SECTION I

Time—35 minutes

27 Questions

Directions: Each set of questions in this section is based on a single passage or a pair of passages. The questions are to be answered on the basis of what is stated or implied in the passage or pair of passages. For some of the questions, more than one of the choices could conceivably answer the question. However, you are to choose the best answer; that is, the response that most accurately and completely answers the question, and blacken the corresponding space on your answer sheet.

"Never was anything as incoherent, shrill, chaotic and ear-splitting produced in music. The most piercing dissonances clash in a really atrocious harmony, and a few puny ideas only increase the disagreeable and deafening effect."

This remark aptly characterizes the reaction of many listeners to the music of Arnold Schoenberg. But this particular criticism comes from the pen of the dramatist August von Kotzebue, writing in 1806 about the overture to Beethoven's opera *Fidelio*.

Both Beethoven and Schoenberg stirred controversy because of the way they altered the language and extended the expressive range of music. Beethoven, of course, has stood as a cultural icon for more than a century, but that didn't happen overnight. His most challenging works did not become popular until well into the twentieth century and, significantly, after the invention of the phonograph, which made repeated listening possible.

Like Beethoven, Schoenberg worked in a constantly changing and evolving musical style that acknowledged tradition while simultaneously lighting out for new territory. This is true of the three different musical styles through which Schoenberg's music evolved. He began in the late-Romantic manner—music charged with shifting chromatic harmonies—that was pervasive in his youth. People who enjoy the music of Brahms ought to love Schoenberg's *Verklaerte Nacht*, and they usually do, once they get past the fact that they are listening to a piece by Schoenberg.

Schoenberg later pushed those unstable harmonies until they no longer had a tonal basis. He did this in part because in his view it was the next inevitable step in the historical development of music, and he felt he was a man of destiny; he also did it because he needed to in order to express what he was compelled to express.

Finally, he developed the 12-tone technique as a means of bringing a new system of order to nontonal music and stabilizing it. In all three styles, Schoenberg operated at an awe-inspiring level of technical mastery. As his career progressed, his music became more condensed, more violent in its contrasts, and therefore more difficult to follow.

But the real issue for any piece of music is not how it is made, but what it has to say. If Schoenberg hadn't existed, it would have been necessary to invent him, and not because of the 12-tone system, the seeds of which appear in Mozart. What makes Schoenberg's music essential is that he precisely delineated recognizable and sometimes disquieting emotional states that music had not recorded before. Some of his work remains disturbing not because it is incoherent, shrill, and ear-splitting, but because it unflinchingly faces difficult truths.

1. Which one of the following most accurately expresses the main point of the passage?

   (A) Though Schoenberg's music is more widely appreciated today than when he was alive, it is still regarded by many as shrill and incoherent.
   (B) Because of his accomplishments as a composer, Schoenberg deserves to be as highly regarded as Beethoven.
   (C) Though Schoenberg's music has not always been well received by listeners, it is worthy of admiration for both its expressive range and its technical innovations.
   (D) Schoenberg is most important for his invention of the 12-tone technique of musical composition.
   (E) Despite the fact that he wrote at a time when recordings of his compositions were possible, Schoenberg has not been accepted as quickly as Beethoven.

2. Which one of the following could be said to be disturbing in a way that is most analogous to the way that Schoenberg's music is said to be disturbing in line 54?

   (A) a comedian whose material relies heavily upon vulgar humor
   (B) a comedian whose humor shines a light on aspects of human nature many people would prefer to ignore
   (C) a comedian whose material is composed primarily of material already made famous by other comedians
   (D) a comedian whose material expresses an extreme political philosophy
   (E) a comedian whose style of humor is unfamiliar to the audience

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3. The author begins with the quote from Kotzebue primarily in order to

   (A) give an accurate account of the music of Beethoven
   (B) give an accurate account of the music of Schoenberg
   (C) suggest that even Beethoven composed works of uneven quality
   (D) suggest that music that is at first seen as alienating need not seem alienating later
   (E) suggest that one critic can sometimes be out of step with the general critical consensus

4. All of the following are similarities between Beethoven and Schoenberg that the author alludes to EXCEPT:

   (A) They worked for a time in the late-Romantic style.
   (B) Their music has been regarded by some listeners as incoherent, shrill, and chaotic.
   (C) Their compositions stirred controversy.
   (D) They worked in changing and evolving musical styles.
   (E) They altered the language and expressive range of music.

