
《TOEFL阅读高频50篇真题》

使用说明

现实中，备考托福的考生执着于刷题，刷最新的真题。各家机构像军备竞赛一样，不断推出新题来吸引生源。于是，网络上流传着大量真真假假的题目。这些“毒药”，并没有让考生在练习中知其所以然，众多考生其实刷的是一种自我感动。如果能够通过适量，甚至极少的材料习得并掌握解题方法，何必沉浸在题海中。因此，甄选出了 50 篇高频的托福阅读文章，作为最优最简备考材料，借此帮助考生们将一套行之有效的方法论练透，高效备考。

本讲义中的 50 篇高频真题文章分为 8 个单元，共涉及 12 个学科：天文学、气象学、地质学、艺术、海洋生物、动物学、植物学、人类学、商业、心理学、古代文明和历史。

以下是练习建议：

初期备考阶段：在精不在多，每天 4 篇，每篇研读 3 遍。

第一遍，阅读文章，概括每个段落的 3s 版本，完成相应的题目。

第二遍，精读文章，总结出每一句话的 3s 版本和句间功能，做错题分析，理解每个选项，为什么对，为什么错；词句基础较弱的同学需要记录不熟的单词、短语，不懂的长难句，通过查字典或者询问同学老师，夯实词句基础。

第三遍，隔天再阅读文章，完成相应的题目，记录对文章和题目的新的理解。

最终，如果能够把每一篇文章给身边备考的同学讲清楚，那么这篇文章就被真正地理解了，否则只是处于“我以为我明白”的幻觉之中，考场上还是速度慢，正确率低。

冲刺阶段：按课程学习到的方法大量做题，形成固定的做题习惯，形成题感。

每天至少练习 6 篇。做题时间严格按照考试标准限制时间：一篇 18 分钟内完成。

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Unit 1 天文学和气象学

Passage 01 - Determining the Ages of the Planets and the Universe

The planets of our solar system all revolve around the Sun in the same direction and in orbits that lie in nearly the same plane. This is strong evidence that the planets formed simultaneously from a single disk of material that rotated in the same direction as the modern planets.

Precisely when the planets came into being has been a difficult issue to resolve. While Earth's water is necessary for life, its abundance near the planet's surface makes rapid erosion inevitable. Continuous alteration of the crust by erosion and also by igneous (volcanic) and metamorphic (pressure and heat within Earth) processes makes unlikely any discovery of rocks nearly as old as Earth. Thus, geologists have had to look beyond this planet in their efforts to date Earth's origin. Fortunately, we do have samples of rock that appear to represent the primitive material of the solar system. These samples are meteorites, which originate as extraterrestrial objects, called meteors, that have been captured in Earth's gravitational field and have then crashed into our planet.

Some meteorites consist of rocky material and, accordingly, are called stony meteorites. Others are metallic and have been designated iron meteorites even though they contain lesser amounts of elements other than iron. Still others consist of mixtures of rocky and metallic material and thus are called stony-iron meteorites. Meteors come in all sizes, from small particles to the small planets known as asteroids; no asteroid, however, has struck Earth during recorded human history. Many meteorites appear to be fragments of larger bodies that have undergone collisions and broken into pieces. Iron meteorites are fragments of the interiors of these bodies, comparable to Earth's core, and stony meteorites are from outer portions of these bodies, comparable to Earth's mantle (the layer between the core and outer crust).

Meteorites have been radiometrically dated by means of several decay systems, including rubidium-strontium, potassium-argon, and uranium-thorium. The dates thus derived tend to cluster around 4.6 billion years, which suggests that this is the approximate age of the solar system. After many meteorites had been dated, it was gratifying to find that the oldest ages obtained for rocks gathered on the surface of the Moon also were approximately 4.6 billion years. This must, indeed, be the age of the solar system. Ancient rocks can be found on the Moon because the lunar surface, unlike that of Earth, has no water to weather and erode rocks and is characterized by only weak movements of its crust.

Determining the age of the universe has been more complicated. Most stars in the universe are clustered into enormous disk-like galaxies. The distance between our galaxy, known as the Milky Way, and all others is increasing. In fact, all galaxies are moving away from one another, evidence that the universe is expanding. It is not the galaxies themselves that are expanding but the space between them. What is happening is analogous to inflating a balloon with small coins attached to its surface. The coins behave like galaxies: although they do not expand, the space between them does. Before the galaxies formed, matter that they contain was concentrated with infinite density at a single point from which it exploded in an event called the big bang. Even after it assembled into galaxies, matter continued to spread in all directions from the site of the big bang.

The evidence that the universe is expanding makes it possible to estimate its age. This evidence, called the redshift, is an increase in the wavelengths of light waves traveling through space—a shift toward the red end of the visible spectrum of wavelengths. Expansion of the space between galaxies causes this shift by stretching light waves as they pass through it. The farther these light waves have traveled through space, the greater the redshift they have undergone. For this reason, light waves that reach Earth from distant galaxies have larger redshifts than those from nearby galaxies. Calculations based on these redshifts indicate that about 13.7 billion years ago all of the galaxies would have been at one spot, the site of the big bang. This, then, is the approximate date of the big bang and the age of the universe.

【Paragraph 1】 The planets of our solar system all revolve around the Sun in the same direction and in orbits that lie in nearly the same plane. This is strong evidence that the planets formed simultaneously from a single disk of material that rotated in the same direction as the modern planets.

【Paragraph 2】 Precisely when the planets came into being has been a difficult issue to resolve. While Earth's water is necessary for life, its abundance near the planet's surface makes rapid erosion inevitable. Continuous alteration of the crust by erosion and also by igneous (volcanic) and metamorphic (pressure and heat within Earth) processes makes unlikely any discovery of rocks nearly as old as Earth. Thus, geologists have had to look beyond this planet in their efforts to date Earth's origin. Fortunately, we do have samples of rock that appear to represent the primitive material of the solar system. These samples are meteorites, which originate as extraterrestrial objects, called meteors, that have been captured in Earth's gravitational field and have then crashed into our planet.

1. According to paragraphs 1 and 2, what evidence leads astronomers to believe that all the planets formed at approximately the same time?

- A. Samples of rocks from all the planets are the same age.
- B. All the planets orbit the Sun in the same direction and in about the same plane.
- C. All planets have the same igneous and metamorphic processes.
- D. The gravitational field of each planet is about the same strength.

2. Which of the following is NOT mentioned in paragraph 2 as a cause of constant change to Earth's crust?

- A. Water
- B. Igneous processes
- C. Metamorphic processes
- D. Meteorites

【Paragraph 3】 Some meteorites consist of rocky material and, accordingly, are called stony meteorites. Others are metallic and have been designated iron meteorites even though they contain lesser amounts of elements other than iron. Still others consist of mixtures of rocky and metallic material and thus are called stony-iron meteorites. Meteors come in all sizes, from small particles to the small planets known as asteroids; no asteroid, however, has struck Earth during recorded human history. Many meteorites appear to be fragments of larger bodies that have undergone collisions and broken into pieces. Iron meteorites are fragments of the interiors of these bodies, comparable to Earth's core, and stony meteorites are from outer portions of these bodies, comparable to Earth's mantle (the layer between the core and outer crust).

3. Which of the following can be inferred from paragraph 3 about meteorites?

- A. Their composition can help determine the part of the larger body from which they broke off.
- B. They are difficult to distinguish from rocks in Earth's mantle.
- C. Their collisions with Earth have become more frequent than in the past.
- D. They are older than the rest of the solar system.

4. According to paragraph 3, which of the following is a characteristic of asteroids?

- A. They are the largest meteors.
- B. They are made mostly of iron and other metals.
- C. They often collide with Earth.
- D. They are the oldest meteors.

【Paragraph 4】 Meteorites have been radiometrically dated by means of several decay systems, including rubidium-strontium, potassium-argon, and uranium-thorium. The dates thus derived tend to cluster around 4.6 billion years, which suggests that this is the approximate age of the solar system. After many meteorites had been dated, it was gratifying to find that the oldest ages obtained for rocks gathered on the surface of the Moon also were approximately 4.6 billion years. This must, indeed, be the age of the solar system. Ancient rocks can be found on the Moon because the lunar surface, unlike that of Earth, has no water to weather and erode rocks and is characterized by only weak movements of its crust.

5. Which of the following can be inferred from paragraph 4 about the radiometric dating of meteorites?

- A. Scientists tried several different radiometric systems before finding one that worked.
- B. The radiometric dating of different meteorites produced similar results.
- C. Many meteorites were damaged by the radiometric dating.
- D. Radiometric dating was not as accurate as scientists expected.

6. According to paragraph 4, why are scientists confident that the age of the oldest meteorites they studied is also the age of the solar system?

- A. Radiometric dating has been proven to be reliable.
- B. The oldest rocks found on the surface of the Moon are the same age as the meteorites.
- C. No meteorites have been found that are younger than 4.6 billion years old.
- D. Meteorites on the Moon are the same age as those on other planets.

【Paragraph 5】 Determining the age of the universe has been more complicated. Most stars in the universe are clustered into enormous disk-like galaxies. The distance between our galaxy, known as the Milky Way, and all others is increasing. In fact, all galaxies are moving away from one another, evidence that the universe is expanding. It is not the galaxies themselves that are expanding but the space between them. What is happening is analogous to inflating a balloon with small coins attached to its surface. The coins behave like galaxies: although they do not expand, the space between them does. Before the galaxies formed, matter that they contain was concentrated with infinite density at a single point from which it exploded in an event called the big bang. Even after it assembled into galaxies, matter continued to spread in all directions from the site of the big bang.

7. Why does the author refer to “inflating a balloon with small coins attached to its surface”?

- A. To help explain how the universe can expand while the galaxies remain the same size
- B. To imply that the universe must eventually stop expanding
- C. To support the statement that most stars are found in disk-shaped galaxies
- D. To help explain how the universe began as a single point of dense matter

【Paragraph 6】 The evidence that the universe is expanding makes it possible to estimate its age. This evidence, called the redshift, is an increase in the wavelengths of light waves traveling through space—a shift toward the red end of the visible spectrum of wavelengths. Expansion of the space between galaxies causes this shift by stretching light waves as they pass through it. The farther these light waves have traveled through space, the greater the redshift they have undergone. For this reason, light waves that reach Earth from distant galaxies have larger redshifts than those from nearby galaxies. Calculations based on these redshifts indicate that about 13.7 billion years ago all of the galaxies would have been at one spot, the site of the big bang. This, then, is the approximate date of the big bang and the age of the universe.

8. According to paragraph 6, how did astronomers learn that the universe is expanding?

- A. By measuring the distance between galaxies
- B. By observing the movement of stars within galaxies
- C. By studying the wavelengths of light from distant galaxies
- D. By comparing the sizes of different galaxies

【Paragraph 3】 ■Some meteorites consist of rocky material and, accordingly, are called stony meteorites. ■Others are metallic and have been designated iron meteorites even though they contain lesser amounts of elements other than iron. ■Still others consist of mixtures of rocky and metallic material and thus are called stony-iron meteorites. ■Meteors come in all sizes, from small particles to the small planets known as asteroids; no asteroid, however, has struck Earth during recorded human history. Many meteorites appear to be fragments of larger bodies that have undergone collisions and broken into pieces. Iron meteorites are fragments of the interiors of these bodies, comparable to Earth’s core, and stony meteorites are from outer portions of these bodies, comparable to Earth’s mantle (the layer between the core and outer crust).

9. Look at the four squares **【■】** that indicate where the following sentence could be added to the passage.

Several varieties of meteorites have been observed.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

There is strong evidence that all the planets of our solar system were formed from the same disk of matter at the same time.

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Answer Choices

- A. Determining the age of the planets by examining rocks on Earth is difficult because Earth's crust is constantly changing.
- B. Meteorites found on Earth and rocks from the Moon's surface are the best evidence for estimating the age of the planets.
- C. The expansion of the universe makes it possible to estimate its age by measuring the amount of the redshift of light coming from distant galaxies.
- D. All three kinds of meteorites are similar in composition to Earth in that they have an inner core, a rocky mantle, and an outer crust.
- E. Radiometric dating of meteorites recovered from the Moon shows that they are older than those that are found on Earth.
- F. The redshift phenomenon measures the rate at which the stars in a galaxy are moving away from each other.

Passage 02 - Alaska and Bark Beetles

Over the twentieth century, global temperatures increased by an average of about 0.7 degrees Celsius, but some places have warmed a lot more than this, and other places have warmed less. These temperature increases have been enough to trigger changes in ecosystems all over the world, especially in places where the warming has been the greatest. In some places, the changes have been subtle, perhaps a slight shift in vegetation that only a careful observer would notice. In other cases, small changes in climate have sparked a chain of larger effects, leading to massive changes.

The biggest climate-caused ecosystem shifts today are happening at the world's most northern latitudes, where the temperature over the last century has been rising about two times faster than the global average. In the northernmost state of the United States, Alaska, for example, warming has paved the way for a spike in the numbers of spruce bark beetles. Bark beetles have been a pest to Alaskan white spruce trees for thousands of years, but their numbers were held in check by the cold climate, which forced the insects to hide in the bark of individual trees for most of the year. As the length of the warm season increased over the 1980s and 1990s, however, bark beetles had more time to fly from one tree to the next, burrow, and lay their eggs between the bark and the wood. The beetles had another thing going for them, too: a multi-year drought had weakened many of the spruce trees, leaving them vulnerable to attack. In the mid-1990s, the bark beetle population exploded, and over the next few years the pests wiped out white spruce forests over an area the size of the U.S. state of Connecticut. In the years since, the combined forces of a longer insect-breeding season and forest management practices that left forests overcrowded gave way to similar epidemics farther south. Large swaths of pine and spruce have been destroyed by insects in several other parts of the United States.

In the late 1990s, the effects of the bark beetle epidemic rippled throughout Alaska's white spruce ecosystem and affected virtually every population of living organism, but not all of the impacts were negative. Fewer spruce trees meant a sunnier area in the forest below the treetops, which allowed grasses to move in and take hold. The grasses, in turn, changed the soil temperature, making the environment more friendly for some other types of vegetation. Animals that feed on grasses, including moose, elk, and some birds, also benefited. But the beetle infestation was bad news for organisms that rely on white spruce for their habitat, like hawks, owls, red squirrels, and voles. Voles a type of small, mouse-like rodent are an especially vital part of the ecosystem because they help spread mycorrhizal fungi, which attach to the roots of plants and help them take in water and nutrients. Voles are also an important food for a number of predators.

Ecosystem changes always hurt some living creatures and help others. It's hard to say, therefore, whether a change is good or bad overall. Instead, ecologists (people who study ecosystems) often focus on the impacts on a single species: for instance, us. In the short term, the Alaskan spruce beetle epidemic supplied a lot of people with firewood, but only by destroying tons of otherwise valuable timber and threatening the livelihoods of loggers. And no one knows for sure what the long-term impacts on the forest will be. Ecosystems tend to return to their previous states after disturbances like pest outbreaks, fires, or major storm events, but if the Alaskan spruce ecosystem is disturbed too often or too much, it might shift to a different type of forest, a woodland, or a grassland instead.

In extreme cases, major assaults on ecosystems can lead to a total collapse in which the ecosystem doesn't bounce back to the way it was or transition to a new, healthy state. The result is an area with very little life; in the oceans, biologists refer to these areas as dead zones. One such example is the coral reef die-off that happened in the Indian Ocean in the late 1990s.

【Paragraph 1】 Over the twentieth century, global temperatures increased by an average of about 0.7 degrees Celsius, but some places have warmed a lot more than this, and other places have warmed less. These temperature increases have been enough to trigger changes in ecosystems all over the world, especially in places where the warming has been the greatest. In some places, the changes have been **subtle**, perhaps a slight shift in vegetation that only a careful observer would notice. In other cases, small changes in climate have sparked a chain of larger effects, leading to massive changes.

1. The word “**subtle**” in the passage is closest in meaning to

- A. limited
- B. unimportant
- C. not obvious
- D. gradual

【Paragraph 2】 The biggest climate-caused ecosystem shifts today are happening at the world's most northern latitudes, where the temperature over the last century has been rising about two times faster than the global average. In the northernmost state of the United States, Alaska, for example, warming has paved the way for a spike in the numbers of spruce bark beetles. Bark beetles have been a pest to Alaskan white spruce trees for thousands of years, but their numbers were held in check by the cold climate, which forced the insects to hide in the bark of individual trees for most of the year. As the length of the warm season increased over the 1980s and 1990s, however, bark beetles had more time to fly from one tree to the next, burrow, and lay their eggs between the bark and the wood. The beetles had another thing going for them, too: a multi-year drought had weakened many of the spruce trees, leaving them vulnerable to attack. In the mid-1990s, the bark beetle population exploded, and over the next few years the pests wiped out white spruce forests over an area the size of the U.S. state of Connecticut. In the years since, the combined forces of a longer insect-breeding season and forest management practices that left forests overcrowded gave way to similar epidemics farther south. Large swaths of pine and spruce have been destroyed by insects in several other parts of the United States.

2. Paragraph 2 suggests that the warming of the Alaskan climate affected bark beetles in which of the following ways

- A. By making it possible for a beetle to deposit its eggs in a greater number of trees
- B. By making it possible for beetles to survive in the bark of trees for longer lengths of time
- C. By making it unnecessary for a beetle to protect its eggs by laying them between the bark and the wood
- D. By increasing the number of spruce trees, thereby providing the beetles with far more places to live

3. According to paragraph 2, all of the following contributed to the destruction of forests in different parts of the United States EXCEPT

- A. a drought that had lasted for several years
- B. a lack of forest management practices
- C. overcrowding in forests
- D. a huge increase in spruce tree pest populations

【Paragraph 3】 In the late 1990s, the effects of the bark beetle epidemic rippled throughout Alaska’s white spruce ecosystem and affected virtually every population of living organism, but not all of the impacts were negative. Fewer spruce trees meant a sunnier area in the forest below the treetops, which allowed grasses to move in and take hold. The grasses, in turn, changed the soil temperature, making the environment more friendly for some other types of vegetation. Animals that feed on grasses, including moose, elk, and some birds, also benefited. But the beetle infestation was bad news for organisms that rely on white spruce for their habitat, like hawks, owls, red squirrels, and voles. Voles a type of small, mouselike rodent are an especially vital part of the ecosystem because they help spread mycorrhizal fungi, which attach to the roots of plants and help them take in water and nutrients. Voles are also an important food for a number of predators.

4. Which of the following statements most accurately describes the relationship of paragraph 3 to paragraph 2
- A. Paragraph 2 explains the causes of the spruce bark beetle epidemic in Alaska, and paragraph 3 discusses the chain of events that occurred as a result of that epidemic.
 - B. Paragraph 2 shows that warming air temperatures can affect a large number of species, and paragraph 3 shows that warming soil temperatures can have even greater effects.
 - C. Paragraph 2 discusses one explanation for the disappearance of spruce trees from a part of Alaska, but paragraph 3 shows that an alternative explanation is more likely to be correct.
 - D. Paragraph 2 describes the negative consequences of climate warming for some species, but paragraph 3 shows that there are also some positive consequences for these same species.
5. According to paragraph 3, which of the following effects did the bark beetle epidemic have on moose, elk, and some birds
- A. The epidemic increased the availability of water for these animals.
 - B. The epidemic increased the availability of food for these animals.
 - C. The epidemic destroyed the habitat of these animals.
 - D. The epidemic meant that these animals experienced more competition from hawks, owls, red squirrels, and voles.
6. According to paragraph 3, a decline in the vole population in Alaska may have which TWO of the following consequences? To receive credit, you must select TWO answer choices.
- A. Some predators may have less to eat.
 - B. Hawk and red squirrel populations may be more successful.
 - C. Plants may find it more difficult to absorb water and nutrients.
 - D. Mycorrhizal fungi numbers may increase.

【Paragraph 4】 Ecosystem changes always hurt some living creatures and help others. It's hard to say, therefore, whether a change is good or bad overall. Instead, ecologists (people who study ecosystems) often focus on the impacts on a single species: for instance, us. In the short term, the Alaskan spruce beetle epidemic supplied a lot of people with firewood, but only by destroying tons of otherwise valuable timber and threatening the livelihoods of loggers. And no one knows for sure what the long-term impacts on the forest will be. **Ecosystems tend to return to their previous states after disturbances like pest outbreaks, fires, or major storm events, but if the Alaskan spruce ecosystem is disturbed too often or too much, it might shift to a different type of forest, a woodland, or a grassland instead.**

7. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Ecosystems like the spruce ecosystem in Alaska tend to return to their previous states after disturbances such as pest outbreaks, fires, or major storm events.
- B. While ecosystems tend to return to their previous states after disturbances, the Alaskan spruce ecosystem might not if it is disturbed too often or too much.
- C. Ecosystems tend to return to their previous states after disturbances, so Alaska might again become covered with woodlands or grasslands.
- D. After certain types of disturbances such as pest outbreaks, ecosystems do not always return to their previous states but shift to being woodlands or grasslands instead.

