromosomes.

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Passage VI

The graph below shows different primary energy sources as percentages of energy consumption in the United States during selected years from 1850 to 1985.

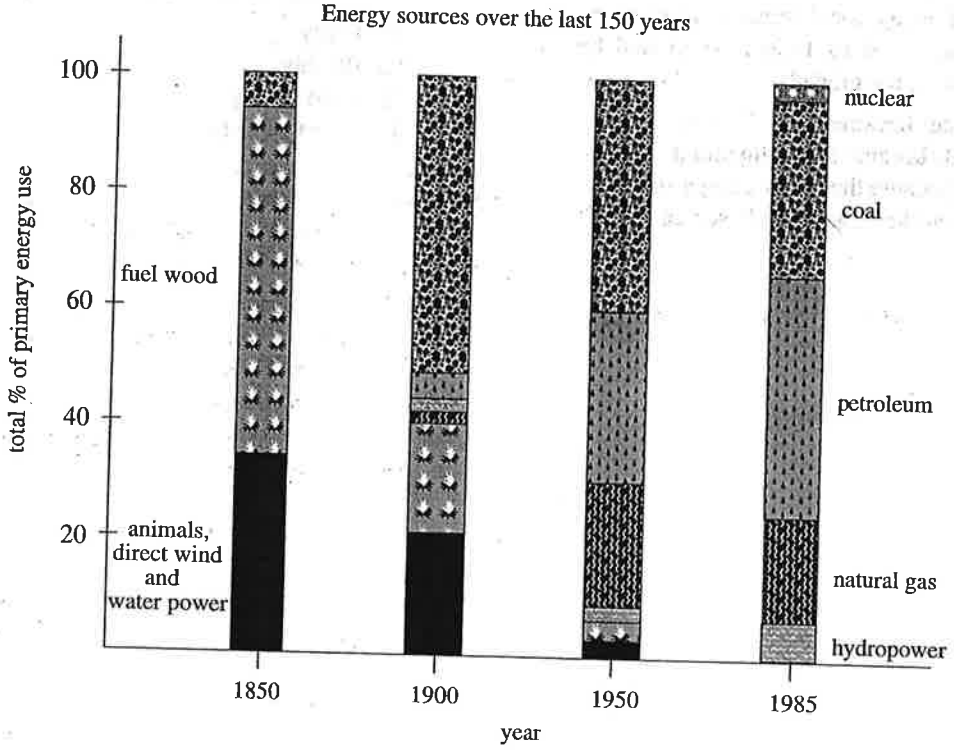

Figure 1

30. As the relative importance of petroleum as a primary energy source increased, the use of coal:

- **F.** also increased.
- **G.** decreased.
- **H.** remained constant.
- **J.** stopped completely.

31. The data shown support the hypothesis that the ability to utilize coal as an energy source:

- **A.** was developed during the 1900s.
- **B.** was dependent on the development of mechanized mining techniques.
- **C.** predated the ability to utilize natural gas.
- **D.** was predated by the ability to utilize natural gas.

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32. As the consumption of alternate energy sources increased, the use of farm animals:

F. decreased to below 1% of the total.
G. increased to over 30% of the total.
H. increased, then decreased.
J. remained the same.

33. Which of the following conclusions concerning energy consumption from 1900 to 1950 is supported by the information given in the graph?

A. Energy sources became more diverse.
B. Work animals became more important.
C. Natural gas became the major energy source.
D. Coal remained the largest single source of energy.

34. The data on the graph support which of the following conclusions?

I. Energy consumption in 1985 relied in part on technologies that did not exist in 1850.
II. The largest source of energy in the United States has always been coal.
III. The short supply of available petroleum will lead to a decrease in its use.

F. I only
G. III only
H. I and II only
J. II and III only

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Passage VII

The regenerative powers of *Asterias rubens*, the common sea star, were investigated in the following experiments.

Experiment 1

Randomly selected sea stars were divided into five groups of 25 each. The individuals in one group were left intact. Members of the other four groups were subjected to selective amputation, as indicated in the table below. The sea stars were kept in laboratory tanks simulating the natural environment of *Asterias rubens* for nine months. The results of periodic observations are recorded in Table 1.

Table 1

Removed body portion	# of sea stars fully regenerated after†: 3 mos.	6 mos.	9 mos.	# of sea stars dead after 9 mos.
None	—	—	—	3
Outer arm	20	23	23	2
Whole arm	15	22	22	3
Arm & 1/5 body	6	21	23	2
2 arms & 1/3 body	5	12	24	1

† cumulative total

Experiment 2

The regenerative powers of portions of *Asterias rubens* were investigated next. Five groups of pieces of *Asterias rubens* were selected at random, placed in separate laboratory tanks under the same conditions as in Experiment 1, and observed for one year. The combined results from all five tanks are presented in Table 2.

Table 2

Removed body portion	# of sea stars fully regenerated after†: 3 mos.	6 mos.	9 mos.	1 yr.	# of sea stars dead after 9 mos.
Outer arm	0	0	0	0	25
Arm & 1/5 body	0	0	8	20	3
2 arms & 1/3 body	0	2	13	22	2

† cumulative total

35. According to the experimental results, approximately what percentage of *Asterias rubens* specimens can regenerate two entire arms and part of the central body within six months?

A. 25%
B. 50%
C. 75%
D. 100%

36. Which of the following conclusions is supported by the results of Experiment 2 only?

F. Sea stars are only capable of regenerating arms.
G. Sea stars with larger portions removed regenerate at faster rates.
H. Some sea stars die as a result of confinement in laboratory tanks.
J. Regeneration is dependent upon the existence of a portion of the central body.

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37. The information given supports which of the following conclusions?

I. *Asterias rubens* are often found in very deep water.
II. *Asterias rubens* can regenerate limbs lost due to attack by other marine animals.
III. The population of *Asterias rubens* would probably increase if body parts were broken off.

A. I only
B. III only
C. II and III only
D. I, II, and III

38. The first group of sea stars was used in Experiment 1:

F. as a control to see how many sea stars were likely to die under the conditions of the experiment.
G. as a control for the second experiment.
H. to test the natural recuperative powers of *Asterias rubens*.
J. to determine the effect of a fresh water environment on *Asterias rubens*.

39. In Experiment 2, the sum of fully regrown and dead sea stars after one year did not always equal 25. The hypothesis which best explains this is that:

A. some of the sea stars were lost during the experiment.
B. the researchers miscalculated somewhere during the course of the experiment.
C. some body parts fused together to form single sea stars.
D. some of the sea stars were alive but not fully regenerated.

40. Sea stars prey on abalone. At one time it was common practice for abalone fishermen to chop sea stars into pieces and throw them back into the ocean. What was the most probable result of this practice?

F. The sea star population immediately skyrocketed.
G. The sea star population increased over a period of time as some pieces underwent regeneration.
H. The sea star population decreased drastically.
J. Every piece that was returned to the ocean eventually became a complete sea star again.

DO NOT RETURN TO ANY OTHER TEST. END OF TEST 4 STOP