5. Which one of the following aspects of Schoenberg's music does the author appear to value most highly?

   (A) the technical mastery of his compositions
   (B) the use of shifting chromatic harmonies
   (C) the use of the 12-tone system of musical composition
   (D) the depiction of emotional states that had never been captured in music before
   (E) the progression through three different styles of composition seen over the course of his career

6. It can be inferred from the passage that the author would be most likely to agree with which one of the following statements about the relationships between the three styles in which Schoenberg wrote?

   (A) Each successive style represents a natural progression from the previous one.
   (B) Each successive style represents an inexplicable departure from the previous one.
   (C) The second style represents a natural progression from the first, but the third style represents an inexplicable departure from the second.
   (D) The second style represents an inexplicable departure from the first, but the third style represents a natural progression from the second.
   (E) The second style represents an inexplicable departure from the first, but the third style represents a natural progression from the first.

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The following passage was adapted from a law journal article published in 1998.

Industries that use biotechnology are convinced that intellectual property protection should be allowable for discoveries that stem from research and have commercial potential. Biotechnology researchers in academic institutions increasingly share this view because of their reliance on research funding that is in part conditional on the patentability of their results. However, questions about the extent to which biotechnology patenting is hindering basic research have recently come to the fore, and the patenting and commercialization of biotechnology inventions are now the focus of increased scrutiny by scientists and policy makers.

The perceived threat to basic research relates to restrictions on access to research materials, such as genetic sequences, cell lines, and genetically altered animals. These restrictions are seen as arising either from enforcement of a patent right or through operation of a contractual agreement. Some researchers fear that patenting biological materials will result in the patent holder's attempting or threatening to enjoin further research through a legal action for patent infringement. In other instances, a patent holder or the owner of biological materials may refuse to make such materials available to scientists conducting basic research unless a costly materials-transfer agreement or license agreement is undertaken. For example, the holder of a patent on unique biological materials may want to receive a benefit or compensation for the costs invested in the creation of the material. Academic researchers who oppose biotechnology patents fear that corporate patent holders will charge prohibitively high fees for the right to conduct basic research involving the use of patented materials.

While it is true that the communal tradition of freely sharing research materials has shifted to a market model, it is also undoubtedly true that even in the early days of biotechnology, some researchers took measures to prevent competitors from gaining access to materials they had created. Scientists who resist the idea of patenting biotechnology seem to be confusing patent rights with control of access to biological materials. They mistakenly assume that granting a patent implies granting the right to deny access. In reality, whether a patent could or would be enforced against a researcher, particularly one conducting basic and noncommercial research, is questionable. First, patent litigation is an expensive endeavor and one usually initiated only to protect a market position occupied by the patent holder or an exclusive patent licensee. Second, there has been a tradition among judges deciding patent cases to respect a completely noncommercial research exception to patent infringement. Moreover, it is likely that patents will actually spur rather than hinder basic research, because patents provide scientists with a compelling incentive to innovate. Researchers know that patents bring economic rewards as well as a degree of licensing control over the use of their discoveries.

7. Which one of the following most accurately expresses the main point of the passage?

   (A) By commercializing the research enterprise, biotechnology patents threaten the progress of basic research in the biological sciences.
   (B) The recent shift away from a communal tradition and toward a market-driven approach to basic scientific research has caused controversy among scientists.
   (C) The current system of patent protection for intellectual property unfairly penalizes both academic researchers and commercial interests.
   (D) Concerns expressed by academic researchers that biotechnology patents will negatively affect their ability to conduct basic research are largely misguided.
   (E) Patent litigation is so expensive that biotechnology patent holders are unlikely to bring patent-infringement lawsuits against scientists engaged in basic research.