【Paragraph 5】 In extreme cases, major assaults on ecosystems can lead to a total collapse in which the ecosystem doesn't bounce back to the way it was or transition to a new, healthy state. The result is an area with very little life; in the oceans, biologists refer to these areas as dead zones. One such example is the coral reef die-off that happened in the Indian Ocean in the late 1990s.

8. In paragraph 5, coral reefs in the Indian Ocean are presented as an example of which of the following

- A. Ecosystems that totally collapsed
- B. Ecosystems that transitioned to a new, healthy state
- C. Ecosystems that bounced back to the way they were
- D. Ecosystems that were affected by a nearby dead zone

Paragraph 4: ■Ecosystem changes always hurt some living creatures and help others. It's hard to say, therefore, whether a change is good or bad overall. ■Instead, ecologists (people who study ecosystems) often focus on the impacts on a single species: for instance, us. ■In the short term, the Alaskan spruce beetle epidemic supplied a lot of people with firewood, but only by destroying tons of otherwise valuable timber and threatening the livelihoods of loggers. ■And no one knows for sure what the long-term impacts on the forest will be. Ecosystems tend to return to their previous states after disturbances like pest outbreaks, fires, or major storm events, but if the Alaskan spruce ecosystem is disturbed too often or too much, it might shift to a different type of forest, a woodland, or a grassland instead.

9. Look at the four squares **【■】** that indicate where the following sentence could be added to the passage.

But even from this limited perspective, the answer is not completely straightforward.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Over the twentieth century, global temperatures increased by an average of about 0.7 degrees Celsius.

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Answer Choices

- A. Global warming has led to changes in ecosystems all over the world, with ecosystems at northern latitudes being affected the most.
- B. A longer warm season in Alaska caused a sharp increase in the number of bark beetles, leading to the destruction of spruce forests, which in turn seriously affected many other species.
- C. Sometimes ecosystems are able to recover from disturbances or to develop into different, but healthy, systems, but in extreme cases, they may collapse completely.
- D. The loss of spruce forests caused an epidemic in mycorrhizal fungi, and these fungi damaged the roots of many plants, making them unable to take in water and nutrients.
- E. Whereas some types of changes are good for the majority of species in an ecosystem, ecologists believe that most disturbances to ecosystems are bad overall.
- F. Coral reefs may die off as a result of the global increase in temperatures, but after a transition period as a dead zone, they are able to return to their original state.

Passage 03 - Milankovitch Cycles and Glaciation

Although the history of glaciation during the Pleistocene epoch (2 million to 10,000 years ago) is well established, we do not know with complete certainty why glaciation takes place. For over a century, geologists and climatologists have struggled with this problem, but it remains unsolved.

It is long known that Earth's orbit around the Sun changes periodically, cyclically affecting the way solar radiation strikes the Earth, but the idea that these changes affect climate was first advanced by James Croll in the late 1800s. Later, Milutin Milankovitch elaborated the theory with calculations that convincingly argued that the cycles, now known as Milankovitch cycles, could cause climatic variations.

The Milankovitch cycles emerge from the way three cyclic changes in Earth's orbit combine. One characteristic of Earth's orbit is its eccentricity, the degree to which the orbit is an ellipse rather than a circle. Changes in the eccentricity of Earth's orbit occur in a cycle of about 96,000 years. The inclination, or tilt, of Earth's axis also varies periodically, moving between 22 degrees and 24.5 degrees. The tilt of Earth's axis, toward the Sun at some times of the year and away from the Sun at other times, is responsible for the annual cycle of seasons. The greater the tilt, the greater the contrast between summer and winter temperatures. Changes in the tilt occur in a cycle 41,000 years long. Also, Earth wobbles as it spins, like a slightly unsteady top. The wobble cycle is completed once every 21,700 years. Changes in eccentricity, tilt and wobble do not affect the total amount of solar radiation Earth receives in a year, but they do affect how evenly or unevenly this radiation is disturbed over the course of a year. According to the Milankovitch theory, about every 40,000 years the three separate cycles combine in such a way that the difference between summer and winter temperatures is at a minimum. At this point winter temperatures are milder but so too are summer temperatures. As a result, less ice is melted in the summer than is formed in the winter, so glaciers build up and a period of glaciation results.

Milankovitch worked out the ideas of climatic cycles in the 1920s and 1930s, but it was not until the 1970s that a detailed chronology of the Pleistocene temperature changes was determined that could test the predictions of this theory. A correspondence between Milankovitch cycles and climate fluctuations of the last 65 million years seems clear. Furthermore, studies of rock samples drilled from the deep-sea floor and the fossils contained in them indicate that the fluctuation of climate during the past few hundred thousand years is remarkably close to that predicted by Milankovitch.

A problem with Milankovitch's explanation of glaciation arises from the fact that the variations in Earth's orbit, and hence the Milankovitch cycles, have existed for billions of years. Thus, we might expect that glaciation would have been a cyclic event throughout geologic time. In fact, periods of glaciation are rare. So there must be another factor acting together with the Milankovitch cycles that causes periods of glaciation. Once this additional factor makes the temperature low enough, the cyclic variations of the Milankovitch cycles will force the planet into and out of glacial epochs with a fixed regularity.

Many hypotheses have been proposed for the additional cooling factor. Some suggest that variations in the Sun's energy output could account for the ice ages. However, our present understanding of the Sun's luminosity holds that it should have progressively increased, not decreased, over the course of Earth's history. Still others argue that volcanic dust injected into the atmosphere shields Earth from the Sun's rays and initiates an ice age. However, no correlation has been found between volcanic activity and the start of the last ice age. An increasingly attractive theory holds that decreases in atmospheric carbon dioxide starts the cooling trend that leads to glaciation. Carbon dioxide traps solar energy reflected from the Earth's surface. If carbon dioxide levels decrease, less heat is trapped and Earth's surface cools. Recent studies of the carbon dioxide content of gas bubbles preserved in the Greenland ice cap do in fact show that high carbon dioxide levels are associated with warm interglacial periods, and low levels with cold glacial periods.

【Paragraph 1】 It is long known that Earth's orbit around the Sun changes periodically, cyclically affecting the way solar radiation strikes the Earth, but the idea that these changes affect climate was first advanced by James Croll in the late 1800s. Later, Milutin Milankovitch **elaborated** the theory with calculations that convincingly argued that the cycles, now known as Milankovitch cycles, could cause climatic variations.

1. The word "**elaborated**" in the passage is closest in meaning to

- A. corrected
- B. defended
- C. studied
- D. developed

【Paragraph 3】 The Milankovitch cycles emerge from the way three cyclic changes in Earth's orbit combine. One characteristic of Earth's orbit is its eccentricity, the degree to which the orbit is an ellipse rather than a circle. Changes in the eccentricity of Earth's orbit occur in a cycle of about 96,000 years. The inclination, or tilt, of Earth's axis also varies periodically, moving between 22 degrees and 24.5 degrees. The tilt of Earth's axis, toward the Sun at some times of the year and away from the Sun at other times, is responsible for the annual cycle of seasons. The greater the tilt, the greater the contrast between summer and winter temperatures. Changes in the tilt occur in a cycle 41,000 years long. Also, Earth wobbles as it spins, like a slightly unsteady top. The wobble cycle is completed once every 21,700 years. Changes in eccentricity, tilt and wobble do not affect the total amount of solar radiation Earth receives in a year, but they do affect how evenly or unevenly this radiation is disturbed over the course of a year. According to the Milankovitch theory, about every 40,000 years the three separate cycles combine in such a way that the difference between summer and winter temperatures is at a minimum. At this point winter temperatures are milder but so too are summer temperatures. As a result, less ice is melted in the summer than is formed in the winter, so glaciers build up and a period of glaciation results.

2. According to paragraph 3, Milankovitch's theory holds that periods of glaciation result from a particular combination of changes in all the following EXCEPT

- A. the shape of Earth's orbit
- B. the inclination of Earth's axis
- C. the wobble of Earth as it spins
- D. the amount of time required for Earth's rotation around the Sun

3. According to paragraph 3, Milankovitch's theory predicts that glaciers build up most when

- A. the least amount of solar heat is being delivered to Earth
- B. winter temperatures are lowest
- C. the difference between winter temperatures and summer temperatures is greatest
- D. both winter temperatures and summer temperatures are relatively mild

【Paragraph 4】 Milankovitch worked out the ideas of climatic cycles in the 1920s and 1930s, but it was not until the 1970s that a detailed chronology of the Pleistocene temperature changes was determined that could test the predictions of this theory. A correspondence between Milankovitch cycles and climate fluctuations of the last 65 million years seems clear. Furthermore, studies of rock samples drilled from the deep-sea floor and the fossils contained in them indicate that the fluctuation of climate during the past few hundred thousand years is remarkably close to that predicted by Milankovitch.

4. Which of the following can be inferred from paragraph 4 about rock samples taken from the sea floor and the fossils they contain?

- A. There is a correspondence between the fossils in the samples and climate fluctuations.
- B. Milankovitch's theory predicts when the samples will contain fossils.
- C. It was not known until the 1970s that fossils were present in rocks taken from the sea floor.
- D. There is no fossil record in the samples older than a few hundred thousand years.

【Paragraph 5】 A problem with Milankovitch's explanation of glaciation arises from the fact that the variations in Earth's orbit, and hence the Milankovitch cycles, have existed for billions of years. Thus, we might expect that glaciation would have been a cyclic event throughout geologic time. In fact, periods of glaciation are rare. So there must be another factor acting together with the Milankovitch cycles that causes periods of glaciation. Once this additional factor makes the temperature low enough, the cyclic variations of the Milankovitch cycles will force the planet into and out of glacial epochs with a fixed regularity.

5. According to paragraph 5, which of the following is a problem with Milankovitch's theory?

- A. It assures that the astronomical cycles have been in existence for billions of years.
- B. It cannot explain why glaciation has been a relatively rare occurrence in Earth's history.
- C. It cannot predict periods of glaciation in Earth's distant past.
- D. It assures that astronomical cycles have an effect on Earth's climate even during periods when there is no glaciation.

【Paragraph 6】 Many hypotheses have been proposed for the additional cooling factor. Some suggest that variations in the Sun's energy output could account for the ice ages. However, our present understanding of the Sun's luminosity holds that it should have progressively increased, not decreased, over the course of Earth's history. Still others argue that volcanic dust injected into the atmosphere shields Earth from the Sun's rays and initiates an ice age. However, no correlation has been found between volcanic activity and the start of the last ice age. An increasingly attractive theory holds that decreases in atmospheric carbon dioxide starts the cooling trend that leads to glaciation. Carbon dioxide traps solar energy reflected from the Earth's surface. If carbon dioxide levels decrease, less heat is trapped and Earth's surface cools. Recent studies of the carbon dioxide content of gas bubbles preserved in the Greenland ice cap do in fact show that high carbon dioxide levels are associated with warm interglacial periods, and low levels with cold glacial periods.

6. The author discusses "our present understanding of the Sun's luminosity" in order to

- A. provide evidence that Milankovitch's astronomical cycles cannot explain the occurrence of the ice ages
- B. present an objection to a proposed explanation of the cause of ice ages
- C. challenge the claim that long-term cooling can account for glaciation
- D. introduce a problem that none of the proposed hypotheses about the causes of glaciation can answer

7. According to paragraph 6, in addition to Milankovitch cycles, each of the following has been proposed as a contributing cause of ice ages EXCEPT

- A. variations in the composition of the Greenland ice cap
- B. variations in the Sun's energy output
- C. volcanic dust injected into the atmosphere
- D. decreases in atmospheric carbon dioxide

8. It follows from the theory of the role of carbon dioxide discussed in paragraph 6, that

- A. the decrease in temperature during the last ice age caused a decrease in atmospheric carbon dioxide
- B. the atmosphere had higher carbon dioxide content during the last ice age than it had during the warm period immediately before it
- C. the cooling of temperatures that led to the last ice age was brought about by a decrease in atmospheric carbon dioxide
- D. there was less carbon dioxide in the atmosphere toward the end of the last ice age than there was at the beginning

【Paragraph 5】 A problem with Milankovitch's explanation of glaciation arises from the fact that the variations in Earth's orbit, and hence the Milankovitch cycles, have existed for billions of years. ■ Thus, we might expect that glaciation would have been a cyclic event throughout geologic time. In fact, periods of glaciation are rare. ■ So there must be another factor acting together with the Milankovitch cycles that causes periods of glaciation. ■ Once this additional factor makes the temperature low enough, the cyclic variations of the Milankovitch cycles will force the planet into and out of glacial epochs with a fixed regularity. ■

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

This factor must precede an ice age and have the effect of slightly lowering Earth's temperature.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

In the 1920s and 1930s, Milutin Milankovitch worked out an account of the cause of Earth's glaciations.

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Answer Choices

- A. Milankovitch argued that glaciations would result when three cycles that affect characteristics of Earth's orbit combined in a certain way.
- B. Milankovitch's predictions have been shown to be in agreement with periods of glaciation over the past 65 million years.
- C. Since ice ages are much less frequent than Milankovitch's explanation predicts, some factor, such as low levels of atmospheric carbon dioxide, must also be involved in triggering glaciation.
- D. Milankovitch showed that changes in Earth's orbit periodically lengthen cold seasons and shorten warm ones so that more ice forms than melts and glaciers build up.
- E. Dust from volcanic eruptions that blocks the Sun's warming radiation has been proposed as an explanation alternative to Milankovitch cycles for the cause of ice ages.
- F. Studies of gas bubbles preserved in the Greenland ice cap strongly suggest that Milankovitch cycles may also influence atmospheric carbon dioxide levels.

Passage 04 - The Climate of Japan

At the most general level, two major climatic forces determine Japan's weather. Prevailing westerly winds move across Eurasia, sweep over the Japanese islands, and continue eastward across the Pacific Ocean. In addition, great cyclonic airflows (masses of rapidly circulating air) that arise over the western equatorial Pacific move in a wheel-like fashion northeastward across Japan and nearby regions. During winter months heavy masses of cold air from Siberia dominate the weather around Japan. Persistent cold winds skim across the Sea of Japan from the northwest, picking up moisture that they deposit as several feet of snow on the western side of the mountain ranges on Honshu Island. As the cold air drops its moisture, it flows over high ridges and down eastern slopes to bring cold, relatively dry weather to valleys and coastal plains and cities.

In spring the Siberian air mass warms and loses density, enabling atmosphere currents over the Pacific to steer warmer air into northeast Asia. This warm, moisture-laden air covers most of southern Japan during June and July. The resulting late spring rains then give way to a drier summer that is sufficiently hot and muggy, despite the island chain's northerly latitude, to allow widespread rice cultivation.

Summer heat is followed by the highly unpredictable autumn rains that accompany the violent tropical windstorm known as typhoons. These cyclonic storms originate over the western Pacific and travel in great clockwise arcs, initially heading west toward the Philippines and southern China, curving northward later in the season. Cold weather drives these storms eastward across Japan through early winter revitalizing Siberian air mass and ushering in a new annual weather cycle.

This yearly cycle has played a key role in shaping Japanese civilization. It has assured the islands ample precipitation, ranging irregularly from more than 200 centimeters annually in parts of the southwest to about 100 in the northeast and averaging 180 for the country as a whole. The moisture enables the islands to support uncommonly lush forest cover, but the combination of precipitous slopes and heavy rainfall also gives the islands one of the world's highest rates of natural erosion, intensified by both human activity and the natural shocks of earthquakes and volcanism. These factors have given Japan its wealth of sedimentary basins, but they have also made mountainsides extremely susceptible to erosion and landslides and hence generally unsuitable for agricultural manipulation.

The island chain's mountainous backbone and great length from north to south produce climatic diversity that has contributed to regional differences. Generally sunny winters along the Pacific seaboard have made habitation there relatively pleasant. Along the Sea of Japan, on the other hand, cold, snowy winters have discouraged settlement. Furthermore, although annual precipitation is high in that region, much of it comes as snow and rushes to the sea as spring runoff, leaving little moisture for farming.

Summer weather patterns in northern Honshu, and especially along the Sea of Japan, have also discouraged agriculture. The area is subject to the *yamase* effect, when cool air from the north sometimes lowers temperatures sharply and damages farm production. The impact of this effect has been especially great on rice cultivation because, if it is to grow well, the rice grown in Japan requires a mean summer temperature of 20°C centigrade or higher. A drop of 2°—3°C lead to a 30—50 percent drop in rice yield, and the *yamase* effect is capable of exceeding that level. This *yamase* effect does not, however, extend very far south, where most precipitation comes in the form of rain and the bulk of it in spring, summer, and fall, when most useful for cultivation. Even the autumn typhoons, which deposit most of their moisture along the southern seaboard, are beneficial because they promote the start of the winter crops that for centuries have been grown in southern Japan.

In short, for the past two millennia, the climate in general and patterns of precipitation in particular have encouraged the Japanese to cluster their settlements along the southern coast, most densely along the sheltered Inland Sea, moving into the

northeast. There the limits that topography imposed on production have been tightened by climate, with the result that agricultural output has been more modest and less reliable, making the risk of crop failure and hardship commensurately greater.

【Paragraph 1】 At the most general level, two major climatic forces determine Japan's weather. Prevailing westerly winds move across Eurasia, sweep over the Japanese islands, and continue eastward across the Pacific Ocean. In addition, great cyclonic airflows (masses of rapidly circulating air) that arise over the western equatorial Pacific move in a wheel-like fashion northeastward across Japan and nearby regions. During winter months heavy masses of cold air from Siberia dominate the weather around Japan. Persistent cold winds skim across the Sea of Japan from the northwest, picking up moisture that they deposit as several feet of snow on the western side of the mountain ranges on Honshu Island. As the cold air drops its moisture, it flows over high ridges and down eastern slopes to bring cold, relatively dry weather to valleys and coastal plains and cities.

1. According to paragraph 1, all of the following are true of the cold air from Siberia EXCEPT

- A. It gathers moisture as it moves across the Sea of Japan
- B. It is responsible for the snow that falls on the western side of Honshu island
- C. It is warmed by the cyclonic airflow from the south that mix-with it.
- D. It is responsible for the cold, dry weather of the eastern valleys and coastal plains and cities

【Paragraph 2】 In spring the Siberian air mass warms and loses density, enabling atmosphere currents over the Pacific to steer warmer air into northeast Asia. This warm, moisture-laden air covers most of southern Japan during June and July. The resulting late spring rains then give way to a drier summer that is sufficiently hot and muggy, despite the island chain's northerly latitude, to allow widespread rice cultivation.

2. Why does the author include the phrase “**despite the island chain's northerly latitude**” in the paragraph?

- A. To indicate that one would not expect such hot, muggy weather at Japan's latitude
- B. To compare Japan's climate to the climate of more northerly latitudes
- C. To give a reason for the hot, muggy weather experienced in Japan during the summer
- D. To explain why Japan's climate is only suitable for rice cultivation

【Paragraph 3】 Summer heat is followed by the highly unpredictable autumn rains that accompany the violent tropical windstorm known as typhoons. These cyclonic storms originate over the western Pacific and travel in great clockwise arcs, initially heading west toward the Philippines and southern China, curving northward later in the season. Cold weather drives these storms eastward across Japan through early winter revitalizing Siberian air mass and ushering in a new annual weather cycle.

3. According to paragraph 3, all of the following are true of autumn storms EXCEPT

- A. They involve rain combined with tropical windstorms
- B. Cyclonic storms have a predictable pattern of travel
- C. Their movement creates a weather cycle that repeats itself
- D. They begin as northern Siberian air masses with consistent rains following the summer heat

【Paragraph 4】 This yearly cycle has played a key role in shaping Japanese civilization. It has assured the islands ample precipitation, ranging irregularly from more than 200 centimeters annually in parts of the southwest to about 100 in the northeast and averaging 180 for the country as a whole. The moisture enables the islands to support uncommonly lush forest cover, but the combination of precipitous slopes and heavy rainfall also gives the islands one of the world's highest rates of natural erosion, intensified by both human activity and the natural shocks of earthquakes and volcanism. These factors have given Japan its wealth of sedimentary basins, but they have also made mountainsides extremely susceptible to erosion and landslides and hence generally unsuitable for agricultural manipulation.