8. The academic researchers mentioned in lines 30–31 would be most likely to subscribe to which one of the following principles?

   (A) The competitive dynamics of the market should be allowed to determine the course of basic scientific research.
   (B) The inventor of a biological material should not be allowed to charge fees that would prevent its use in basic research.
   (C) Academic researchers should take measures to prevent their competitors from gaining access to materials they have created.
   (D) Universities should take aggressive legal action to protect their intellectual property.
   (E) Funding for scientific research projects should depend at least in part on the commercial potential of those projects.

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9. According to the passage, why do university researchers increasingly believe that patents should be granted for commercially promising biotechnology discoveries?

(A) Researchers' prospects for academic advancement depend on both the quality and the quantity of their research.
(B) Researchers' funding is often contingent on whether they can produce a patentable product.
(C) Researchers see no incompatibility between unfettered basic research and the granting of biotechnology patents.
(D) Researchers increasingly believe their intellectual labor is being unfairly exploited by universities that partner with for-profit corporations.
(E) Most researchers prefer a competitive model of scientific research to a communal model.

10. With which one of the following statements would the author be most likely to agree?

(A) In the early days of biotechnology research, scientists freely shared research materials because they were not entitled to intellectual property protection for their inventions.
(B) Corporate patent holders typically charge excessive fees for the right to conduct research involving their patented materials.
(C) The cost of patent litigation is an effective check on patent holders who might otherwise try to prevent researchers engaged in basic research from using patented materials.
(D) Biotechnology researchers in academic institutions rely too heavily on funding that is partially contingent on the patentability of their results.
(E) Scientists who oppose the idea of patenting biotechnology do so because their work is not sufficiently innovative to qualify for patent protection.

11. The author refers to the early days of biotechnology (line 38) primarily in order to

(A) furnish a brief account of the evolution of academic biotechnology research
(B) establish that present competitive practices in biotechnology research are not entirely unprecedented
(C) express nostalgia for a time when biotechnology research was untainted by commercial motives
(D) argue that biotechnology research is considerably more sophisticated today than it was in the past
(E) provide a historical justification for opposition to biotechnology patents

12. The passage provides the strongest support for inferring which one of the following?

(A) Policy makers are no less likely than academic researchers to favor new restrictions on biotechnology patents.
(B) Most biotechnology patent holders believe that the pursuit of basic research in academic institutions threatens their market position.
(C) Biotechnology researchers who work in academic institutions and oppose biotechnology patents are generally unable to obtain funding for their work.
(D) Suing for patent infringement is not the only way in which patent holders can assert legal control over the use of their patented materials.
(E) Rapid commercialization in the field of biotechnology has led to a dearth of highly educated biologists willing to teach in academic institutions.

13. Suppose a university researcher wants to conduct basic, noncommercial research involving cell lines patented by a for-profit biotechnology corporation. The author would be most likely to make which one of the following predictions about the researcher's prospects?

(A) The researcher will probably be unable to use the cell lines because the corporation holding the patent will demand a prohibitively high payment for their use.
(B) The corporation holding the patent will probably successfully sue the researcher for patent infringement if she conducts the research without permission.
(C) The university that employs the researcher will likely prohibit the research in an effort to avoid being sued by the corporation holding the patent.
(D) The researcher has a good chance of not being held liable for patent infringement if she conducts the research and is subsequently sued.
(E) The corporation will probably offer to fund the research if granted exclusive rights to any resulting marketable product.

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Before contact with Europeans, the Haudenosaune, a group of nations in northeastern North America also known as the Iroquois, had been developing a form of communication, primarily for political purposes, that used wampum, a bead carved from seashell. Most historians have insisted that wampum was primarily a form of money. While wampum certainly did become a medium of exchange among Europeans and Haudenosaune alike, this was due to the Europeans, who misinterpreted the significance of wampum and used it solely to purchase goods from the Haudenosaune. However, the true significance of wampum for the Haudenosaune lies in its gradual development from objects with religious significance into a method for maintaining permanent peace among distinct nations. Over time wampum came to be used to record and convey key sociopolitical messages.

Wampum came in two colors, white and deep purple. Loose beads constituted the simplest and oldest form of wampum. Even in the form of loose beads, wampum could represent certain basic ideas. For example, white was associated with the sky-yearning spirit, Sapling, whose terrestrial creations, such as trees, were often beneficial to humanity; deep purple was associated with Sapling's twin brother, Flint, the earth-loving spirit whose frequent mischievous vandalism (e.g., in the form of storms) often severely disrupted human life. Legend indicates, for example, that ancient Haudenosaune anglers threw the beads into the water in which they fished to communicate with Sapling or Flint (differing versions of the Haudenosaune cosmology attribute the creation of fish to one or the other of these spirits). Later, loose beads were strung together forming string wampum. It is thought that string wampum was used to send simple political messages such as truce requests.

It was, however, the formation of the Haudenosaune Confederacy from a group of warring tribes, believed by some to have occurred around 1451, that supplied the major impetus for making wampum a deliberate system of both arbitrary and pictorially derived symbols designed primarily for political purposes. This is evident in the invention of wampum belts to encode the provisions of the Haudenosaune Confederacy's constitution. These belts combined string wampum to form icons that could be deciphered by those knowing the significance of the stylized symbols. For example, longhouses, depicted in front-view outline, usually meant a particular nation of the confederacy. Council fires, possibly indicating talks in progress, were diamond outlines that could appear alone or within trees or longhouses. Lines between humanlike figures seem to have indicated the current state of relations between peoples; belts containing such images were often used as safe-conduct passes. The arrangements of the two colors also directed interpretation of the symbols. Thus, the belts served to record, store, and make publicly available items of governmental business. Although the wampum symbol system had a limited lexicon, it served to effectively frame and enforce the law of the confederacy for hundreds of years.

14. Which one of the following most accurately expresses the main point of the passage?

(A) The Haudenosaune's use of wampum originated with combinations of strings of beads with religious significance, but the need for communication between nations led to more complex uses of wampum including the transmission of political messages.

(B) For the Haudenosaune, wampum did not originally serve as a form of money but as an evolving form of communication that, through the use of colors and symbols, conveyed information and that eventually encoded the provisions of the Haudenosaune Confederacy's constitution.

(C) Wampum's significance for the Haudenosaune—as a form of communication linking their traditions with the need for the sharing of information within the confederacy—was changed through European contact so that it became exclusively a medium of commercial exchange.

(D) There is substantial evidence that the Haudenosaune's use of wampum as a medium of communication based on color combinations had its origin in the political events surrounding the establishment of the Haudenosaune Confederacy.

(E) Because of the role played by wampum in relations between the Haudenosaune and Europeans, many historians have overlooked the communicative role that bead combinations played in Haudenosaune culture prior to contact with Europeans.

15. The fishing practice mentioned in the second paragraph is offered primarily as an instance of

(A) a type of knowledge that was encoded and passed on through the use of wampum

(B) a traditional practice that was altered by contact with Europeans

(C) an activity that was regulated by the laws of the Haudenosaune Confederacy

(D) a practice that many historians learned of by studying wampum

(E) a traditional practice that reflects a stage in the evolution of wampum's uses

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16. The last paragraph of the passage serves primarily to

(A) detail how wampum belts evolved from other forms of wampum
(B) distinguish between wampum belts and less complex forms of string wampum
(C) illustrate how wampum functioned as a system of symbolic representation
(D) outline the Haudenosaune Confederacy's constitution as it was encoded using wampum
(E) give evidence of wampum's effectiveness as a means of ensuring compliance with the law of the Haudenosaune Confederacy

17. It can be inferred from the passage that the author would be most likely to agree with which one of the following?

(A) Even if the evolution of wampum had not been altered by the arrival of Europeans, wampum would likely have become a form of currency because of its compactness.
(B) The use of colors in wampum to express meaning arose in response to the formation of the Haudenosaune Confederacy.
(C) The ancient associations of colors with spirits were important precursors to, and foundations of, later wampum representations that did not depend directly on these associations for their meaning.
(D) Because the associations with certain colors shifted over time, the same color beads acquired different meanings on belt wampum as opposed to string wampum.
(E) If the Europeans who first began trading with the Haudenosaune had been aware that wampum was used as a means of communication, they would not have used wampum as a medium of exchange.