4. All of the following are mentioned in paragraph 4 as contribute in paragraph 4 as contribute to the high rate of erosion in the Japanese EXCEPT

- A. very steep slopes and heavy rainfall
- B. intense agricultural manipulation
- C. earthquakes and volcanic activities
- D. human activity

【Paragraph 5】 The island chain's mountainous backbone and great length from north to south produce climatic diversity that has contributed to regional differences. Generally sunny winters along the Pacific seaboard have made habitation there relatively pleasant. Along the Sea of Japan, on the other hand, cold, snowy winters have discouraged settlement. Furthermore, although annual precipitation is high in that region, much of it comes as snow and rushes to the sea as spring runoff, leaving little moisture for farming.

5. According to paragraph 5, which of the following is a major factor in the limited habitation in the area along the Sea of Japan?

- A. It has too many mountains.
- B. It is vulnerable to floods during spring runoff.
- C. Its climate is highly irregular and unpredictable.
- D. It is cold and snowy during winter.

【Paragraph 6】 Summer weather patterns in northern Honshu, and especially along the Sea of Japan, have also discouraged agriculture. The area is subject to the *yamase* effect, when cool air from the north sometimes lowers temperatures sharply and damages farm production. The impact of this effect has been especially great on rice cultivation because, if it is to grow well, the rice grown in Japan requires a mean summer temperature of 20°C centigrade or higher. A drop of 2°—3°C lead to a 30—50 percent drop in rice yield, and the *yamase* effect is capable of exceeding that level. This *yamase* effect does not, however, extend very far south, where most precipitation comes in the form of rain and the bulk of it in spring, summer, and fall, when most useful for cultivation. Even the autumn typhoons, which deposit most of their moisture along the southern seaboard, are beneficial because they promote the start of the winter crops that for centuries have been grown in southern Japan.

6. Which of the following can be inferred from paragraph 6 about farming in southern Japan?

- A. Farming is limited to rice cultivation.
- B. Farming is difficult because of the *yamase* effect.
- C. Farming takes place throughout the year.
- D. Farming suffers from the effects of autumn typhoons.

【Paragraph 7】 In short, for the past two millennia, the climate in general and patterns of precipitation in particular have encouraged the Japanese to **cluster** their settlements along the southern coast, most densely along the sheltered Inland Sea, moving into the northeast. **There the limits that topography imposed on production have been tightened by climate, with the result that agricultural output has been more modest and less reliable, making the risk of crop failure and hardship commensurately greater.**

7. The word “**cluster**” in the passage is closest in meaning to

- A. build
- B. group
- C. move
- D. expand

8. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information

- A. Agricultural production has been more successful in northeastern Japan than along the Inland Sea, where topography and climate make life difficult for people.
- B. Topography and climate have combined to limit agricultural production in northeastern Japan, resulting in an increased risk of crop failure and hardship.
- C. Along the Inland Sea, where topography makes the climate more severe, decreased agriculture output has resulted from crop failure and hardship.
- D. The risk of crop failure in northeastern Japan has caused greater hardship than have climate and topography.

【Paragraph 4】 This yearly cycle has played a key role in shaping Japanese civilization. ■It has assured the islands ample precipitation, ranging irregularly from more than 200 centimeters annually in parts of the southwest to about 100 in the northeast and averaging 180 for the country as a whole. ■The moisture enables the islands to support uncommonly lush forest cover, but the combination of precipitous slopes and heavy rainfall also gives the islands one of the world’s highest rates of natural erosion, intensified by both human activity and the natural shocks of earthquakes and volcanism. ■These factors have given Japan its wealth of sedimentary basins, but they have also made mountainsides extremely susceptible to erosion and landslides and hence generally unsuitable for agricultural manipulation. ■

9. Look at the four squares **【■】** that indicates where the following sentence could be added to the passage.

Such a large amount of rainfall has both positive and negative effects on the environment of Japanese islands.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Japan's yearly weather cycled influences settlement patterns and agriculture across the islands.

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Answer choices

- A. The yamase effects has a great impact on rice growth in northern Japan but does not affect cultivation in southern Japan, where precipitation comes in the forms of rain rather than snow.
- B. Agriculture practices that stabilize sediments have reduced erosion and landscape allowed the growth of lush forests in Japan.
- C. Climate changes during the last two millennia have caused the Japanese to move their settlements towards the northeast, where the climate is more favorable to agriculture.
- D. Japan's yearly weather cycle makes farming possible only in the summer, as the effects of the Siberia air mass result in winters that are too cold and snowy for agriculture.
- E. Cold westerly winds from Siberia and cyclonic airflows from the Pacific Ocean provide ample rainfall for farming but contribute to high rates of erosion.
- F. Settlements are most concentrated along the Pacific seaboard to the south where climate and topography are more suitable for crop cultivation than along the Sea of Japan.

Passage 05 - Saving Soil and Cropland

The world's farmers are literally losing ground on two fronts—the loss of soil from erosion and the conversion of cropland to nonfarm uses. Both are well-established trends that reduce agricultural output, but since both are gradual processes, they are often not given the attention they deserve.

The 1930s Dust Bowl that threatened to turn the United States Great Plains into a vast desert was a traumatic experience that led to revolutionary changes in American agricultural practices, such as the planting of tree shelterbelts—rows of trees planted beside fields to slow wind and thus reduce wind erosion. Perhaps the most lasting change is strip cropping, the planting of crops on alternate strips with fallowed (not planted) land each year. This permits soil moisture to accumulate on the fallowed strips, while the planted strips reduce wind speed and hence the wind erosion on the idled strips. The key to controlling wind erosion is to keep the land covered with vegetation as much as possible and to slow wind speed at ground level.

One of the time-tested methods of dealing with water erosion is terracing—creating hill-side ridges—to reduce runoff. Another newer, highly effective tool in the soil conservation tool kit is conservation tillage, which includes both no tillage and minimum tillage. In conventional farming, land is plowed, disked, or harrowed to prepare the seedbed, seed is drilled into the soil with a planter, and row crops are cultivated with a mechanical cultivator two or three times to control weeds. With minimum tillage, farmers simply drill seeds directly into the soil. The only tillage is a one-time disturbance in a narrow band of soil where the seeds are inserted, leaving the remainder of the soil undisturbed, covered by crop residues and thus resistant to both water and wind erosion.

In the United States, where farmers during the 1990s were required to implement a soil-conservation plan on erodible cropland to be eligible for crop price supports, the no-till area went from 7 million hectares in 1990 to nearly 21 million hectares (51 million acres) in 2000, tripling within a decade. An additional 23 million hectares were minimum-tilled, for a total of 44 million hectares of conservation tillage. This total included 37 percent of the corn crop, 57 percent of soybeans, and 30 percent of the wheat. Outside the United States, data for crop year 1998-1999 show Brazil using conservation tillage on 11 million hectares and Argentina on 7 million hectares. Canada, using conservation tillage on 4 million hectares, rounds out the “big four”. And now no-till farming is catching on in Europe, Africa, and Asia. In addition to reducing soil losses, minimum-till and no-till practices also help retain water and reduce energy use.

Another example of an effort to control soil erosion is the Conservation Reserve Program (CRP). Created in the United States in 1985, the CRP aimed to convert 45 million acres of highly erodible land into permanent vegetative cover under ten-year contracts. Under this program, farmers were paid to plant grass or trees on fragile cropland. The retirement of 35 million acres under the CRP, together with the adoption of conservation practices on 37 percent of all cropland, reduced soil erosion in the United States from 3.1 billion tons in 1982 to 1.9 billion tons in 1997.

Saving cropland is sometimes more difficult than saving the topsoil on the cropland. This is particularly the case when dealing with urban sprawl, where strong commercial forces have influence. With cropland becoming scarce, efforts to protect prime farmland from urban spread are needed everywhere. Japan provides a good example of such efforts. It has successfully protected rice paddies even within the boundaries of Tokyo, thus enabling it to remain self-sufficient in rice, its staple food.

In the United States, Portland, Oregon, provides another example. The state adopted boundaries to urban growth twenty years ago, requiring each community to project its growth needs for the next two decades and then, based on the results, draw an outer boundary that would accommodate that growth. This has worked in Oregon because it has forced development back to

the city.

【Paragraph 1】 The world's farmers are literally losing ground on two fronts—the loss of soil from erosion and the conversion of cropland to nonfarm uses. Both are well-established trends that reduce agricultural output, but since both are gradual processes, they are often not given the attention they deserve.

【Paragraph 2】 **The 1930s Dust Bowl that threatened to turn the United States Great Plains into a vast desert was a traumatic experience that led to revolutionary changes in American agricultural practices, such as the planting of tree shelterbelts—rows of trees planted beside fields to slow wind and thus reduce wind erosion.** Perhaps the most lasting change is strip cropping, the planting of crops on alternate strips with fallowed (not planted) land each year. This permits soil moisture to accumulate on the fallowed strips, while the planted strips reduce wind speed and hence the wind erosion on the idled strips. The key to controlling wind erosion is to keep the land covered with vegetation as much as possible and to slow wind speed at ground level.

1. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. The 1930s Dust Bowl was a revolutionary event that threatened to destroy United States agriculture by turning the Great Plains into a vast desert.
- B. The 1930s Dust Bowl in the United States resulted in radical changes in agricultural practices aimed at reducing wind erosion, such as the planting of tree shelterbelts.
- C. Tree shelterbelts, which are often used in the Great Plains area, are made up of the trees that are planted in long rows beside agricultural fields.
- D. Of all the innovative techniques used to control wind erosion after the 1930s Dust Bowl, only tree shelterbelts proved effective.

2. According to paragraph 2, which of the following is true about strip cropping?

- A. It increases crop yields annually.
- B. It forces farmers to plant crops that absorb less water and fewer nutrients from the soil.
- C. It requires the use of shelterbelts.
- D. It prevents wind erosion and allows moisture to collect on sections of land left unplanted.

【Paragraph 3】 One of the time-tested methods of dealing with water erosion is terracing—creating hill-side ridges—to reduce runoff. Another newer, highly effective tool in the soil conservation tool kit is conservation tillage, which includes both no tillage and minimum tillage. In conventional farming, land is plowed, disked, or harrowed to prepare the seedbed, seed is drilled into the soil with a planter, and row crops are cultivated with a mechanical cultivator two or three times to control weeds. With minimum tillage, farmers simply drill seeds directly into the soil. The only tillage is a one-time disturbance in a narrow band of soil where the seeds are inserted, leaving the remainder of the soil undisturbed, covered by crop residues and thus resistant to both water and wind erosion.

3. According to paragraph 3, all of the following are practices involved in minimum tillage EXCEPT

- A. using mechanical devices to control weeds
- B. leaving unseeded soil undisturbed
- C. disturbing the soil only once where the seeds are inserted
- D. protecting against water and wind erosion by leaving parts of the soil covered with crop residues

【Paragraph 4】 In the United States, where farmers during the 1990s were required to implement a soil-conservation plan on erodible cropland to be eligible for crop price supports, the no-till area went from 7 million hectares in 1990 to nearly 21 million hectares (51 million acres) in 2000, tripling within a decade. An additional 23 million hectares were minimum-tilled, for a total of 44 million hectares of conservation tillage. This total included 37 percent of the corn crop, 57 percent of soybeans, and 30 percent of the wheat. Outside the United States, data for crop year 1998-1999 show Brazil using conservation tillage on 11 million hectares and Argentina on 7 million hectares. Canada, using conservation tillage on 4 million hectares, rounds out the “big four”. And now no-till farming is catching on in Europe, Africa, and Asia. In addition to reducing soil losses, minimum-till and no-till practices also help retain water and reduce energy use.

4. According to paragraph 4, why did the amount of no-till area increase between 1990 and 2000 in the United States?

- A. More land area had become available for farming during this period.
- B. Fewer crops were needed since no till farming had increased the soybean, wheat, and corn crop yields.
- C. Because conventional farming practices were too expensive, farmers decided to use the cheaper no-till conservation plan.
- D. The government provided financial support to farmers who practiced soil conservation.

5. Paragraph 4 suggests that all of the following were among the largest users of conservation tillage during the late 1990s EXCEPT

- A. Argentina
- B. Europe
- C. Canada
- D. Brazil

【Paragraph 5】 Another example of an effort to control soil erosion is the Conservation Reserve Program (CRP). Created in the United States in 1985, the CRP aimed to convert 45 million acres of highly erodible land into permanent vegetative cover under ten-year contracts. Under this program, farmers were paid to plant grass or trees on fragile cropland. The retirement of 35 million acres under the CRP, together with the adoption of conservation practices on 37 percent of all cropland, reduced soil erosion in the United States from 3.1 billion tons in 1982 to 1.9 billion tons in 1997.

6. What can be inferred from paragraphs 4 and 5 about soil conservation efforts in the United States?

- A. Encouraging minimum tillage practices resulted in much more efficient soil conservation than converting erodible land into vegetative cover.
- B. Complete retirement of land combined with soil-conservation practices significantly reduced soil erosion.
- C. Measuring the success of government-supported conservation programs over extended periods of time was sometimes as difficult as getting the programs started.
- D. The reduction of energy use due to practices such as conservation tillage and land retirement was much larger in the United States than in any other country.

【Paragraph 6】 Saving cropland is sometimes more difficult than saving the topsoil on the cropland. This is particularly the case when dealing with urban sprawl, where strong commercial forces have influence. With cropland becoming scarce, efforts to protect prime farmland from urban spread are needed everywhere. Japan provides a good example of such efforts. It has successfully protected rice paddies even within the boundaries of Tokyo, thus enabling it to remain self-sufficient in rice, its staple food.

7. In paragraph 6, the author refers to Tokyo, Japan, in order to

- A. explain why Japan is not likely to experience problems with soil erosion in the future
- B. provide evidence of the importance of maintaining cropland close to big cities
- C. point to an approach for reducing urban spread into croplands that has had positive results
- D. argue for the use of Japanese techniques to prevent erosion in the United States.

【Paragraph 7】 In the United States, Portland, Oregon, provides another example. The state adopted boundaries to urban growth twenty years ago, requiring each community to project its growth needs for the next two decades and then, based on the results, draw an outer boundary that would accommodate that growth. This has worked in Oregon because it has forced development back to the city.

8. Select the TWO answer choices that, according to paragraph 7, indicate true statements about Oregon. To obtain credit, you must select TWO answer choices.

- A. It planned and set long-term limits to urban growth.
- B. Its urban development within the city limits increased.
- C. Its surrounding farmland provided what the city needed to make it self-sufficient.
- D. It allowed each of its communities to deal with the commercial forces behind urban spread independently.

【Paragraph 3】 ■One of the time-tested methods of dealing with water erosion is terracing—creating hill-side ridges—to reduce runoff. ■Another newer, highly effective tool in the soil conservation tool kit is conservation tillage, which includes both no tillage and minimum tillage. ■In conventional farming, land is plowed, disked, or harrowed to prepare the seedbed, seed is drilled into the soil with a planter, and row crops are cultivated with a mechanical cultivator two or three times to control weeds. ■With minimum tillage, farmers simply drill seeds directly into the soil. The only tillage is a one-time disturbance in a narrow band of soil where the seeds are inserted, leaving the remainder of the soil undisturbed, covered by crop residues and thus resistant to both water and wind erosion.

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

These methods differ from traditional farming practices.

Where would the sentence best fit?

10. Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Agricultural output all over the world is being reduced due to soil erosion and an increased use of cropland for nonfarming purposes.

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Answer Choices

- A. Terracing, probably one of the oldest methods for controlling soil erosion, led to the creation of the more sophisticated and more efficient conservation practices used in contemporary farming.
- B. The United States has successfully instituted programs that encourage conservation tillage and the retirement of highly erodible land.
- C. City governments in the United States and Japan developed conservation programs that encourage farmers near big cities to cultivate crops that minimize soil erosion.
- D. After the 1930s Dust Bowl, the United States made significant changes to its agricultural practices, including the planting of tree shelterbelts and strip cropping.
- E. The conservation Reserve Program created in the United States in 1985 is gradually being adopted in other areas at the world such as Europe, Africa, and Asia.
- F. Saving cropland is sometimes difficult because it involves dealing with commercial forces, but some efforts like those in Tokyo and Oregon have been successful.

Passage 06 - Early Theories of Continental Drift

The idea that the past geography of Earth was different from today is not new. The earliest maps showing the east coast of South America and the west coast of Africa probably provided people with the first evidence that continents may have once been joined together, then broken apart and moved to their present positions.

During the late nineteenth century, Austrian geologist Eduard Suess noted the similarities between the Late Paleozoic plant fossils of India, Australia, South Africa, and South America. The plant fossils comprise a unique group of plants that occurs in coal layers just above the glacial deposits on these southern continents. In this book *The Face of the Earth* (1885), he proposed the name “Gondwanaland” (called Gondwana here) for a supercontinent composed of the aforementioned southern landmasses. Suess thought these southern continents were connected by land bridges over which plants and animals migrated. Thus, in his view, the similarities of fossils on these continents were due to the appearance and disappearance of the connecting land bridges.

The American geologist Frank Taylor published a pamphlet in 1910 presenting his own theory of continental drift. He explained the formation of mountain ranges as a result of the lateral movements of continents. He also envisioned the present-day continents as parts of larger polar continents that eventually broke apart and migrated toward equator after Earth’s rotation was supposedly slowed by gigantic tidal forces. According to Taylor, these tidal forces were generated when Earth’s gravity captured the Moon about 100 million years ago. Although we know that Taylor’s explanation of continental drift is incorrect, one of his most significant contributions was his suggestion that the Mid-Atlantic Ridge—an underwater mountain chain discovered by the 1872-1876 British *HMS Challenger* expeditions—might mark the site at which an ancient continent broke apart, forming the present -day Atlantic Ocean.

However, it is Alfred Wegener, a German meteorologist, who is generally credited with developing the hypothesis of continental drift. In his monumental book, *The Origin of Continents and Oceans* (1915), Wegener proposed that all landmasses were originally united into a single supercontinent that he named “Pangaea.” Wegner portrayed his grand concept of continental movement in a series of maps showing the breakup of Pangaea and the movement of various continents to their present-day locations. What evidence did Wegener use to support his hypothesis of continental drift? First, Wegener noted that the shorelines of continents fit together, forming a large supercontinent and that marine, nonmarine, and glacial rock sequences of Pennsylvanian to Jurassic ages are almost identical for all Gondwana continents, strongly indicating that they were joined together at one time. Furthermore, mountain ranges and glacial deposits seem to match up in such a way that suggests continents could have once been a single landmass. And last, many of the same extinct plant and animal groups are found today on widely separated continents, indicating that the continents must have been in proximity at one time. Wegener argued that this vast amount of evidence from a variety of sources surely indicated the continents must have been close together at one time in the past.

Alexander Du Toit, a South African geologist was one of Wegener’s ardent supporters. He noted that fossils of the Permian freshwater reptile “Mesosaurus” occur in rocks of the same age in both Brazil and South Africa. Because the physiology of freshwater and marine animals is completely different, it is hard to imagine how a freshwater reptile could have swum across the Atlantic Ocean and then found a freshwater environment nearly identical to its former habitat. Furthermore, if Mesosaurus could have swum across the ocean, its fossil remains should occur in other localities besides Brazil and South Africa. It is more logical to assume that Mesosaurus lived in lakes in what are now adjacent areas of South America and Africa but were then united in a single continent.

Despite what seemed to be overwhelming evidence presented Wegener and later Du Toit and others, most geologists at the time refused to entertain the idea that the continents might have moved in the past.

【Paragraph 2】 During the late nineteenth century, Austrian geologist Eduard Suess noted the similarities between the Late Paleozoic plant fossils of India, Australia, South Africa, and South America. The plant fossils comprise a unique group of plants that occurs in coal layers just above the glacial deposits on these southern continents. In this book *The Face of the Earth* (1885), he proposed the name “Gondwanaland” (called Gondwana here) for a supercontinent composed of the aforementioned southern landmasses. Suess thought these southern continents were connected by land bridges over which plants and animals migrated. Thus, in his view, the similarities of fossils on these continents were due to the appearance and disappearance of the connecting land bridges.

1. According to paragraph 2, Eduard Suess believed that similarities of plant and animal fossils on the southern continents were due to

- A. living in the southern climate
- B. crossing the land bridges
- C. fossilization in the coal layers
- D. movements of the supercontinent

【Paragraph 3】 The American geologist Frank Taylor published a pamphlet in 1910 presenting his own theory of continental drift. He explained the formation of mountain ranges as a result of the lateral movements of continents. He also envisioned the present-day continents as parts of larger polar continents that eventually broke apart and migrated toward equator after Earth’s rotation was supposedly slowed by gigantic tidal forces. According to Taylor, these tidal forces were generated when Earth’s gravity captured the Moon about 100 million years ago. Although we know that Taylor’s explanation of continental drift is incorrect, one of his most significant contributions was his suggestion that the Mid-Atlantic Ridge—an underwater mountain chain discovered by the 1872-1876 British *HMS Challenger* expeditions—might mark the site at which an ancient continent broke apart, forming the present -day Atlantic Ocean.

2. According to paragraph 3, Frank Taylor believed that

- A. present-day continents broke off from larger continents and drifted toward the poles due to tidal forces
- B. the lateral shifting of continents caused the formation of mountain ranges
- C. polar continents began to join together when Earth’s gravity captured the Moon 100 million years ago
- D. Earth’s gravity and speed of rotation created large polar continents

3. Which of the following can be inferred from paragraph 3 about the Mid-Atlantic Ridge?

- A. It was once above sea level.
- B. It formed at the same time that Earth’s gravity captured the Moon.
- C. It was much more extensive when it was first formed than it is today.
- D. It was unknown before the HMS Challenger voyages.

【Paragraph 4】 However, it is Alfred Wegener, a German meteorologist, who is generally credited with developing the hypothesis of continental drift. In his **monumental** book, *The Origin of Continents and Oceans* (1915), Wegener proposed that all landmasses were originally united into a single supercontinent that he named “Pangaea.” Wegner portrayed his grand concept of continental movement in a series of maps showing the breakup of Pangaea and the movement of various continents to their present-day locations. What evidence did Wegener use to support his hypothesis of continental drift? First, Wegener noted that the shorelines of continents fit together, forming a large supercontinent and that marine, nonmarine, and glacial rock sequences of Pennsylvanian to Jurassic ages are almost identical for all Gondwana continents, strongly indicating that they were joined together at one time. Furthermore, mountain ranges and glacial deposits seem to match up in such a way that suggests continents could have once been a single landmass. And last, many of the same extinct plant and animal groups are found today on widely separated continents, indicating that the continents must have been in proximity at one time. Wegener argued that this vast amount of evidence from a variety of sources surely indicated the continents must have been close together at one time in the past.

4. The word “**monumental**” in the passage is closest in meaning to

- A. final
- B. persuasive
- C. well-known
- D. great and significant

5. According to paragraph 4, Wegener felt confident that his theory are correct in part because

- A. contemporary scientists were unable to successfully challenge his evidence
- B. many different types of evidence seemed to support his theory
- C. his theory accounted for phenomena that earlier theories could not explain
- D. he had used the most advanced techniques available to gather his evidence

6. According to paragraph 4, Wegener pointed to all of the following in support of his theory of continental drift EXCEPT

- A. Plants and animals now living on some continents appear to be descended from plants and animals that originated on other continents.
- B. Rock sequences associated with the continents are extremely similar.
- C. The coastlines of some continents seem to fit together.
- D. Mountains on some continents would be adjacent to mountains on other continents if these continents were joined.

【Paragraph 5】 Alexander Du Toit, a South African geologist was one of Wegener’s ardent supporters. He noted that fossils of the Permian freshwater reptile “Mesosaurus” occur in rocks of the same age in both Brazil and South Africa. Because the physiology of freshwater and marine animals is completely different, it is hard to imagine how a freshwater reptile could have swum across the Atlantic Ocean and then found a freshwater environment nearly identical to its former habitat. Furthermore, if Mesosaurus could have swum across the ocean, its fossil remains should occur in other localities besides Brazil and South Africa. It is more logical to assume that Mesosaurus lived in lakes in what are now adjacent areas of South America and Africa but were then united in a single continent.

7. Why does the author mention the fact that “**the physiology of freshwater and marine animals is completely different**”?

- A. To explain why Du Toit was able to determine that Mesosaurus was a freshwater reptile
- B. To explain why Du Toit concluded that certain fossils in rocks in Brazil and South Africa were those of the same animal
- C. To cast doubt on the idea that Mesosaurus could have swum from one landmass to another
- D. To show Du Toit determined which landmass Mesosaurus originated on

8. Which of the following can be inferred from paragraph 5 about the Permian Mesosaurus of Brazil and South Africa?

- A. It was the dominant animal in the habitats in which it lived.
- B. It lived in similar environments in both places.
- C. It was a weak swimmer compared with other freshwater reptiles.
- D. Its physiology differed from that of modern freshwater reptiles.

【Paragraph 5】 Alexander Du Toit, a South African geologist was one of Wegener’s ardent supporters. He noted that fossils of the Permian freshwater reptile “Mesosaurus” occur in rocks of the same age in both Brazil and South Africa. ■Because the physiology of freshwater and marine animals is completely different, it is hard to imagine how a freshwater reptile could have swum across the Atlantic Ocean and then found a freshwater environment nearly identical to its former habitat. ■Furthermore, if Mesosaurus could have swum across the ocean, its fossil remains should occur in other localities besides Brazil and South Africa. ■It is more logical to assume that Mesosaurus lived in lakes in what are now adjacent areas of South America and Africa but were then united in a single continent. ■

9. Look at the four squares **【■】** that indicates where the following sentence could be added to the passage.

In addition to supplying new geological evidence for continental drift, he crafted convincing arguments based on ancient life forms.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage.

Several theories involving the movement of continents were proposed in the nineteenth and early twentieth centuries.

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Answer Choices

- A. Early maps showing the coastlines of South America and Africa inspired Eduard Suess to search for fossil evidence that today's southern continents had once been joined in a single landmass.
- B. To Eduard Suess, continental drift accounted for the presence of the same types of fossils on different continents that had at times been connected by land bridges.
- C. Du Toit's study of the freshwater reptile *Mesosaurus* added to the already considerable body of evidence that Alfred Wegener had gathered in support of the idea of continental drift.
- D. Frank Taylor expanded on Eduard Suess's theory of continental drift by arguing that tidal forces 100 million years ago had broken continents apart and caused the rise of the Mid-Atlantic Ridge.
- E. Alfred Wegener, who first developed the theory of continental drift argued that all landmasses were originally part of a supercontinent that broke up into separate continents.
- F. Early theories of continental drift were not widely accepted at the time because they failed to explain why continents moved.

Passage 07 - How Soil is Formed

Soil formation is a dynamic process that takes place in different environments. It is strongly influenced by the parent material, climate (largely vegetation and temperature and water exchanges), topography (the elevations, depressions, directions and angles of slopes, and other surface features of the landscape), and time.

The parent material is the unconsolidated mass on which soil formation takes place. This material may or may not be derived from the on-site geological substrate or bedrock on which it rests. Parent materials can be transported by wind, water, glaciers, and gravity and deposited on top of bedrock. Because of the diversity of materials involved, soils derived from transported parent materials are commonly more fertile than soils from parent materials derived in place. Whatever the parent material, whether derived in place from bedrock or from transported material, it ultimately comes from geological materials, such as igneous, sedimentary, and metamorphic rocks, and the composition of the rocks largely determines the chemical composition of the soil.

Climate is most influential in determining the nature and intensity of weathering and the type of vegetation that further affects soil formation. The soil material experiences daily and seasonal variations in heating and cooling. Open surfaces exposed to thermal radiation undergo the greatest daily fluctuations in heating and cooling, soils covered with vegetation the least. Hill slopes facing the sun absorb more heat than those facing away from the sun. Radiant energy has a pronounced effect on the moisture regime, especially the evaporative process and dryness. Temperature can stimulate or inhibit biogeochemical reactions in soil material.

Water is involved in all biogeochemical reactions in the soil because it is the carrier of the acids that influence the weathering process. Water enters the soil material as a liquid and leaves it as a liquid by percolation (the slow movement of water through the soil's pores) and as a gas through evaporation. The water regime-the water flow over a given time-in soil material is sporadic, and in many parts of the Earth is highly seasonal. Water that enters the soil during heavy rainfall and snowmelt moves down through the soil. As it moves, it leaves behind suspended material and may carry away mineral matter in solution, a process called leaching. On sloping land, water distributes material laterally (sideways) through the soil.

Topography is a major factor in soil development. More water runs off and less enters the soil on steep slopes than on relatively level land. Water draining from slopes enters the soil on low and flat land. Thus soils and soil material tend to be dry on slopes and moist on wet on the low land. Steep slopes are subject to surface erosion and soil creep-the downslope movement of soil material, which accumulates on lower slopes and lowlands.

Vegetation, animals, bacteria, and fungi all contribute to the formation of soil. Vegetation, in particular, is responsible for organic material in the soil and influences its nutrient content. For example, forests store most of their organic matter on the surface, whereas in grasslands most of the organic matter added to the soil comes from the deep fibrous root systems. Organic acids produced by vegetation accelerate the weathering process.

The weathering of rock material and the accumulation, decomposition, and mineralization of organic material require considerable time. Well-developed soils in equilibrium with weathering, erosion, and biotic influences may require 2,000 to 20,000 years for their formation, but soil differentiation from parent material may take place in as short a time as 30 years. Certain acid soils in humid regions develop in 2,000 years because the leaching process is speeded by acidic materials. Parent materials heavy in texture require a much longer time to develop into soils because of an impeded downward flow of water. Soils develop more slowly in dry regions than in humid ones. Soils on steep slopes often remain poorly developed regardless of geological age because rapid erosion removes soil nearly as fast as it is formed. Floodplain soils age little

through time because of the continuous accumulation of new materials. Such soils are not deeply weathered and are more fertile than geologically old soils because they have not been exposed to the leaching process as long. The latter soils tend to be infertile because of long-time leaching of nutrients without replacement from fresh material.

【Paragraph 2】 The parent material is the unconsolidated mass on which soil formation takes place. This material may or may not be derived from the on-site geological substrate or bedrock on which it rests. Parent materials can be transported by wind, water, glaciers, and gravity and deposited on top of bedrock. Because of the diversity of materials involved, soils derived from transported parent materials are commonly more fertile than soils from parent materials derived in place. **Whatever the parent material, whether derived in place from bedrock or from transported material, it ultimately comes from geological materials, such as igneous, sedimentary, and metamorphic rocks, and the composition of the rocks largely determines the chemical composition of the soil.**

1. According to paragraph 2, which of the following is true about parent material found at a given site?
 - A. It was most likely deposited there by glaciers rather than by wind and water.
 - B. It is formed and consolidated entirely from the bedrock on which it rests.
 - C. It can vary in its richness and fertility according to where it originated.
 - D. The speed with which it is transported determines its location.
2. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.
 - A. Transported parent materials, parent materials derived in place from bedrock, and various kinds of rocks all contribute to the composition of a soil.
 - B. The chemical composition of a soil is ultimately determined by the geological materials from which it forms, regardless of where or how the parent material originates.
 - C. The parent material from which a soil is formed ultimately comes from igneous, sedimentary, and metamorphic rocks.
 - D. The composition of the geological materials from which the parent material was originally derived can be determined by studying the chemical composition of the soil.

【Paragraph 4】 Water is involved in all biogeochemical reactions in the soil because it is the carrier of the acids that influence the weathering process. Water enters the soil material as a liquid and leaves it as a liquid by percolation (the slow movement of water through the soil's pores) and as a gas through evaporation. The water regime—the water flow over a given time—in soil material is sporadic, and in many parts of the Earth is highly seasonal. Water that enters the soil during heavy rainfall and snowmelt moves down through the soil. As it moves, it leaves behind suspended material and may carry away mineral matter in solution, a process called leaching. On sloping land, water distributes material laterally (sideways) through the soil.

3. According to paragraph 4, water passing through the soil can affect the soil's composition in which of the following ways?
 - A. By stopping certain chemical reactions from taking place in the soil
 - B. By carrying away minerals
 - C. By reducing the acidity of the soil
 - D. By preventing leaching of minerals

【Paragraph 5】 Topography is a major factor in soil development. More water runs off and less enters the soil on steep slopes than on relatively level land. Water draining from slopes enters the soil on low and flat land. Thus, soils and soil material tend to be dry on slopes and moist on wet on the low land. Steep slopes are subject to surface erosion and soil creep-the downslope movement of soil material, which accumulates on lower slopes and lowlands.

4. According to paragraph 5, why does soil material tend to be drier on steep slopes than on flatter land?

- A. Steep slopes are less likely to experience soil creep.
- B. Soil material on steep slopes tends to be thicker.
- C. Water that falls on steep slopes tends to erode the soil there and deposit it on level ground.
- D. More water runs off steep slopes before it can enter the soil.

【Paragraph 6】 Vegetation, animals, bacteria, and fungi all contribute to the formation of soil. Vegetation, in particular, is responsible for organic material in the soil and influences its nutrient content. For example, forests store most of their organic matter on the surface, whereas in grasslands most of the organic matter added to the soil comes from the deep fibrous root systems. Organic acids produced by vegetation accelerate the weathering process.

5. Paragraph 6 supports which of the following ideas about organic material soil?

- A. Most of the organic material in soil comes from fibrous root systems.
- B. How organic material is distributed in soil depends on the type of vegetation the soil supports.
- C. The organic materials in soil prevent acids from forming during the weathering process.
- D. Animals, bacteria, and fungi consume much of the nutrient content in soil.

【Paragraph 7】 The weathering of rock material and the accumulation, decomposition, and mineralization of organic material require considerable time. Well-developed soils in equilibrium with weathering, erosion, and biotic influences may require 2,000 to 20,000 years for their formation, but soil differentiation from parent material may take place in as short a time as 30 years. Certain acid soils in humid regions develop in 2,000 years because the leaching process is speeded by acidic materials. Parent materials heavy in texture require a much longer time to develop into soils because of an impeded downward flow of water. Soils develop more slowly in dry regions than in humid ones. Soils on steep slopes often remain poorly developed regardless of geological age because rapid erosion removes soil nearly as fast as it is formed. Floodplain soils age little through time because of the continuous accumulation of new materials. Such soils are not deeply weathered and are more fertile than geologically old soils because they have not been exposed to the leaching process as long. The latter soils tend to be infertile because of long-time leaching of nutrients without replacement from fresh material.

6. The word “**impeded**” in the passage is closest in meaning to

- A. excessive
- B. restricted
- C. diverted
- D. uneven

7. According to paragraph 7, why does floodplain soil tend to be especially fertile?

- A. Because floodplain soil tends to be deeply weathered
- B. Because floodplain soil is not continually replaced by the addition of new material
- C. Because floodplain soil has not had many nutrients removed
- D. Because most floodplains are in geologically new regions

8. The purpose of paragraph 7 in the passage is to

- A. provide evidence that soils in equilibrium maintain nutrients for longer periods of time than other soils
- B. explain why geologically younger soils are more fertile than older soils, regardless of where they are found
- C. explain how long it takes for soils to develop and what elements affect their fertility
- D. summarize the various stages of soil formation discussed earlier in the passage

【Paragraph 5】 Topography is a major factor in soil development. ■More water runs off and less enters the soil on steep slopes than on relatively level land. ■Water draining from slopes enters the soil on low and flat land. ■Thus, soils and soil material tend to be dry on slopes and moist on wet on the low land. ■Steep slopes are subject to surface erosion and soil creep-the downslope movement of soil material, which accumulates on lower slopes and lowlands.

9. Look at the four squares 【■】 that indicate where the following sentence can be added to the passage.

Its role is demonstrated by the contrast between what happens on steep slopes and what happens on the lower-lying land at the bottom of those slopes.

Where would the sentence best fit?

10. 【Directions】 An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

There are a variety of elements that influence soil development.

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Answer Choices

- A. By analyzing the chemical composition of developed soil, it is possible to determine the location of the geological substrate from which the parent material was originally derived.
- B. Both topography and the types of organisms present in the soil as it develops determine its nutrient level.
- C. The length of time that it takes to develop high-quality soil is determined by humidity levels, the makeup of parent materials, and patterns of water flow and erosion.
- D. The weathering process is strongly influenced by temperature and its variation, the nature of the water flow, and by the acids carried in the water.
- E. Where soil material is regularly subject to rapid and extreme variations in temperature and water content, certain biogeochemical reactions necessary for soil formation cannot take place.
- F. Because high humidity speeds up both leaching processes and erosion, soils in humid regions take much longer to reach equilibrium than soils in dry regions, and are seldom as fertile.

Passage 08 - Earthquake Prediction

Accurate prediction of earthquakes is not currently possible, although intensive research is proceeding in many areas.

Two types of earthquake prediction are theoretically possible. The first type is long-term forecasting, in which the probability of an earthquake along a particular segment of a within a certain time interval is calculated by studying seismic gaps and historical records of earthquakes that have occurred along that fault segment. By plotting the number of earthquakes within specific time intervals against their magnitudes, diagrams can be constructed for a local area. From this plot it is possible to determine the recurrence interval, or the average time interval between earthquakes of a specific magnitude. Predictions can then be made that an earthquake of that magnitude has a high probability of occurrence within a specified time interval if the date of the last earthquake is known.

Research leading to short-term forecasting, which involves a shorter time interval, has been focused on precursors observed prior to previous earthquakes. Precursors are physical or chemical phenomena that occur in a typical pattern before an earthquake. These phenomena include changes in the velocity of seismic waves, the electrical resistance of rocks, the frequency of the usually minor preliminary earthquakes (foreshocks), the deformation of the land surface, and the water level or water chemistry of wells in the area. Many of these precursors can be explained by a theory called the dilatancy model. Under this hypothesis, rocks in the process of strain along a fault show significant dilation or swelling before rupture. This volume increase is caused by the opening of microcracks, which are minute failure zones in weaker mineral grains in the rock and along grain boundaries. Groundwater flows into the highly stressed areas during the formation of microcracks. These changes in density and water content affect the ability of the rock to transmit seismic waves and conduct electricity. Therefore, seismic-wave velocity and electrical resistance progressively change as the overall rupture along the fault draws near. Localized changes in land-surface elevation are also related to volume changes at depth. An area of recent uplift along the San Andreas Fault near Los Angeles, which has been named the Palmdale Bulge, is being monitored in great detail as a possible indicator of a future earthquake.

Volume changes and groundwater movement may be reflected by changes in water levels in wells and also by changes in the chemical composition of groundwater. Radon gas has been observed to increase in wells prior to earthquakes. These increases are perhaps related to the release of radon gas from rocks during the formation of microcracks. The pattern of seismic activity is also significant in the vicinity of a fault area where rupture is imminent. This pattern consists of an initial rise in the number of small events, followed by a decline in foreshocks just prior to the major earthquake. The decline may represent a temporary increase in rock strength before the newly formed microcracks are filled with water.

The precursor phenomena can be grouped into stages according to the dilatancy model. Stage I consists of a gradual stress buildup along the fault. Stages II and III are correlated with dilatancy and water influx. Stage IV is the major earthquake, and stage V is the aftermath of the event. If every earthquake followed the sequence with uniform stage duration, earthquake prediction would be a simple matter. Instead of following the same patterns, each earthquake is unique in terms of specific precursor behavior patterns and length of precursor stages. A magnitude 6.9 North American earthquake in 1989 was preceded by a substantially smaller magnitude 5 earthquake fifteen months before the event. Another foreshock of similar size occurred two months before the event. In each case, a public advisory was issued stating that those smaller earthquakes could be foreshocks to a stronger earthquake within five days. However, the fault did not cooperate, and those predictions were not successful. Continued research and study of future earthquakes will certainly lead to refinement of the dilatancy model or to a replacement model with more accurate predictive capabilities.

【Paragraph 2】 Two types of earthquake prediction are theoretically possible. The first type is long-term forecasting, in which the probability of an earthquake along a particular segment of a within a certain time interval is calculated by studying seismic gaps and historical records of earthquakes that have occurred along that fault segment. By plotting the number of earthquakes within specific time intervals against their magnitudes, diagrams can be constructed for a local area. From this plot it is possible to determine the recurrence interval, or the average time interval between earthquakes of a specific magnitude. Predictions can then be made that an earthquake of that magnitude has a high probability of occurrence within a specified time interval if the date of the last earthquake is known.

1. According to paragraph 2, all of the following information is used in the process of long-term earthquake prediction EXCEPT the

- A. analysis of seismic gaps
- B. record of past earthquakes in the fault area
- C. date of the last recorded earthquake in the area
- D. pattern of earthquake activity in other nearby fault segments

2. According to paragraph 2, long-term forecasting can be used to predict which of the following

- A. The influence of earthquake activity in one segment of the fault area on other segments
- B. The frequency with which earthquakes of a certain size will occur
- C. The possible date of the next earthquake
- D. The magnitude of the next earthquake

【Paragraph 3】 Research leading to short-term forecasting, which involves a shorter time interval, has been **focused** on precursors observed prior to previous earthquakes. Precursors are physical or chemical phenomena that occur in a typical pattern before an earthquake. These phenomena include changes in the velocity of seismic waves, the electrical resistance of rocks, the frequency of the usually minor preliminary earthquakes (foreshocks), the deformation of the land surface, and the water level or water chemistry of wells in the area. Many of these precursors can be explained by a theory called the dilatancy model. Under this hypothesis, rocks in the process of strain along a fault show significant dilation or swelling before rupture. This volume increase is caused by the opening of microcracks, which are minute failure zones in weaker mineral grains in the rock and along grain boundaries. Groundwater flows into the highly stressed areas during the formation of microcracks. These changes in density and water content affect the ability of the rock to transmit seismic waves and conduct electricity. Therefore, seismic-wave velocity and electrical resistance progressively change as the overall rupture along the fault draws near. Localized changes in land-surface elevation are also related to volume changes at depth. An area of recent uplift along the San Andreas Fault near Los Angeles, which has been named the Palmdale Bulge, is being monitored in great detail as a possible indicator of a future earthquake.