18. The passage provides the most support for inferring which one of the following?

(A) Wampum was probably used on occasion as a medium of economic exchange long before the Haudenosaune had contact with Europeans.
(B) The formation of the Haudenosaune Confederacy called for a more complex method of communication than wampum as used until then had provided.
(C) Once wampum came to be used as currency in trade with Europeans, the constitution of the Haudenosaune Confederacy had to be recodified using other methods of representation.
(D) Prior to Haudenosaune contact with Europeans, wampum served primarily as a means of promulgating official edicts and policies of the Haudenosaune Confederacy.
(E) As belt wampum superseded string wampum as a method of communication, wampum beads acquired subtler shadings in the colors used to represent abstract ideas.

19. It can be inferred from the passage that the author would be most likely to agree with which one of the following?

(A) There is evidence that objects similar to wampum were used for symbolic representation by other peoples in addition to the Haudenosaune.
(B) The Europeans who first came in contact with the Haudenosaune insisted on using wampum as a form of currency in spite of their awareness of its true significance.
(C) There is evidence that Europeans who came in contact with the Haudenosaune adopted some long-standing Haudenosaune uses of wampum.
(D) A long-term peaceful association among the groups that formed the Haudenosaune Confederacy was an important precondition for the use of wampum as a means of communication.
(E) Present day interpretations of the significance of some of the symbols used in wampum belts are not conclusive.

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Passage A

Karl Popper's main contribution to the philosophy of science concerns the power of negative evidence. The fundamental point is simple: No number of white swans, for example, can ever prove that all swans are white, but a single black swan disproves the hypothesis. Popper gives this logical asymmetry between positive and negative evidence hyperbolic application, maintaining that positive evidence has no value as evidence and that negative evidence is tantamount to disproof. Moreover, Popper takes the search for negative evidence to be at the heart of scientific research; that is, for Popper, scientific research involves not only generating bold theories, but also searching for evidence that would disprove them. Indeed, for him, a theory counts as scientific only if it makes predictions that are testable in this way.

However, Popper's use of the logical asymmetry does not adequately capture the actual situation scientists face. If a theory deductively entails a false prediction, then the theory must be false as well. But a scientific theory rarely entails predictions on its own. When scientists actually derive a theory's predictions, they almost always need diverse additional "auxiliary" premises, which appeal to other theories, to the correct functioning of instrumentation, to the absence of disturbing forces, etc. When a prediction fails, logic indicates that at least one of the premises must be false, but it does not indicate which one. When an experiment does not work out as predicted, there is usually more than one possible explanation. Positive evidence is never conclusive. But negative evidence rarely is either.

Passage B

When the planet Uranus was discovered, astronomers attempted to predict its orbit. They based their predictions on Newton's laws and auxiliary assumptions about the mass of the sun and the masses, orbits, and velocities of other planets. One of the auxiliary assumptions was that no planets existed in the vicinity of Uranus. When the astronomers made their observations, they found that the orbit they had predicted for Uranus was incorrect. One possible explanation for the failure of their prediction was that Newton's laws were incorrect. Another was that there was an error in the auxiliary assumptions. The astronomers changed their assumptions about the existence of other planets, concluding that there must be another planet close enough to Uranus to produce the observed orbit. Not long afterward, scientists discovered the planet Neptune in the precise place it would have to be to bring their calculations into alignment with their observations.