3. Paragraph 3 mentions all of the following as examples of precursors EXCEPT

- A. changes in the speed of seismic waves
- B. changes in the availability of electricity
- C. changes in the frequency of foreshocks
- D. changes in land surfaces

4. According to the dilatancy model, what happens to rocks shortly before an earthquake?

- A. They lose significant amounts of moisture.
- B. They show signs of expanding.
- C. They move downward at great speed.
- D. They increase in temperature.

5. According to paragraph 3, the groundwater that flows into microcracks before an earthquake causes

- A. changes in seismic waves and electrical activity
- B. increases in the mineral content of rocks
- C. the disappearance of grain boundaries in rocks
- D. a release in the tension of highly stressed areas of rocks

6. The author discusses the San Andreas Fault near Los Angeles in order to

- A. contrast past and future patterns of earthquake activity in the area
- B. give an example of an area where underground earthquake activity is apparent from land changes above the ground
- C. explain why recent earthquake predictions have increased accuracy
- D. suggest that some areas of earthquake activity are easier to monitor than others

【Paragraph 4】 Volume changes and groundwater movement may be reflected by changes in water levels in wells and also by changes in the chemical composition of groundwater. Radon gas has been observed to increase in wells prior to earthquakes. These increases are perhaps related to the release of radon gas from rocks during the formation of microcracks. The pattern of seismic activity is also significant in the vicinity of a fault area where rupture is imminent. This pattern consists of an initial rise in the number of small events, followed by a decline in foreshocks just prior to the major earthquake. The decline may represent a temporary increase in rock strength before the newly formed microcracks are filled with water.

7. According to paragraph 4, which of the following occurs just before an earthquake

- A. The chemical content of groundwater drops.
- B. The rocks weaken as they fill with water.
- C. Seismic activity decreases.
- D. Radon gas causes microcracks to form.

【Paragraph 5】 The precursor phenomena can be grouped into stages according to the dilatancy model. Stage I consists of a gradual stress buildup along the fault. ■Stages II and III are correlated with dilatancy and water influx. Stage IV is the major earthquake, and stage V is the aftermath of the event. ■If every earthquake followed the sequence with uniform stage duration, earthquake prediction would be a simple matter. ■Instead of following the same patterns, each earthquake is unique in terms of specific precursor behavior patterns and length of precursor stages. ■A magnitude 6.9 North American earthquake in 1989 was preceded by a substantially smaller magnitude 5 earthquake fifteen months before the event. Another foreshock of similar size occurred two months before the event. In each case, a public advisory was issued stating that those smaller earthquakes could be foreshocks to a stronger earthquake within five days. However, the fault did not cooperate, and those predictions were not successful. Continued research and study of future earthquakes will certainly lead to refinement of the dilatancy model or to a replacement model with more accurate predictive capabilities.

8. How is paragraph 5 organized?

- A. The sequence of earthquake stages is given, and the effect of variable stage length on earthquake prediction is explained.
- B. The earthquake stages are named, and the most important stage is illustrated with a specific earthquake event.
- C. The sequence of earthquake stages is given, and evidence is presented that the intervals between stages are roughly equal in length.
- D. The earthquake stages are first named, and each is then described in greater detail.

9. Look at the four squares [■] that indicate where the following sentence could be added to the passage.

But the reality of earthquake forecasting is considerably more complex.

Where would the sentence best fit?

10. **【Directions】** Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Two types of earthquake prediction are theoretically possible: long-term forecasting and short-term forecasting.

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Answer Choices

- A. Short-term forecasting has been used more widely than long-term forecasting in the prediction of earthquakes.
- B. Long-term forecasting of earthquakes uses data on past seismic activity to determine the likelihood that an earthquake will occur in a certain area within a certain time period.
- C. Short-term forecasting research has studied earthquake precursors such as volume increases in rocks and unusual movements in underground water that occur shortly before an earthquake takes place.
- D. The dilatancy model has been used to successfully forecast some recent earthquakes.
- E. Attempts to improve forecasting by using five stages of earthquake predictors have been unsuccessful because each earthquake has unique precursor patterns and durations.
- F. The magnitude 6.9 North American earthquake in 1989 was not successfully predicted because the many foreshocks before the event were too small to measure.

Passage 09 - Cave and Rock Art

Some of the earliest human art to survive consists of engraved or painted works on open-air rocks or on the floors, walls, and ceilings of caves, some of them in deep crannies. They were created during the Upper Paleolithic period (40,000 to 10,000B.C.), and the best were done by what we call the Magdalenians (from the name of a site), peoples who flourished in Europe from 18,000 to 10,000 B.C. Such works have a unity and can be described as the Magdalenian art system, the first in human history. It was also the longest, lasting for much of the total time humans have produced art.

In any history of art, then, the Magdalenian system must occupy a place of importance. Also, of all the forms of art practiced on the planet, it is the one about which we know the least. But we do possess a reasonable amount of knowledge, bearing in mind that the first cave art was only discovered in the 1860s, and it was not until 1902 that it was accepted as a fact by anthropologists and art historians. By the end of the twentieth century, there were 277 agreed examples in Europe. Unfortunately, most cave art works are extremely fragile. When a cave is opened and the conditions that enable the paintings to survive are altered, deterioration can be rapid. Thus, except in places where expensive air-conditioning has been installed, caves are no longer open to the public. Even the Altamira cave in Spain, finest of them all, is now open only to small parties for brief periods. Scholars themselves find it difficult to gain admission. Some of these works are photographed, but the camera gives a poor idea of their nature and quality. Some are difficult to see anyway: the best part of Altamira has to be studied lying down. Hence inaccessibility is a real and growing obstacle to unlocking the secrets of the Magdalenian art system.

However, there is some knowledge on which we can build, beginning with subject matter. Cave art portrays human hands, large numbers of animals in different activities, including various species, such as the woolly rhinoceros, that are now extinct and a few that were extinct even at the time they were painted, geometric figures, and signs. Humans are also portrayed, but these instances are rare. Next, we come to methods and materials. The earliest and most rudimentary images are finger drawings in soft clay on the rock surface, the artist following the example of claw marks made by animals. Then came engraving (using a tool to cut into a material), by far the commonest method, using flakes of sharp flint and in some cases stone picks. Different types of rock, and rock formations, were used to give variety, add color, and produce depth, so that some of these engravings are akin to sculptural low reliefs (shallow sculptures carved into walls). Fine engraving is rare and late. Clay engraving on the floors has been obliterated by the feet of modern visitors, but some good examples survive.

Finally, and most impressively, we get painting. The first colors were red, iron oxide (hematite, a form of red ochre), and black (manganese dioxide), though black from juniper or pine carbons has also been discovered. White from kaolin or mica was used occasionally. The only other colors available to Magdalenian painters were yellow and brown. However, great ingenuity was displayed by artists. At Lascaux cave we have found pestles and mortars in which colors were mixed, together with no less than 158 different mineral fragments from which the mixtures were made. There seems to have been no shortage of pigment—large lumps have been found at some sites. Shells of barnacles were used as containers. One artist employed a human skull. Cave water and the calcium it contained were used as mixers, and vegetable and animal oils as binders. The artists had primitive crayons, and they applied the paint with brush tools, though none have survived. All kinds of devices and implements were used to aid art. Important lines were preceded by dots, which were then joined up. Sometimes paint was sprayed. Stencils were used. Blowpipes made from bird bones served as tubes for applying paint. By these means, Magdalenian painters were able to produce polychrome art.

【Paragraph 1】 Some of the earliest human art to survive consists of engraved or painted works on open-air rocks or on the floors, walls, and ceilings of caves, some of them in deep crannies. They were created during the Upper Paleolithic period (40,000 to 10,000B.C.), and the best were done by what we call the Magdalenians (from the name of a site), peoples who flourished in Europe from 18,000 to 10,000 B.C. Such works have a unity and can be described as the Magdalenian art system, the first in human history. It was also the longest, lasting for much of the total time humans have produced art.

1. According to paragraph 1, which of the following is true of the artwork of the Magdalenians?

- A. Its best features were later made part of a unified art system by other people after the end of the Paleolithic period.
- B. It includes the finest examples of paintings done on rocks
- C. Compared to the artwork of later groups, it was produced for only a short time.
- D. Its earliest forms were on open-air rocks, while its later forms were in caves.

【Paragraph 2】 In any history of art, then, the Magdalenian system must occupy a place of importance. Also, of all the forms of art practiced on the planet, it is the one about which we know the least. **But we do possess a reasonable amount of knowledge, bearing in mind that the first cave art was only discovered in the 1860s, and it was not until 1902 that it was accepted as a fact by anthropologists and art historians.** By the end of the twentieth century, there were 277 agreed examples in Europe. Unfortunately, most cave art works are extremely fragile. When a cave is opened and the conditions that enable the paintings to survive are altered, deterioration can be rapid. Thus, except in places where expensive air-conditioning has been installed, caves are no longer open to the public. Even the Altamira cave in Spain, finest of them all, is now open only to small parties for brief periods. Scholars themselves find it difficult to gain admission. Some of these works are photographed, but the camera gives a poor idea of their nature and quality. Some are difficult to see anyway: the best part of Altamira has to be studied lying down. Hence inaccessibility is a real and growing obstacle to unlocking the secrets of the Magdalenian art system.

2. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Because cave art was not discovered until the 1860s and anthropologists and art historians did not begin studying it until 1902, we still have little knowledge of it.
- B. Cave art was first discovered in the 1860s, but it was not until 1902 that anthropologists and art historians first began to understand it.
- C. We know quite a bit about cave art, given that it was not discovered until the 1860s and not accepted as authentic until 1902.
- D. We know a reasonable amount about cave art as a result of the efforts of anthropologists and art historians since the first discoveries in the 1860s.

3. Why does the author include the information that some cave art has been “photographed, but the camera gives a poor idea of their nature and quality”?

- A. To help explain why lack of access to caves is an obstacle to understanding the Magdalenian art system
- B. To suggest that these artworks have suffered less deterioration than has sometimes been claimed
- C. To argue that air-conditioning should be installed in the Altamira cave in Spain
- D. To emphasize the need to view these artworks while lying down

4. According to paragraph 2, why has the public been prevented from visiting most caves that contain prehistoric art?

- A. Space within caves is usually limited, so priority is given to scholars and art experts.
- B. Cave containing artworks are often located in difficult-to-reach places.
- C. Artworks can be damaged by environmental changes that result from opening a cave.
- D. Many caves containing artworks are unsafe for the general public to enter and wander through.

【Paragraph 3】 However, there is some knowledge on which we can build, beginning with subject matter. Cave art portrays human hands, large numbers of animals in different activities, including various species, such as the woolly rhinoceros, that are now extinct and a few that were extinct even at the time they were painted, geometric figures, and signs. Humans are also portrayed, but these instances are rare. Next, we come to methods and materials. The earliest and most rudimentary images are finger drawings in soft clay on the rock surface, the artist following the example of claw marks made by animals. Then came engraving (using a tool to cut into a material), by far the commonest method, using flakes of sharp flint and in some cases stone picks. Different types of rock, and rock formations, were used to give variety, add color, and produce depth, so that some of these engravings are akin to sculptural low reliefs (shallow sculptures carved into walls). Fine engraving is rare and late. Clay engraving on the floors has been obliterated by the feet of modern visitors, but some good examples survive.

5. According to paragraph 3, which of the following is the least likely to be portrayed in Magdalenian cave art?

- A. geometric shapes
- B. human hands
- C. groups of human beings
- D. various species of animals

6. According to paragraph 3, which of the following statements is true of cave art?

- A. The oldest known cave art was created using animal claws in soft clay.
- B. No works of cave art created on floors remain today because all the examples have been ruined by the feet of modern visitors.
- C. Cave engravings were later followed by prehistoric finger drawings in clay.
- D. Cave engravers employed different types of rock to create variety and texture.

【Paragraph 4】 Finally, and most impressively, we get painting. The first colors were red, iron oxide (hematite, a form of red ochre), and black (manganese dioxide), though black from juniper or pine carbons has also been discovered. White from kaolin or mica was used occasionally. The only other colors available to Magdalenian painters were yellow and brown. However, great ingenuity was displayed by artists. At Lascaux cave we have found pestles and mortars in which colors were mixed, together with no less than 158 different mineral fragments from which the mixtures were made. There seems to have been no shortage of pigment—large lumps have been found at some sites. Shells of barnacles were used as containers. One artist employed a human skull. Cave water and the calcium it contained were used as mixers, and vegetable and animal oils as binders. The artists had primitive crayons, and they applied the paint with brush tools, though none have survived. All kinds of devices and implements were used to aid art. Important lines were preceded by dots, which were then joined up. Sometimes paint was sprayed. Stencils were used. Blowpipes made from bird bones served as tubes for applying paint. By these means, Magdalenian painters were able to produce polychrome art.

7. Which of the following can be inferred from paragraph 4 about the cave water and the calcium it contained in cave water?

- A. It made the cave water unsuitable for drinking.
- B. It was involved in combining paint pigments.
- C. It helped to bind paints to the surfaces being painted.
- D. It made paint last longer.

8. Paragraph 4 discusses all of the following with regard to cave painters EXCEPT

- A. how they chose the locations of their paintings
- B. what materials they used to create some of their colors
- C. what techniques they used in making their creations
- D. what kinds of tools they used

【Paragraph 2】 In any history of art, then, the Magdalenian system must occupy a place of importance. Alas, of all the forms of art practiced on the planet, it is the one about which we know the least. But we do possess a reasonable amount of knowledge, bearing in mind that the first cave art was only discovered in the 1860s, and it was not until 1902 that it was accepted as a fact by anthropologists and art historians. By the end of the twentieth century, there were 277 agreed examples in Europe. Unfortunately, most cave art works are extremely fragile. When a cave is opened and the conditions that enable the paintings to survive are altered, deterioration can be rapid. ■ Thus, except in places where expensive air-conditioning has been installed, caves are no longer open to the public. ■ Even the Altamira cave in Spain, finest of them all, is now open only to small parties for brief periods. ■ Scholars themselves find it difficult to gain admission. Some of these works are photographed, but the camera gives a poor idea of their nature and quality. ■ Some are difficult to see anyway: the best part of Altamira has to be studied lying down. Hence inaccessibility is a real and growing obstacle to unlocking the secrets of the Magdalenian art system.

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

There is a potential for serious damage from the introduction of light, changes in air circulation, and the breath of visitors.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Magdalenian artworks were created during the Upper Paleolithic period.

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Answer Choices

- A. Examples of Magdalenian art are found in all parts of Europe, and there is evidence that artists in neighboring regions were influenced by the Magdalenian system.
- B. Magdalenian artists created a variety of images, including geometric figures, and varied the type of rock chosen for engravings to produce different artistic effects.
- C. A unifying aspect of the Magdalenian system was the tendency of artists to blend multiple colors together rather than to use colors individually.
- D. Scholars know a fair amount about Magdalenian cave art, but the need to preserve the fragile works has prevented scholars from studying them as thoroughly as they would like.
- E. Magdalenian painters were able to create impressive, multicolored artworks by using minerals and plant and animal materials to make and mix colors.
- F. Some Magdalenian engravings and paintings are so sophisticated in design and skillfully executed that it was once doubted that prehistoric people created them.

Passage 10 - Historical Trends in European Urban Design

European city planning and design have a long history. Most Greek and Roman settlements were deliberately laid out on the grid system, within which the siting of key buildings was carefully thought out. The roots of modern Western urban planning and design can be traced to the Renaissance and Baroque periods (between the fifteenth and seventeenth centuries) in Europe, when artists and intellectuals dreamed of ideal cities, and rich and powerful regimes used urban design to produce extravagant symbolizations of wealth, power, and destiny. Inspired by the classical artforms of ancient Greece and Rome, Renaissance urban design sought to recast cities in a deliberate attempt to show off the power and the glory of the state and church.

Spreading slowly from its origins in Italy at the beginning of the fifteenth century, Renaissance design successfully diffused to most of the larger cities of Europe. Dramatic advances in weaponry brought a surge of planned redevelopment that featured impressive geometric-shaped fortifications and an extensive sloping, clear zone of fire. Inside new walls, cities were recast according to a new aesthetic of grand design: fancy palaces, geometrical plans, streetscapes, and gardens that emphasized views of dramatic perspectives. These developments were often so extensive and so interconnected with each other that they effectively fixed the layout of cities well into the eighteenth, and even into the nineteenth, century, when walls and/or open spaces eventually made way for urban redevelopment in the form of parks, railway lines, or beltways.

As societies and economies became more complex with the transition to industrial capitalism, national rulers and city leaders looked to urban design to impose order, safety, and efficiency, as well as to symbolize the new seats of power and authority. The most important early precedent was set in Paris by Napoleon III, who presided over a comprehensive program of urban redevelopment and monumental urban design. The work was carried out by Baron Georges-Eugene Haussmann between 1853 and 1870. Haussmann demolished large sections of old Paris to make way for broad, new, tree-lined avenues, with numerous public open spaces and monuments. In doing so, he made the city not only more efficient (wide boulevards meant better flows of traffic) and a better place to live (parks and gardens allowed more fresh air and sunlight in a crowded city and were held to be a civilizing influence) but also safer from revolutionary politics (wide boulevards were hard to barricade; monuments and statues helped to instill a sense of pride and identity).

The preferred architectural style for these new designs was the Beaux Arts style. In this school, architects were trained to draw on Classical, Renaissance, and Baroque styles, synthesizing them in designs for new buildings for the Industrial Age. The idea was that the new buildings would blend artfully with the older palaces, cathedrals, and civic buildings that dominated European city centers. Haussmann's ideas were widely influential and extensively copied.

Early in the twentieth century there emerged a different intellectual and artistic reaction to the pressures of industrialization and urbanization. This was the Modern movement, which was based on the idea that buildings and cities should be designed and run like machines. Equally important to the Modernists was that urban design should not simply reflect dominant social and cultural values but, rather, help to create a new moral and social order. The movement's best-known advocate was Le Corbusier, a Paris-based Swiss who provided the inspiration for technocratic urban design. Modernist buildings sought to dramatize technology, exploit industrial production techniques, and use modern materials and unembellished, functional design. Le Corbusier's ideal city featured linear clusters of high-density, medium-rise apartment blocks, elevated on stilts and segregated from industrial districts; high-rise tower office blocks; and transportation routes all separated by broad expanses of public open space.

After 1945 this concept of urban design became pervasive, part of what became known as the International Style: boxlike steel-frame buildings with concrete-and-glass facades. The International Style was avant-garde yet respectable and, above all,

comparatively inexpensive to build. This tradition of urban design, more than anything else, has imposed a measure of uniformity on cities around the world.

【Paragraph 1】 European city planning and design have a long history. Most Greek and Roman settlements were deliberately laid out on the grid system, within which the siting of key buildings was carefully thought out. The roots of modern Western urban planning and design can be traced to the Renaissance and Baroque periods (between the fifteenth and seventeenth centuries) in Europe, when artists and intellectuals dreamed of ideal cities, and rich and powerful **regimes** used urban design to produce extravagant symbolizations of wealth, power, and destiny. Inspired by the classical artforms of ancient Greece and Rome, Renaissance urban design sought to recast cities in a deliberate attempt to show off the power and the glory of the state and church.

1. In paragraph 1, why does the author mention that most Greek and Roman settlements were laid out on the grid system
 - A. To show how they resembled one another in terms of their layout
 - B. To support the claim that city planning had a long history in Europe
 - C. To help explain why cities of Renaissance and Baroque design were typically laid out in the form of a grid
 - D. To contrast the sophistication of Greek and Roman urban design with the simplicity of the urban design of the Renaissance and Baroque periods
2. The word “**regimes**” in the passage is closest in meaning to
 - A. cities
 - B. builders
 - C. governments
 - D. planners
3. According to paragraph 1, an important goal of Renaissance urban design was to
 - A. serve as an expression of the wealth and power of the ruling class
 - B. improve the classical forms of ancient Greek and Roman cities
 - C. show that the state rather than the church was the most powerful institution in a city
 - D. restore the religious and civic buildings of a city to their previous glory

【Paragraph 2】 Spreading slowly from its origins in Italy at the beginning of the fifteenth century, Renaissance design successfully diffused to most of the larger cities of Europe. Dramatic advances in weaponry brought a surge of planned redevelopment that featured impressive geometric-shaped fortifications and an extensive sloping, clear zone of fire. Inside new walls, cities were recast according to a new aesthetic of grand design fancy palaces, geometrical plans, streetscapes, and gardens that emphasized views of dramatic perspectives. These developments were often so extensive and so interconnected with each other that they effectively fixed the layout of cities well into the eighteenth, and even into the nineteenth, century, when walls and/or open spaces eventually made way for urban redevelopment in the form of parks, railway lines, or beltways.

4. Paragraph 2 supports the idea that important features typical of Renaissance urban design resulted from

- A. Renaissance designers' improved understanding of geometry
- B. the characteristics of new weaponry
- C. an increased interest in highly productive gardens
- D. the need to reduce the likelihood of fires

【Paragraph 3】 As societies and economies became more complex with the transition to industrial capitalism, national rulers and city leaders looked to urban design to impose order, safety, and efficiency, as well as to symbolize the new seats of power and authority. The most important early precedent was set in Paris by Napoleon III, who presided over a comprehensive program of urban redevelopment and monumental urban design. The work was carried out by Baron Georges-Eugene Haussmann between 1853 and 1870. Haussmann demolished large sections of old Paris to make way for broad, new, tree-lined avenues, with numerous public open spaces and monuments. In doing so, he made the city not only more efficient (wide boulevards meant better flows of traffic) and a better place to live (parks and gardens allowed more fresh air and sunlight in a crowded city and were held to be a civilizing influence) but also safer from revolutionary politics (wide boulevards were hard to barricade; monuments and statues helped to instill a sense of pride and identity).

5. Paragraph 3 mentions each of the following as an accomplishment of Haussmann's redevelopment of Paris EXCEPT

- A. improving the flow of traffic
- B. making it harder for revolutionaries to be effective
- C. improving housing in large sections of old Paris
- D. bringing more fresh air and sunlight into the city

【Paragraph 4】 The preferred architectural style for these new designs was the Beaux Arts style. In this school, architects were trained to draw on Classical, Renaissance, and Baroque styles, synthesizing them in designs for new buildings for the Industrial Age. The idea was that the new buildings would blend artfully with the older palaces, cathedrals, and civic buildings that dominated European city centers. Haussmann's ideas were widely influential and extensively copied.

6. According to paragraph 4, what was an advantage of the Beaux Arts style

- A. It was especially well suited for industrial buildings.
- B. It fit in well with important older buildings in European cities.
- C. It could be easily copied by builders everywhere.
- D. It allowed new buildings to be constructed much more efficiently.

【Paragraph 5】 Early in the twentieth century there emerged a different intellectual and artistic reaction to the pressures of industrialization and urbanization. This was the Modern movement, which was based on the idea that buildings and cities should be designed and run like machines. Equally important to the Modernists was that urban design should not simply reflect dominant social and cultural values but, rather, help to create a new moral and social order. The movement's best-known advocate was Le Corbusier, a Paris-based Swiss who provided the inspiration for technocratic urban design. Modernist buildings sought to dramatize technology, exploit industrial production techniques, and use modern materials and unembellished, functional design. Le Corbusier's ideal city featured linear clusters of high-density, medium-rise apartment blocks, elevated on stilts and segregated from industrial districts; high-rise tower office blocks; and transportation routes all separated by broad expanses of public open space.

7. According to paragraph 5, Modernist urban design differed from previous urban design styles in that it

- A. meant to contribute to a new moral and social order
- B. was heavily influenced by the work of one urban planner
- C. was a reaction to social and economic changes
- D. was intended to make cities more beautiful

8. Paragraph 5 supports the idea that Le Corbusier held which of the following views

- A. Industrial production techniques should be used only for buildings in industrial districts.
- B. Different types of activities that go on in a city should be kept physically separated from each other.
- C. All the buildings in a city should be about the same height and of similar design.
- D. Major transportation routes should be kept at a significant distance from cities.

【Paragraph 5】 Early in the twentieth century there emerged a different intellectual and artistic reaction to the pressures of industrialization and urbanization. This was the Modern movement, which was based on the idea that buildings and cities should be designed and run like machines. ■Equally important to the Modernists was that urban design should not simply reflect dominant social and cultural values but, rather, help to create a new moral and social order. ■The movement's best-known advocate was Le Corbusier, a Paris-based Swiss who provided the inspiration for technocratic urban design. ■Modernist buildings sought to dramatize technology, exploit industrial production techniques, and use modern materials and unembellished, functional design. Le Corbusier's ideal city featured linear clusters of high-density, medium-rise apartment blocks, elevated on stilts and segregated from industrial districts; high-rise tower office blocks; and transportation routes all separated by broad expanses of public open space. ■

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

This mechanical analogy was a significant departure from earlier attitudes that emphasized the civilizing influence of cities and their buildings.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

European city planning and design have developed over a long history.

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Answer Choices

- A. Beginning in fifteenth-century Italy, advances in weaponry led to the redesign of cities, and a new aesthetic of grand design inspired by classical art forms took hold.
- B. The walls and open spaces typical of Renaissance urban design were re-discovered in the early twentieth century and became a major component of the Modern movement.
- C. The social changes brought about by the transition to industrial capitalism placed new demands on urban planners that could only be met by adopting new design styles.
- D. The redevelopment of Paris in the mid-1800s displayed a new idea of urban design to make cities orderly, efficient, and healthier and to positively reflect the new social and economic order.
- E. The goal of Beaux Arts style architects was to replace the older palaces, cathedrals, and civic buildings that dominated European cities with modern buildings.
- F. The twentieth-century International Style's boxlike steel, glass, and concrete buildings arose from the Modernist view that buildings and cities should be designed and run like machines.

Passage 11 - Mexican Mural Art

The first major modern art movement in Latin America was Mexican muralism, which featured large-scale murals painted on the wall surfaces of public buildings. One of the most persistent strands in Latin American art in the last 80 years has been an engagement with political and social issues, including the struggle for social justice. This in turn has been accompanied by a desire for authentic forms of self-expression and freedom from cultural dependency. Although these preoccupations have taken many different forms, Mexican muralism was the first, and its influence was the most far-reaching. Muralism flourished in Mexico in the years immediately following the Mexican Revolution (1910 - 1920) as a result of a combination of circumstances: a climate of revolutionary optimism and cultural experimentation that challenged traditional Eurocentrism; a small but strong group of relatively mature artists of energy, ideas, and ability; and a visionary minister of education, Jose Vasconcelos. Vasconcelos believed that Mexico was destined to play a central role on the international stage. He understood that ideas could be more quickly assimilated through images than through any other medium, and he had the courage to allocate the funds, and the walls of public buildings, to the artists to do with as they liked.

The muralists shared a belief in the power of art to transform society for the better; to challenge social, political, economic, and cultural stereotypes; and to enrich the intellectual life of their country. During the 1920s and 1930s, they covered miles of wall with paintings representing aspects of Mexico's past and present and the future to which all aspired. Although Mexican muralism is representational and often narrative in form, it should be recognized as a modern movement. It was modernizing in intent, in that it challenged the old order culturally, socially, and politically. By definition, it was a public, accessible form of art not a commodity that could be bought and sold by the wealthy elite. Its purpose was to educate, inform, enlighten, politicize and thus empower the general public, in particular the working classes.

The muralist movement was not a unified force, however. The painters who were its leaders took different directions and did not always see eye to eye. Diego Rivera (1886 - 1957) sought to promote a pluralistic vision of Mexican society by drawing on the rich heritage of the pre-Columbian past (before Christopher Columbus arrived in the Americas in 1492) and contemporary popular culture, and he investigated pre-Columbian styles and techniques in an effort to create an aesthetic language that was new and Mexican. He was deeply influenced by native pictographic traditions of communication in which pictures represent written words and ideas, and he sought to develop a modern equivalent, a visual language that could be read like a book. The art of Jose Clemente Orozco (1883 - 1949) is less optimistic: he saw both the pre-Columbian past and the revolutionary present in a more negative light, the former as barbarous, the latter often tarnished by corruption and cruelty. He offers no comforting narratives and his expressive, aggressive technique serves as a metaphor of Mexico's harsh, contradictory reality. David Alfaro Siqueiros (1898 - 1976) was the most politically active of the three and was an internationalist both ideologically and artistically. In his art he deliberately avoided traditional materials and methods, preferring to use modern industrial paints and spray guns. His works look forward to a fully socialist future where the workers will have won the right to the benefits of the modern industrial era, and his often fragmented, complex imagery does not patronize or make concessions to his audience.

The Mexican muralist movement is undoubtedly one of the most important manifestations of twentieth-century Mexican culture. Its impact elsewhere in the region, as well as in the United States and Europe, has been enormous. The work of Rivera, Orozco, and Siqueiros triggered a homegrown muralist movement in the United States in cities like New York City, Detroit, Los Angeles, and San Francisco. The influence of the Mexicans on the modern Spanish painter Picasso's first mural and almost his only major explicitly propagandist work of art -his famous *Guernica* of 1937- is unmistakable even though the artist himself would have denied it. In Latin America, Mexican-influenced muralism has recurred whenever artists have felt the need to make a clear, public statement in a language that has not been borrowed from outside.

【Paragraph 1】 The first major modern art movement in Latin America was Mexican muralism, which featured large-scale murals painted on the wall surfaces of public buildings. One of the most persistent strands in Latin American art in the last 80 years has been an engagement with political and social issues, including the struggle for social justice. This in turn has been accompanied by a desire for authentic forms of self-expression and freedom from cultural dependency. Although these preoccupations have taken many different forms, Mexican muralism was the first, and its influence was the most far-reaching. Muralism flourished in Mexico in the years immediately following the Mexican Revolution (1910 - 1920) as a result of a combination of circumstances: a climate of revolutionary optimism and cultural experimentation that challenged traditional Eurocentrism; a small but strong group of relatively mature artists of energy, ideas, and ability; and a visionary minister of education, Jose Vasconcelos. Vasconcelos believed that Mexico was destined to play a central role on the international stage. He understood that ideas could be more quickly assimilated through images than through any other medium, and he had the courage to allocate the funds, and the walls of public buildings, to the artists to do with as they liked.

1. According to paragraph 1, Mexican muralism is concerned with
 - A. the attempt to make art a more important subject in the Latin American educational system
 - B. the combination of European art traditions with authentic Latin American art forms
 - C. the creation of a just society and an independent form of cultural expression
 - D. the use of art to raise funds for the construction of new public buildings
2. The author mentions the Mexican Revolution in the passage in order to
 - A. explain how the Mexican government used muralism to challenge European political beliefs
 - B. emphasize an important reason that Mexican muralism thrived
 - C. give an example of one of the most popular subjects of muralism
 - D. emphasize the success of Mexican artists who participated in political conflicts
3. It can be inferred from paragraph 1 that the muralists got most of their financial support from
 - A. opponents of traditional European art
 - B. wealthy art lovers
 - C. other muralists from around the world
 - D. the Mexican government

【Paragraph 2】 The muralists shared a belief in the power of art to transform society for the better; to challenge social, political, economic, and cultural stereotypes; and to enrich the intellectual life of their country. During the 1920s and 1930s, they covered miles of wall with paintings representing aspects of Mexico's past and present and the future to which all aspired. Although Mexican muralism is representational and often narrative in form, it should be recognized as a modern movement. It was modernizing in intent, in that it challenged the old order culturally, socially, and politically. By definition, it was a public, accessible form of art not a commodity that could be bought and sold by the wealthy elite. Its purpose was to educate, inform, enlighten, politicize and thus empower the general public, in particular the working classes.

4. According to paragraph 2, in what way can Mexican muralism be regarded as a characteristically modern art movement
 - A. It was representational and often narrative in form.
 - B. It was supported by a small but enlightened artistic elite.
 - C. It questioned traditional ideas.
 - D. It emphasized the future rather than dwelling on the past.

【Paragraph 3】 The muralist movement was not a unified force, however. The painters who were its leaders took different directions and did not always see eye to eye. Diego Rivera (1886 - 1957) sought to promote a pluralistic vision of Mexican society by drawing on the rich heritage of the pre-Columbian past (before Christopher Columbus arrived in the Americas in 1492) and contemporary popular culture, and he investigated pre-Columbian styles and techniques in an effort to create an aesthetic language that was new and Mexican. He was deeply influenced by native pictographic traditions of communication in which pictures represent written words and ideas, and he sought to develop a modern equivalent, a visual language that could be read like a book. The art of Jose Clemente Orozco (1883 - 1949) is less optimistic: he saw both the pre-Columbian past and the revolutionary present in a more negative light, the former as barbarous, the latter often tarnished by corruption and cruelty. He offers no comforting narratives and his expressive, aggressive technique serves as a metaphor of Mexico's harsh, contradictory reality. David Alfaro Siqueiros (1898 - 1976) was the most politically active of the three and was an internationalist both ideologically and artistically. In his art he deliberately avoided traditional materials and methods, preferring to use modern industrial paints and spray guns. His works look forward to a fully socialist future where the workers will have won the right to the benefits of the modern industrial era, and his often fragmented, complex imagery does not patronize or make concessions to his audience.

5. Paragraph 3 makes all of the following points about artist Diego Rivera EXCEPT

- A. He used elements of pre-Columbian art to help make a new, modern art.
- B. He tried to develop a visual language that communicated as clearly as native pictographs had.
- C. He used his art to express his ideas of what Mexican society should be like.
- D. He tried but failed to unify the muralist movement.

6. According to paragraph 3, which of the following was true of Orozco's art?

- A. It was concerned with Mexican problems of the past and the present.
- B. It presented the pre-Columbian past favorably.
- C. Its images were intended to be pleasing to viewers.
- D. Its technique was more typical of international artists than Mexican artists.

7. According to paragraph 3, which of the following is NOT true of David Alfaro Siqueiros?

- A. He used modern industrial materials rather than traditional materials in his art.
- B. He designed images that were intentionally meant to please his audience.
- C. He believed in socialism and viewed the future of workers in the modern industrial era favorably.
- D. He took an international approach to both politics and art.

【Paragraph 4】 The Mexican muralist movement is undoubtedly one of the most important manifestations of twentieth-century Mexican culture. Its impact elsewhere in the region, as well as in the United States and Europe, has been enormous. The work of Rivera, Orozco, and Siqueiros triggered a homegrown muralist movement in the United States in cities like New York City, Detroit, Los Angeles, and San Francisco. The influence of the Mexicans on the modern Spanish painter Picasso's first mural and almost his only major explicitly propagandist work of art -his famous *Guernica* of 1937- is unmistakable even though the artist himself would have denied it. In Latin America, Mexican-influenced muralism has recurred whenever artists have felt the need to make a clear, public statement in a language that has not been borrowed from outside.

8. The author mentions Picasso's mural *Guernica* in order to

- A. provide an example of one of the biggest European influences on Mexican muralism
- B. indicate that politically motivated murals were as popular in Europe as they were in Mexico
- C. explain why the influence of Mexican muralism was especially strong among Spanish artists
- D. provide evidence that the Mexican muralists had a significant impact on the international art world

【Paragraph 4】 ■The Mexican muralist movement is undoubtedly one of the most important manifestations of twentieth-century Mexican culture. ■Its impact elsewhere in the region, as well as in the United States and Europe, has been enormous. ■The work of Rivera, Orozco, and Siqueiros triggered a homegrown muralist movement in the United States in cities like New York City, Detroit, Los Angeles, and San Francisco. ■The influence of the Mexicans on the modern Spanish painter Picasso's first mural and almost his only major explicitly propagandist work of art -his famous *Guernica* of 1937- is unmistakable even though the artist himself would have denied it. In Latin America, Mexican-influenced muralism has recurred whenever artists have felt the need to make a clear, public statement in a language that has not been borrowed from outside.

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

However, its influence was not limited to Mexico itself.

Where would the sentence best fit passage?

10. 【Directions】 An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Mexican muralism was the first major modern art movement in Latin America.

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Answer Choices

- A. The Mexican Revolution resulted in a new respect for traditional culture, leading the muralists to paint scenes depicting the everyday lives of poor Mexicans.
- B. In the 1920s and 1930s, following the Mexican Revolution, a talented group of artists painted many large-scale, politically motivated murals on public buildings.
- C. Jose Vasconcelos made Mexico an important international player by promoting the art and ideas of the revolutionary muralists.
- D. The muralists challenged cultural and economic stereotypes and experimented with both pre-Columbian and industrial themes, styles, and techniques.
- E. The leaders of the muralist movement Rivera, Orozco, and Siqueiros all believed in the transformative power of art but differed in terms of their artistic methods and political beliefs.
- F. Mexican muralism was a traditional representational art focused on Mexico's pre-Colombian society and culture.

Passage 12 - Olmec Art

The earliest Mesoamerican art and architecture to combine ideological complexity, craft, and permanence was that of the Olmecs, whose civilization flourished between about 1500 B.C. and 100 B.C. The early Olmecs established major ceremonial centers along the rich lowlands of the modern Mexican states of Veracruz and Tabasco. At distant Teopantecuanitlan, the Olmecs established a sacred precinct, the first monumental evidence of the Olmecs in the highlands. But the Olmecs had an advanced social and economic system, with networks for commerce extending far to the west and south. The fertile gulf plain probably allowed for an agricultural surplus, controlled by only a handful of individuals. From the art and architecture of their ceremonial centers (we know too little about Olmec domestic life to call their sites cities), it is clear that for the Olmecs, social stratification was sufficiently advanced for their society to place great importance on the records of specific individuals, particularly in the form of colossal heads (enormous stone sculptures of human heads and faces).

Long before modern radiocarbon dating testified to the antiquity of this culture, archaeologists and art historians had become aware of the power of Olmec art through individual objects. Some even identified the Olmec culture as the oldest of Mesoamerican civilizations, perhaps a mother culture from which all others derived, as the art historian Miguel Covarrubias once thought. Eventually the antiquity of Olmec culture was confirmed, and today many important elements of Mesoamerican art and architecture can be seen to have had a probable Olmec origin: ball courts, pyramids, portraiture, and mirrors. Some later Mesoamerican deities probably derive from Olmec gods, and even the famous “Maya” calendar was already in use by peoples in the Olmec area at the dawn of Maya civilization.

One of the first important Olmec objects to come to modern attention was the Kunz axe, acquired in the 1860s in Oaxaca, Mexico. The ceremonial axe puzzled and intrigued investigators for years because on the one hand, it was clearly neither Aztec nor Maya, the best-known ancient Mesoamerican cultures, and in fact it had no features that could be linked with any known civilization, while on the other hand, it had surely been made in Mesoamerica in antiquity.

The axe (exhibits) many qualities of the style we now call Olmec: precious blue-green translucent jade, worked to reveal a figure in both two and three dimensions. More than half the axe is devoted to the creature's face an open, toothless mouth, and closely set, slanting eyes which has often been likened to the face of a howling human infant. The creature's hands are worked in lower relief, and in them he grasps a miniature version of himself. Feet and toes are indicated only by incision (carved lines), and incision also marks the face, ears, and upper body, perhaps to suggest tattooing, ear ornaments, and a tunic. For over two millennia this large, precious axe was presumably kept as a treasure or heirloom. It was not until 1955, after several seasons of excavation at La Venta had produced many fine jade objects and a convincing series of radiocarbon dates in the first millennium B.C., that objects such as the Kunz axe were at last understood by scholars to embody the principles of the first great art style of Mesoamerica.

Early scholars of the Olmec style noticed a pattern of imagery repeated on many of the carved stone objects. Many howling baby faces were found, and other faces seemed to combine the features of humans and jaguars (large cats). Today, while the presence of jaguar imagery is still acknowledged, scholars have discovered that aspects of many other tropical rainforest fauna can be identified in the carvings. The caiman (a kind of alligator), eagle, toad, jaguar, and snake all appear in the Olmec supernatural repertoire. Anthropologist Peter David Joralemon has suggested that most of the motifs and images can be allocated to a few Olmec deities. The paw-wing motif, for example, can be shown to be an element of the winged dragon, itself perhaps derived from the eagle and caiman. This whole intricate symbolic code appears to have been in use from the first appearance of the Olmecs, and to have been employed consistently for a thousand years.

【Paragraph 1】 The earliest Mesoamerican art and architecture to combine ideological complexity, craft, and permanence was **that** of the Olmecs, whose civilization flourished between about 1500 B.C. and 100 B.C. The early Olmecs established major ceremonial centers along the rich lowlands of the modern Mexican states of Veracruz and Tabasco. At distant Teopantecuanitlan, the Olmecs established a sacred precinct, the first monumental evidence of the Olmecs in the highlands. But the Olmecs had an advanced social and economic system, with networks for commerce extending far to the west and south. The fertile gulf plain probably allowed for an agricultural surplus, controlled by only a handful of individuals. From the art and architecture of their ceremonial centers (we know too little about Olmec domestic life to call their sites cities), it is clear that for the Olmecs, social stratification was sufficiently advanced for their society to place great importance on the records of specific individuals, particularly in the form of colossal heads (enormous stone sculptures of human heads and faces).