Later astronomers, again using Newton's laws, predicted the orbit of Mercury. Once again, the predictions were not borne out. They hypothesized the existence of another planet in the vicinity, which they called Vulcan. However, Vulcan was never found, and some scientists began to think that perhaps Newton's laws were in error. Finally, when Einstein's general theory of relativity was introduced, astronomers discovered that calculations based on that theory and the old auxiliary assumptions predicted the observed orbit of Mercury, leading to the rejection of Newton's theory of gravity and to increased confidence in Einstein's theory.

20. Which one of the following is a central topic of both passages?

(A) the logical asymmetry of positive and negative evidence
(B) the role of auxiliary assumptions in predicting planetary orbits
(C) the role of negative evidence in scientific research
(D) the proper technique for confirming a scientific theory
(E) the irrelevance of experimentation for disproving a scientific theory

21. Which one of the following is mentioned in passage A and illustrated in passage B?

(A) repudiating an experimental result
(B) revising a theory
(C) disproving a theory
(D) predicting a planet's orbit
(E) theories that are not testable by experiment

22. In passage B, which one of the following most clearly illustrates a disturbing force, as described in passage A (line 26)?

(A) Uranus
(B) the sun
(C) Neptune
(D) Mercury
(E) the moon

23. In saying that Popper gives a certain idea "hyperbolic application" (line 7), the author of passage A means to suggest that Popper

(A) extends the idea to cases in which it does not apply
(B) underestimates the significance of the idea
(C) commits a logical fallacy in reasoning about the idea
(D) draws too radical a conclusion from the idea
(E) exaggerates the idea's relevance to a particular theory

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24. The author of passage A would be most likely to take which one of the following results mentioned in passage B as support for the claim made in the last sentence of passage A?

(A) the discovery of Uranus
(B) the initial failure of Newton's laws to correctly predict Uranus's orbit
(C) the ultimate failure of Newton's laws to correctly predict Mercury's orbit
(D) the failure to find Vulcan
(E) the success of Einstein's general theory of relativity at predicting Mercury's orbit

25. In passage B's description of the developments leading to the rejection of Newton's theory of gravity, which one of the following astronomical bodies plays a role most analogous to the black swan discussed in passage A?

(A) Mercury
(B) Uranus
(C) Neptune
(D) Venus
(E) the sun

26. It can be inferred that the author of passage B would be likely to be most skeptical of which one of the following ideas mentioned in passage A?

(A) Popper's main contribution to the philosophy of science concerned the power of negative evidence.
(B) Positive evidence plays no role in supporting a theory.
(C) Auxiliary premises are usually needed in order to derive predictions from a scientific theory.
(D) There is a logical asymmetry between positive and negative evidence.
(E) Scientific research involves generating bold theories and attempting to refute them.

27. Which one of the following scientific episodes is most analogous to the discovery of Neptune, as that episode is described in passage B?

(A) Galileo proposed that ocean tides are the result of Earth's motion in its orbit around the sun. But Galileo's theory of tides falsely predicted that there is only one high tide per day, when in fact there are two.
(B) By observing "variable stars"—stars that vary in brightness—in Andromeda, Edwin Hubble discovered that Andromeda is actually a galaxy in its own right. This enabled him to settle the debate about whether the Milky Way constitutes the entirety of the universe.
(C) Walter Alvarez postulated that an asteroid impact caused the extinction of the dinosaurs. He based this on observing high levels of the mineral iridium in certain rock core samples. Later evidence of a large impact crater was discovered in the Yucatan Peninsula that dates to the time of the dinosaur extinction.
(D) Bernard Brunhes discovered rocks that were magnetized in a direction opposite to that of the present-day magnetic field. He concluded that Earth's magnetic field must have been reversed at some point in the past.
(E) When a neutron decays into a proton and an electron, the combined energies of the two particles is less than the energy of the original neutron, in apparent contradiction of the law of conservation of energy. Wolfgang Pauli postulated that a third undetected particle is also created during the decay. The particle's existence was later confirmed.

S T O P

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THIS SECTION ONLY. DO NOT WORK ON ANY OTHER SECTION IN THE TEST.