1. The word “**that**” in the passage refers to
 - A. Mesoamerican art and architecture
 - B. the ideological complexity, craft, and permanence
 - C. the earliest civilization
 - D. the permanent art and architecture
2. Paragraph 1 supports which of the following ideas about Olmec society
 - A. Major artists and successful traders had roughly equal status.
 - B. The most important members of Olmec society resided in the highlands.
 - C. More people were engaged in producing monumental works of art than were engaged in agriculture.
 - D. There was a well-developed social structure in which some individuals held more power than others.

【Paragraph 2】 Long before modern radiocarbon dating testified to the antiquity of this culture, archaeologists and art historians had become aware of the power of Olmec art through individual objects. Some even identified the Olmec culture as the oldest of Mesoamerican civilizations, perhaps a mother culture from which all others derived, as the art historian Miguel Covarrubias once thought. Eventually the antiquity of Olmec culture was confirmed, and today many important elements of Mesoamerican art and architecture can be seen to have had a probable Olmec origin: ball courts, pyramids, portraiture, and mirrors. Some later Mesoamerican deities probably derive from Olmec gods, and even the famous “Maya” calendar was already in use by peoples in the Olmec area at the dawn of Maya civilization.

3. The author put the word Maya in quotation marks in order to indicate that
 - A. few Mesoamericans were familiar with the Maya calendar
 - B. the calendar commonly attributed to the Maya was not actually developed by them
 - C. the names of Mesoamerican gods were included in the Maya calendar
 - D. it is doubtful that the Olmec and the Maya used the same calendars

【Paragraph 3】 One of the first important Olmec objects to come to modern attention was the Kunz axe, acquired in the 1860s in Oaxaca, Mexico. **The ceremonial axe puzzled and intrigued investigators for years because on the one hand, it was clearly neither Aztec nor Maya, the best-known ancient Mesoamerican cultures, and in fact it had no features that could be linked with any known civilization, while on the other hand, it had surely been made in Mesoamerica in antiquity.**

4. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Because the Kunz axe could not be linked with known Mesoamerican cultures of antiquity, investigators concluded that it was neither Aztec nor Maya.
- B. The ceremonial axe puzzled and intrigued investigators because it was neither Aztec nor Maya, nor was it from any other ancient Mesoamerican civilization.
- C. On the one hand the ceremonial axe was puzzling because it was not Aztec or Maya, and on the other hand it was intriguing because no other Mesoamerican culture made ceremonial axes.
- D. The Kunz axe puzzled investigators for years because, although it was clearly made in ancient Mesoamerica, it could not be attributed to any known Mesoamerican culture.

【Paragraph 4】 The axe (exhibits) many qualities of the style we now call Olmec: precious blue-green translucent jade, worked to reveal a figure in both two and three dimensions. More than half the axe is devoted to the creature's face an open, toothless mouth, and closely set, slanting eyes which has often been likened to the face of a howling human infant. The creature's hands are worked in lower relief, and in them he grasps a miniature version of himself. Feet and toes are indicated only by incision (carved lines), and incision also marks the face, ears, and upper body, perhaps to suggest tattooing, ear ornaments, and a tunic. For over two millennia this large, precious axe was presumably kept as a treasure or heirloom. It was not until 1955, after several seasons of excavation at La Venta had produced many fine jade objects and a convincing series of radiocarbon dates in the first millennium B.C., that objects such as the Kunz axe were at last understood by scholars to **embody** the principles of the first great art style of Mesoamerica.

5. The word “**embody**” in the passage is closest in meaning to

- A. utilize
- B. reveal
- C. incorporate
- D. clarify

6. It can be inferred from paragraph 4 that the author provides a very detailed description of the Kunz axe because

- A. the Kunz axe is more like later Mesoamerican art than it is like Olmec art
- B. the Kunz axe is a characteristic example of Olmec artistic style and principles
- C. the Kunz axe is the single most important and valuable piece of Olmec art so far discovered
- D. the face of the creature represented on the Kunz axe resembles a human infant

【Paragraph 5】 Early scholars of the Olmec style noticed a pattern of imagery repeated on many of the carved stone objects. Many howling baby faces were found, and other faces seemed to combine the features of humans and jaguars (large cats). Today, while the presence of jaguar imagery is still acknowledged, scholars have discovered that aspects of many other tropical rainforest fauna can be identified in the carvings. The caiman (a kind of alligator), eagle, toad, jaguar, and snake all appear in the Olmec supernatural repertoire. Anthropologist Peter David Joralemon has suggested that most of the motifs and images can be allocated to a few Olmec deities. The paw-wing motif, for example, can be shown to be an element of the winged dragon, itself perhaps derived from the eagle and caiman. This whole intricate symbolic code appears to have been in use from the first appearance of the Olmecs, and to have been employed consistently for a thousand years.

7. In paragraph 5, the author uses the example of the paw-wing motif in order to illustrate
- A. how Olmec images may be related to a few Olmec deities
 - B. why jaguar imagery is the most important of Olmec animal imagery
 - C. the importance of the paw-wing motif in cultures before the Olmec
 - D. how images of animals from beyond the rainforest were represented in Olmec art
8. According to paragraph 5, which of the following is true about the Olmec symbolic code
- A. It included only animals that have paws or wings.
 - B. It did not change significantly from one century to the next.
 - C. It was not strongly connected to Olmec religion.
 - D. It developed gradually over a thousand-year period.

【Paragraph 2】 Long before modern radiocarbon dating testified to the antiquity of this culture, archaeologists and art historians had become aware of the power of Olmec art through individual objects. ■ Some even identified the Olmec culture as the oldest of Mesoamerican civilizations, perhaps a mother culture from which all others derived, as the art historian Miguel Covarrubias once thought. ■ Eventually the antiquity of Olmec culture was confirmed, and today many important elements of Mesoamerican art and architecture can be seen to have had a probable Olmec origin: ball courts, pyramids, portraiture, and mirrors. ■ Some later Mesoamerican deities probably derive from Olmec gods, and even the famous “Maya” calendar was already in use by peoples in the Olmec area at the dawn of Maya civilization. ■

9. Look at the four squares that indicate where the following sentence could be added to the passage.

But these opinions lacked proof.

Where would the sentence best fit Click on a square to add the sentence to the passage.

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

The Olmec culture was identified as the oldest of Mesoamerican civilizations, perhaps a mother culture from which all others derived.

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Answer Choices

- A. Between 1500 B.C. and 100 B.C., the Olmecs developed complex ceremonial centers, an extensive agricultural and trading economy, and a highly distinctive art.
- B. Early in their history, the Olmec left the fertile gulf plain and moved to Teopantecuanitlan.
- C. The frequent reappearance of Olmec images in the art of the Maya and Aztecs suggests that the Olmecs gave rise to these later civilizations.
- D. The Kunz axe, once linked with Maya culture after being found at an ancient Maya site, was eventually attributed to Olmec artists.
- E. Many cultural innovations are now attributed to the Olmecs that were once attributed to other Mesoamerican cultures, including the calendar used by the Maya.
- F. Olmec art involved a complex symbolic code, including various animal images and the howling baby seen on the Kunz axe and elsewhere, that was used consistently for a thousand years.

Passage 13 - Portraits as Art

According to the Oxford English Dictionary, portraiture is, “a representation or delineation of a person, especially of the face, made by life, by drawing, painting, photographing, engraving... a likeness.” However, this simplistic definition disregards the complexities of portraiture. Portraits are works of art that engage with ideas of identity as they are perceived, represented, and understood in different times and places, rather than simply aim to represent a likeness. These concepts of identity can encompass social hierarchy, gender, age, profession, and the character of the subject, among other things. Rather than being fixed, these features are expressive of the expectations and circumstances of the time when the portrait was made. It is impossible to reproduce the aspects of identity; it is only possible to evoke or suggest them. Consequently, even though portraits represent individuals, it is generally conventional or typical - rather than unique - qualities of subject that are stressed by the artist. Portrait art has also undergone significant shifts in artistic convention and practice. Despite the fact that the majority of portraits portray the subject matter in some amount of verisimilitude, (an appearance of being true or real), they are still the outcome of prevailing artistic fashions and favored styles, techniques, and media. Therefore, portrait art is a vast art category which provides a wide range of engagements with social, psychological, and artistic practices and expectations.

Since portraits are distinct from other genres or art categories in the ways they are produced, the nature of what they represent, and how they function as objects of use and display, they are worthy of separate study. First, during their production, portraits require the presence of a specific person, or an image of the individual to be represented, in almost all cases. In the majority of instances, the production of portraiture has necessitated sittings, which result in interaction between the subject(s) and artist throughout the creation of the work. If the sitter is of high social standing or is occupied and unavailable to sit in the studio regularly, portraitists could use photographs or sketches of their subject. In Europe, during the seventeenth and eighteenth century, the sitting time was sometimes decreased by focusing solely on the head and using professional drapery painters to finish the painting. For instance, Sir Peter Lily, the English artist, had a collection of poses in a pattern book that enabled him to focus on the head and require fewer sittings from his aristocratic patrons. Portrait painters could be asked to present the likeness of individuals who were deceased. In this sort of instance, photographs or prints of the subject could be reproduced. Theoretically, portraitists could work from impressions or memories when creating a painting, but this is a rare occurrence according to documented records. Nonetheless, whether the work is based on model sittings, copying a photograph or sketch, or using memory, the process of painting a portrait is closely linked with the implicit or explicit attendance of the model.

Furthermore, portrait painting can be differentiated from other artistic genres like landscape, still life, and history by its connection with appearance, or likeness. As such, the art of portrait painting got a reputation for imitation, or copying, instead of for artistic innovation or creativity; consequently, it is sometimes viewed as being of a lower status than the other genres. According to Renaissance art theory, (which prevailed until the start of the nineteenth century) fine art was supposed to represent idealized images, as well as to be original and creative instead of to copy other works. Portraiture, in comparison, became linked with the level of a mechanical exercise as opposed to a fine art. Michelangelo’s well known protest that he would not paint portraits because there were not enough ideally beautiful models is only one example of the dismissive attitude to portraiture that persisted among professional artist - even those who, ironically, made their living from portraiture. In the time of modernism, during the nineteenth and twentieth centuries, the attitude towards portraiture was critical. Even so, artists from around the globe persisted painting portraits in spite of their theoretical objections. Picasso, for instance, became renowned for cubist still-life painting early in his career, but some of his most effective early experiments in this new style were his portraits of art dealers.

【Paragraph 1】 According to the Oxford English Dictionary, portraiture is, “a representation or delineation of a person, especially of the face, made by life, by drawing, painting, photographing, engraving... a likeness.” However, this simplistic definition disregards the complexities of portraiture. Portraits are works of art that engage with ideas of identity as they are perceived, represented, and understood in different times and places, rather than simply aim to represent a likeness. These concepts of identity can encompass social hierarchy, gender, age, profession, and the character of the subject, among other things. Rather than being fixed, these features are expressive of the expectations and circumstances of the time when the portrait was made. It is impossible to reproduce the aspects of identity; it is only possible to evoke or suggest them. Consequently, even though portraits represent individuals, it is generally conventional or typical - rather than unique - qualities of subject that are stressed by the artist. Portrait art has also undergone significant shifts in artistic convention and practice. Despite the fact that the majority of portraits portray the subject matter in some amount of verisimilitude, (an appearance of being true or real), they are still the outcome of **prevailing** artistic fashions and favored styles, techniques, and media. Therefore, portrait art is a vast art category which provides a wide range of engagements with social, psychological, and artistic practices and expectations.

1. According to paragraph 1, which of the following gives support of portrait painting's complexity?

- A. Portraits representing faces are more true to life than portraits that portray a whole figure
- B. Portrait art comes in many varieties, which include painting, photography, and drawing
- C. Portraiture tries to portray the most uncommon attributes of a given subject
- D. Portraiture is an interpretation of a subject rather than a copy of it

2. The word “**prevailing**” in the passage is closest in meaning to

- A. apparent
- B. distinct
- C. steady
- D. current

【Paragraph 2】 Since portraits are distinct from other genres or art categories in the ways they are produced, the nature of what they represent, and how they function as objects of use and display, they are worthy of separate study. First, during their production, portraits require the presence of a specific person, or an image of the individual to be represented, in almost all cases. In the majority of instances, the production of portraiture has necessitated sittings, which result in interaction between the subject(s) and artist throughout the creation of the work. If the sitter is of high social standing or is occupied and unavailable to sit in the studio regularly, portraitists could use photographs or sketches of their subject. In Europe, during the seventeenth and eighteenth century, the sitting time was sometimes decreased by focusing solely on the head and using professional drapery painters to finish the painting. For instance, Sir Peter Lily, the English artist, had a collection of poses in a pattern book that enabled him to focus on the head and require fewer sittings from his aristocratic patrons. Portrait painters could be asked to present the likeness of individuals who were deceased. In this sort of instance, photographs or prints of the subject could be reproduced. Theoretically, portraitists could work from impressions or memories when creating a painting, but this is a rare occurrence according to documented records. Nonetheless, whether the work is based on model sittings, copying a photograph or sketch, or using memory, the process of painting a portrait is closely linked with the implicit or explicit attendance of the model.

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3. Paragraph 2 suggests which of the following differences between portraiture and other types of art?
- A. Portraits portray the subject matter in a more accurate manner than other forms of art.
 - B. Portraits typically take less time to produce than other art forms.
 - C. Portraits typically necessitate an increased level of personal interaction between the subject matter and artist than other art forms.
 - D. In opposition to other art forms, portraiture usually necessitates collaboration among several artists.
4. The author discusses the “Sir Peter Lily, the English artist”, to provide an example of an artist who
- A. invented a method to reduce the necessary number of sittings for his rich patrons
 - B. employed professional drapery painters to help him finish his portraits
 - C. concentrated on painting different parts of the subject body at each sitting
 - D. had an uncommon range of patrons as subjects
5. All of the following are mentioned in paragraph 2 as techniques employed by artists to create portraits EXCEPT
- A. combining facial traits from different subjects
 - B. observing the subjects directly during painting
 - C. copying a photograph
 - D. recalling what the subject looked like from memory

【Paragraph 3】 Furthermore, portrait painting can be differentiated from other artistic genres like landscape, still life, and history by its connection with appearance, or likeness. As such, the art of portrait painting got a reputation for imitation, or copying, instead of for artistic innovation or creativity; consequently, it is sometimes viewed as being of a lower status than the other genres. According to Renaissance art theory, (which prevailed until the start of the nineteenth century) fine art was supposed to represent idealized images, as well as to be original and creative instead of to copy other works. Portraiture, in comparison, became linked with the level of a mechanical exercise as opposed to a fine art. Michelangelo’s well known protest that he would not paint portraits because there were not enough ideally beautiful models is only one example of the dismissive attitude to portraiture that persisted among professional artist - even those who, ironically, made their living from portraiture. In the time of modernism, during the nineteenth and twentieth centuries, the attitude towards portraiture was critical. Even so, artists from around the globe persisted painting portraits in spite of their theoretical objections. Picasso, for instance, became renowned for cubist still-life painting early in his career, but some of his most effective early experiments in this new style were his portraits of art dealers.

6. According to paragraph 3, portraiture grew to be regarded as a mechanical practice due to its association with which of the following?
- A. innovation
 - B. imitation
 - C. perfectionism
 - D. creativity
7. What can be inferred from paragraph 3 regarding Michelangelo’s view of portraiture?
- A. He felt that imitating and copying were prerequisites of achieving creative portraits.
 - B. He thought that portrait artists ought to select subjects from long ago rather than present day.
 - C. He felt that portrait art should be viewed as a form of fine art.
 - D. He felt that portraits should only portray idealized beauty.

8. In paragraph 3, the author talks about Picasso as an example of an artist who

- A. altered the way other artists felt about portrait art
- B. relied on portrait art to establish a high reputation
- C. had fewer theoretical objections to portraiture than most modern artists
- D. created portraits in spite of his doubts about portraiture as a fine art form

【Paragraph 3】 Since portraits are distinct from other genres or art categories in the ways they are produced, the nature of what they represent, and how they function as objects of use and display, they are worthy of separate study. ■First, during their production, portraits require the presence of a specific person, or an image of the individual to be represented, in almost all cases. ■In the majority of instances, the production of portraiture has necessitated sittings, which result in interaction between the subject(s) and artist throughout the creation of the work. ■If the sitter is of high social standing or is occupied and unavailable to sit in the studio regularly, portraitists could use photographs or sketches of their subject. ■In Europe, during the seventeenth and eighteenth century, the sitting time was sometimes decreased by focusing solely on the head and using professional drapery painters to finish the painting. For instance, Sir Peter Lily, the English artist, had a collection of poses in a pattern book that enabled him to focus on the head and require fewer sittings from his aristocratic patrons. Portrait painters could be asked to present the likeness of individuals who were deceased. In this sort of instance, photographs or prints of the subject could be reproduced. Theoretically, portraitists could work from impressions or memories when creating a painting, but this is a rare occurrence according to documented records. Nonetheless, whether the work is based on model sittings, copying a photograph or sketch, or using memory, the process of painting a portrait is closely linked with the implicit or explicit attendance of the model.

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage

In certain instances, portrait artists depended on a combination of direct and indirect involvement with their subjects.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Portraiture as an art form is more complex than is suggested by its definition.

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Answer Choices

- A. The definitions of portrait art in the dictionary have regularly transformed throughout the years to reflect shifting attitudes regarding the genre.
- B. Portrait art should be considered as a distinct artistic genre due to its intense occupation with the subject and the way in which it was produced.
- C. Beginning in the Renaissance and continuing into the start of the nineteenth century, portrait art was idealized to a greater degree than it is in today.
- D. Portraits generally mirror the conventions of the time rather than the unique qualities of the individual.
- E. Throughout history, the majority of professional artists avoided portrait art since they regarded it as a mechanical art form, and not as fine art.
- F. Portrait art was at times viewed in a negative light since it was considered as simple copying void of artistic innovation.

Passage 14 - The Early History of Motion Pictures

Motion pictures and television are possible because of two quirks of the human perceptual system: the phi phenomenon and persistence of vision. The phi phenomenon refers to what happens when a person sees one light source go out while another one close to the original is illuminated. To our eyes, it looks like the light moves from one place to another. In persistence of vision, our eyes continue to see an image for a split second after the image has disappeared from view. First observed by the ancient Greeks, persistence of vision became more widely known in 1824 when Peter Roget (who also developed the thesaurus) demonstrated that human beings retain an image of an object for about one-tenth of a second after the object is taken from view. Following Roget's pronouncement, a host of toys that depended on this principle sprang up in Europe. Bearing fanciful names (the Thaumatrope, the Praxinoscope), these devices made a series of hand-drawn pictures appear to move.

Before long, several people realized that a series of still photographs on celluloid film could be used instead of hand drawing. In 1878 a colorful Englishman, later turned American, Edward Muybridge, attempted to settle a \$25,000 bet over whether the four feet of a galloping horse ever simultaneously left the ground. He arranged a series of 24 cameras alongside a racetrack to photograph a galloping horse. Rapidly viewing the series of pictures produced an effect much like that of a motion picture. Muybridge's technique not only settled the bet (the feet did leave the ground simultaneously at certain instances) but also photography. Instead of 24 cameras taking one picture in rapid order, it was Thomas Edison and his assistant, William Dickson, who finally developed what might have been the first practical motion-picture camera and viewing device. Edison was apparently trying to provide a visual counterpart to his recently invented phonograph. When his early efforts did not work out, he turned the project over to his assistant. Using flexible film, Dickson solved the vexing problem of how to move the film rapidly through the camera by perforating its edge with tiny holes and pulling it along by means of sprockets, projections on a wheel that fit into the holes of the film. In 1889 Dickson had perfected a machine called the Kinetoscope and even starred in a brief film demonstrating how it worked.

These early efforts in the Edison lab were not directed at projecting movies to large crowds. Still influenced by the success of his phonograph, Edison thought a similar device could make a money by showing brief films to one person at a time for a penny a look. Edison built a special studio to produce films for his new invention, and by 1894, Kinetoscope parlors were spring up in major cities. The long-range commercial potential of his invention was lost on Edison. He reasoned that the real money would be made by selling his peep-show machine. If a large number of people were shown the film at the same time, fewer machines would be needed. Developments in Europe proved Edison wrong as inventors there devised large-screen projection devices. Faced with competition, Edison perfected the Vitascope and unveiled it in New York City in 1896.

Early movies were simple snippets of action—acrobats tumbling, horse running, jugglers juggling, and so on. Eventually, the novelty wore off and films became less of an attraction. Public interest was soon rekindled when early filmmakers discovered that movies could be used to tell story. In France, Alice Guy-Blache produced *The Cabbage Fairy*, a one-minute film about a fairy who produces children in a Cabbage patch, and exhibited it at the Paris International Exhibition in 1896. Guy-Blache went on to found her own studio in America. Better known is the work of a fellow French filmmaker and magician, Georges Méliès. In 1902 Méliès produced a science-fiction film that was the great-great-grandfather of *Star Wars* and *Star Trek*; it was called *A Trip to the Moon*.

【Paragraph 1】 Motion pictures and television are possible because of two quirks of the human perceptual system: the phi phenomenon and persistence of vision. The phi phenomenon refers to what happens when a person sees one light source go out while another one close to the original is illuminated. To our eyes, it looks like the light moves from one place to another. In persistence of vision, our eyes continue to see an image for a split second after the image has disappeared from view. First observed by the ancient Greeks, persistence of vision became more widely known in 1824 when Peter Roget (who also developed the thesaurus) demonstrated that human beings retain an image of an object for about one-tenth of a second after the object is taken from view. Following Roget's pronouncement, a host of toys (the Thaumatrope, the Praxinoscope) that depended on this principle sprang up in Europe. Bearing fanciful panes, these devices made a series of hand-drawn pictures appear to move.

1. According to paragraph 1, what is the phi phenomenon?

- A. The appearance of movement that occurs when one light is turned off while another lights up nearby
- B. The tendency to see two lights placed close together as coming from a single light source
- C. The fact that the human eye sees a light source for a split second after it has disappeared
- D. The impression that there are several light sources when there is actually only one

2. According to paragraph 1, which of the following statements does NOT correctly describe persistence of vision?

- A. It was originally noticed by the ancient Greeks.
- B. It refers to an image of an object seen by the human eye for one-tenth of a second after the object has disappeared.
- C. It is a scientific principle that was already widely accepted before Peter Roget demonstrated its validity.
- D. It provided the basis for a number of European toys, including the Thaumatrope and the Praxinoscope.

【Paragraph 2】 Before long, several people realized that a series of still photographs on celluloid film could be used instead of hand drawing. In 1878 a colorful Englishman, later turned American, Edward Muybridge, attempted to settle a \$25,000 bet over whether **the four feet of a galloping horse ever simultaneously left the ground**. He arranged a series of 24 cameras alongside a racetrack to photograph a galloping horse. Rapidly viewing the series of pictures produced an effect much like that of a motion picture. Muybridge's technique not only settled the bet (the feet did leave the ground simultaneously at certain instances) but also photography. Instead of 24 cameras taking one picture in rapid order, it was Thomas Edison and his assistant, William Dickson, who finally developed what might have been the first practical motion-picture camera and viewing device. Edison was apparently trying to provide a visual counterpart to his recently invented phonograph. When his early efforts did not work out, he turned the project over to his assistant. Using flexible film, Dickson solved the vexing problem of how to move the film rapidly through the camera by perforating its edge with tiny holes and pulling it along by means of sprockets, projections on a wheel that fit into the holes of the film. In 1889 Dickson had perfected a machine called the Kinetoscope and even starred in a brief film demonstrating how it worked.

3. In paragraph 2, why does the author mention the bet that Edward Muybridge tried to settle about whether "the four feet of a galloping horse ever simultaneously left the ground" ?

- A. To introduce and explain a fundamental principle of motion-picture photography
- B. To demonstrate that still photographs produced a visual effect that surpassed that of hand-drawn pictures
- C. To emphasize that photographers had to be willing to take risks in order to portray their subjects
- D. To suggest the difficulty of trying to capture animal movement in motion-picture photography

4. According to paragraph 2, how did Muybridge contribute to the development of motion-picture technology?

- A. He invented the first motion-picture camera.
- B. He demonstrated the technique of taking a series of photographs and viewing them in rapid succession.
- C. He asked Edison and Dickson to create a motion-picture camera that was both practical and economical.
- D. He combined hand drawings and still photographs to create movie-like effects.

5. Paragraph 2 suggests that Thomas Edison's early efforts to develop a motion-picture camera failed because he could not figure out how to

- A. display the camera's pictures to an audience
- B. move the film quickly through the camera
- C. line the edge of the film with holes that were small enough
- D. prevent the film from tearing

【Paragraph 3】 These early efforts in the Edison lab were not directed at projecting movies to large crowds. Still influenced by the success of his phonograph, Edison thought a similar device could make a money by showing brief films to one person at a time for a penny a look. Edison built a special studio to produce films for his new invention, and by 1894, Kinetoscope parlors were spring up in major cities. The long-range commercial potential of his invention was lost on Edison. Hereasoned that the real money would be made by selling his peep-show machine. If a large number of people were shown the film at the same time, fewer machines would be needed. Developments in Europe proved Edison wrong as inventors there devised large-screen projection devices. Faced with competition, Edison perfected the Vitascope and unveiled it in New York City in 1896.

6. According to paragraph 3, what were Kinetoscope parlors?

- A. Places where people could pay a penny to view a short film by looking into a machine
- B. Places where people could gather in crowds to watch short films projected onto large screens
- C. Special studios where Edison produced films that would be shown by his newly invented machine
- D. Places where Edison sold his phonographs, peep-show machines, and other popular inventions

7. Which of the following can be inferred from paragraph 3 about the Vitascope?

- A. It was widely used in Europe before being adopted in the United States.
- B. It never made as much money as the equivalent European projection device.
- C. It was a larger version of the original Kinetoscope.
- D. It was designed to show motion pictures to large groups of people.

【Paragraph 4】 Early movies were simple snippets of action—acrobats tumbling, horse running, jugglers juggling, and so on. Eventually, the novelty wore off and films became less of an attraction. Public interest was soon rekindled when early filmmakers discovered that movies could be used to tell story. In France, Alice Guy-Blache produced *The Cabbage Fairy*, a one-minute film about a fairy who produces children in a Cabbage patch, and exhibited it at the Paris International Exhibition in 1896. Guy-Blache went on to found her own studio in America. Better known is the work of a fellow French filmmaker and magician, Georges Melies. In 1902 Melies produced a science-fiction film that was the great-great-grandfather of *Star Wars* and *Star Trek*; it was called *A Trip to the Moon*.

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8. In paragraph 4, the author describes the film *The Cabbage Fairy* in order to
- A. argue for the importance of continuous action to keep audiences interested
 - B. suggest that early films were more popular than live performances were
 - C. provide an example of one of the first films to tell a story
 - D. emphasize how relatively short most early movies were

【Paragraph4】 Early movies were simple snippets of action—acrobats tumbling, horse running, jugglers juggling, and so on. Eventually, the novelty wore off and films became less of an attraction. Public interest was soon rekindled when early filmmakers discovered that movies could be used to tell story. ■ In France, Alice Guy-Blache produced *The Cabbage Fairy*, a one-minute film about a fairy who produces children in a Cabbage patch, and exhibited it at the Paris International Exhibition in 1896. ■ Guy-Blache went on to found her own studio in America. ■ Better known is the work of a fellow French filmmaker and magician, Georges Melies. ■ In 1902 Melies produced a science-fiction film that was the great-great-grandfather of *Star Wars* and *Star Trek*; it was called *A Trip to the Moon*.

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

Although she directed hundreds of short films and produced hundreds more over the course of her career, she has largely been forgotten.

Where would the sentence best fit?

10. 【Directions】 An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selected THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

The phi phenomenon and persistence of vision are two characteristics of the human perceptual system that make motion pictures and television possible.

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Answer Choices

- A. When the persistence of vision became widely known, it inspired the development of toys that made hand-drawn pictures appear to move.
- B. The invention of the motion-picture camera led to the discovery that a horse's feet do not leave the ground while the horse is galloping.
- C. The primary competitors in early motion-picture technology were Edison's Kinetoscope and the European-designed and manufactured large-screen projection devices.
- D. The motion-picture camera develops from the experiments in sequential photography that were originally done by Edward Muybridge.
- E. Later developments in film included a focus on large-screens projection rather than individual viewing machines and narrative films rather than simple action sequences.
- F. French filmmakers Alice Guy-Blache and Georges started the first two major movie studios in America and in France, respectively.

Passage 15 - Bioluminescence in Marine Creatures

At night along the sea's edge, the ocean sometimes seems to glow, as if lit from within. This glow is the result of bioluminescence, a phenomenon exhibited by many of the sea's zooplankton. Bioluminescence is the production of cold light through internal biological processes, as opposed to phosphorescence or fluorescence, both of which are re-emitted light that was initially absorbed from an external source.

Many of the sea's creatures, including squid, dinoflagellates, bacteria, worms, crustaceans, and fish, are known to produce light. The process that marine creatures use to create light is like that of the common firefly and similar to that which creates the luminous green color seen in plastic glow sticks, often used as children's toys or for illumination during nighttime events. When a glow stick is bent, two chemicals mix, react, and create a third substance that gives off light. Bioluminescent organisms do essentially the same thing; they have a substance, called luciferin, that reacts with oxygen in the presence of enzyme, luciferase. When the reaction is complete, a new molecule is formed that gives off light—glowing blue—green in the underwater world. This biologically driven chemical reaction occurs within the organism's special light-producing cells, called photocytes, or light-producing organs, called photophores. Probably one of the most complex light-producing systems is that of the squid. Some squid have both photophores and chromatophores (organs for changing color) with their skin, thus enabling them to control both the color and intensity of the light produced. Recent research has also revealed that in some squid and fish, bioluminescent light may be produced by bacteria that live in a mutually beneficial partnership inside the animal's light organs.

How and why bioluminescence occurs is not fully understood; however, in the undersea realm, it appears to be used in a variety of interesting and ingenious ways. The most commonly observed form of bioluminescence in the sea is the pinpoint sparking of light at night that can create cometlike trails behind moving objects. Almost always, this is the result of dinoflagellates reacting to water motion. The relatively short, momentary displays of light may have evolved to startle, distract, or frighten would-be predators. Collection nets brought up from the sea's depths at night frequently glow green at great distance. Slowly fading green blobs or pulses of light can be seen coming from the organisms within, often from gelatinous creatures. This type of light display may be used to stun, disorient, or lure prey. Like a wide-eyed deer caught on a road and dazed by headlights, undersea creatures living within the ocean's darkness may be momentarily disoriented by short flashes of bioluminescent light. Another of the sea's light-producing organisms is a small copepod (a type of crustacean) named *Sapphirina iris*. In the water, *Sapphirina* creates short flashes of a remarkably rich, azure blue light. But its appearance under a microscope is even more spectacular, the living copepod appears as if constructed of delicately handcrafted, multicolored pieces of stained glass. Within the deep sea, some fish also have a dangling bioluminescent lure or a patch of luminescent skin near the mouth, which may be used to entice unsuspecting prey.

Other sea creatures have both light-sensing and light-producing organs. These creatures are thought to use bioluminescence as a form of communication or as a means of identifying an appropriate mate. In the lantern fish, the pattern of photophores distinguishes one species from another. In other fish, bioluminescence may help to differentiate males from females. The squid uses light as a means of camouflage. By producing light from the photophores on its underside, the squid can match light from above and become nearly invisible to predators looking up from below. Squid, as well as some of the gelatinous zooplankton, have also been known to release luminescent clouds or strands of organic material, possibly as a decoy to facilitate escape. And finally, because what they eat is often bioluminescent, many of the transparent deep-sea creatures have red or black stomachs to hide the potentially flashing contents of ingested bioluminescent creatures. Without such a blacked-out stomach, their digestive organs would flash like a neon sign that says, "Eat me, eat me!"

【Paragraph 2】 Many of the sea’s creatures, including squid, dinoflagellates, bacteria, worms, crustaceans, and fish, are known to produce light. The process that marine creatures use to create light is like that of the common firefly and similar to that which creates the luminous green color seen in plastic glow sticks, often used as children’s toys or for illumination during nighttime events. When a glow stick is bent, two chemicals mix, react, and create a third substance that gives off light. Bioluminescent organisms do essentially the same thing; they have a substance, called luciferin, that reacts with oxygen in the presence of enzyme, luciferase. When the reaction is complete, a new molecule is formed that gives off light—glowing blue—green in the underwater world. This biologically driven chemical reaction occurs within the organism’s special light-producing cells, called photocytes, or light-producing organs, called photophores. Probably one of the most complex light-producing systems is that of the squid. Some squid have both photophores and chromatophores (organs for changing color) with their skin, thus enabling them to control both the color and intensity of the light produced. Recent research has also revealed that in some squid and fish, bioluminescent light may be produced by bacteria that live in a mutually beneficial partnership inside the animal’s light organs.

1. Why does the author mention the common firefly in the passage?

- A. To relate the light production of marine creature to that of a familiar light-producing species
- B. To compare the light production of an insect with the more complex light production of marine creatures
- C. To provide an example of a species that does not use a chemical reaction to produce light
- D. To support the point that bioluminescence usually occurs at night

2. Which of the following statements about the chemical reaction that produces bioluminescence is NOT true, according to paragraph 2?

- A. It occurs when luciferin reacts with oxygen.
- B. It produces a glowing blue-green light.
- C. It is much like the process by which children’s toys are illuminated.
- D. It requires organs called chromatophores.

3. Which of the following statements about bioluminescent creatures is implied by paragraph 2?

- A. Bioluminescent creatures cannot produce light if bacteria enter their light organs.
- B. Not all bioluminescent creatures have both photophores and chromatophores.
- C. Most bioluminescent organisms do not need the enzyme luciferase in order to produce light.
- D. Creatures with light-producing organs are much more common than those that have only light producing cells.

【Paragraph 3】 How and why bioluminescence occurs is not fully understood; however, in the undersea realm, it appears to be used in a variety of interesting and **ingenious** ways. The most commonly observed form of bioluminescence in the sea is the pinpoint sparking of light at night that can create cometlike trails behind moving objects. Almost always, this is the result of dinoflagellates reacting to water motion. The relatively short, momentary displays of light may have evolved to startle, distract, or frighten would-be predators. Collection nets brought up from the sea's depths at night frequently glow green at great distance. Slowly fading green blobs or pulses of light can be seen coming from the organisms within, often from gelatinous creatures. This type of light display may be used to stun disorient, or lure prey. Like a wide-eyed deer caught on a road and dazed by headlights, undersea creatures living within the ocean's darkness may be momentarily disoriented by short flashes of bioluminescent light. Another of the sea's light-producing organisms is a small copepod (a type of crustacean) named *Sapphirina iris*. In the water, *Sapphirina* creates short flashes of a remarkably rich, azure blue light. But its appearance under a microscope is even more spectacular, the living copepod appears as if constructed of delicately handcrafted, multicolored pieces of stained glass. Within the deep sea, some fish also have a dangling bioluminescent lure or a patch of luminescent skin near the mouth, which may be used to entice unsuspecting prey.

4. The word “**ingenious**” in the passage is closest in meaning to

- A. inventive
- B. important
- C. unusual
- D. specialized

5. According to paragraph 3, when do dinoflagellates produce pinpoint sparkling displays of light?

- A. When they are caught in collection nets?
- B. When they are hunting food?
- C. When there is a sudden movement of the water around them?
- D. When they are stunned or disoriented?

6. According to paragraph 3, what is notable when looking at *Sapphirina iris* under a microscope?

- A. It produces brief flashes of light.
- B. Its body is a rich azure blue color.
- C. It has luminescent skin on its mouth.
- D. It looks as if it is made of glass of many colors.

7. Which of the following is NOT mentioned in paragraph 3 as a possible reason for the use of bioluminescence?

- A. To provide a means of lighting the dark marine waters
- B. To momentarily disorient other creatures
- C. To frighten away potential predators
- D. To attract prey

【Paragraph 4】 Other sea creatures have both light-sensing and light-producing organs. These creatures are thought to use bioluminescence as a form of communication or as a means of identifying an appropriate mate. In the lantern fish, the pattern of photophores distinguishes one species from another. In other fish, bioluminescence may help to differentiate males from females. The squid uses light as a means of camouflage. By producing light from the photophores on its underside, the squid can match light from above and become nearly invisible to predators looking up from below. Squid, as well as some of the gelatinous zooplankton, have also been known to release luminescent clouds or strands of organic material, possibly as a decoy to facilitate escape. And finally, because what they eat is often bioluminescent, many of the transparent deep-sea creatures have red or black stomachs to hide the potentially flashing contents of ingested bioluminescent creatures. Without such a blacked-out stomach, their digestive organs would flash like a neon sign that says, “Eat me, eat me!”

8. According to paragraph 4, squid use bioluminescence to

- A. communicate with other squid
- B. locate mates
- C. tell males and females apart
- D. hide from predators

【Paragraph 4】 Other sea creatures have both light-sensing and light-producing organs. These creatures are thought to use bioluminescence as a form of communication or as a means of identifying an appropriate mate. ■In the lantern fish, the pattern of photophores distinguishes one species from another. ■In other fish, bioluminescence may help to differentiate males from females. ■The squid uses light as a means of camouflage. ■By producing light from the photophores on its underside, the squid can match light form above and become nearly invisible to predators looking up from below. Squid, as well as some of the gelatinous zooplankton, have also been known to release luminescent clouds or strands of organic material, possibly as a decoy to facilitate escape. And finally, because what they eat is often bioluminescent, many of the transparent deep-sea creatures have red or black stomachs to hide the potentially flashing contents of ingested bioluminescent creatures. Without such a blacked-out stomach, their digestive organs would flash like a neon sign that says, “Eat me, eat me!”

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage

Yet, certain species use bioluminescence for exactly the opposite purpose -- to blend in with surroundings and become less identifiable.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Many of the sea's creatures produce light through bioluminescence.

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Answer Choices

- A. Bioluminescent creature uses a substance called luciferin and an enzyme to produce light in a biologically driven chemical reaction.
- B. Bioluminescence can be used to achieve various and sometimes seemingly opposite goals such as frightening away predators or luring prey.
- C. Bioluminescence can be used by some sea creatures as a form of communication or as a means of identifying an appropriate mate.
- D. The majority of bioluminescent creatures are gelatinous in nature, allowing them to produce light.
- E. The same bioluminescent creature cannot have both light-sensing and light-producing organs.
- F. Sea creatures that eat bioluminescent material possess special chemicals that keep their stomach contents from flashing.

Passage 16 - Coral Reef Communities

Coral reefs are massive underwater structures made from the hard limestone exoskeletons of thousands of tiny living organisms (coral polyps) produced one on top of another in warm, clear, shallow ocean waters. Living polyps extend upward and outward from the coral colony center and live on top of the old dead exoskeletons. Coral reef communities are crowded with other animals representing virtually every major animal phylum. Space is at a premium on reefs, corals, seaweeds (various forms of algae), sponges, or other organisms cover virtually every surface. Because both corals and algae require light to survive, access to light, like space, is also a resource subject to competition.

Fast-growing, branching corals can grow over slower-growing, encrusting, or massive corals and deny them light. In response, the slower-growing forms can extend stinging filaments from their digestive cavity and kill their competitor's polyps. Undamaged polyps on the faster-growing, branching coral, however, may grow very long sweeper tentacles, containing powerful nematocysts (stingers) that kill polyps on the slower-growing form. The faster-growing form repairs the damage and continues to overgrow its competitor. In addition to sweeper tentacles and stinging filaments, corals have several other mechanisms available for attack or defense.

In general, slower-growing corals are more aggressive than fast-growing species. In cases where a competitor cannot be overcome, however, corals may survive by taking advantage of differences in local habitats. Massive corals are generally more shade tolerant and able to survive at greater depths. Therefore, on many reefs it is the fast-growing, branching corals that ultimately dominate at the upper, shallower portion of the reef, whereas more massive forms dominate in deeper areas.

Corals also must compete with other reef organisms, each with its own strategies for survival. Sponges, soft corals, and seaweeds (algae) can overgrow stony corals and smother them. Algae are competitively superior to corals in shallow water but less so at depth. Survival of coral in shallow water, therefore, may depend on grazing by plant-eating echinoderms (starfish and sea urchins) and fishes. In Jamaica, overfishing removed most of the plant-eating fish from coral reefs. Initially, algal growth was kept in check by grazing sea urchins, but in 1982, a pathogen reduced the population by 99 percent. Without grazers, the algae were able to completely overgrow the coral.

Competition may occur among other reef communities. Grazing by urchins and fishes is important in preventing seaweeds from overgrowing the reef. The dominant algae on a healthy reef are usually fast-growing filamentous forms or coralline algae, well protected by calcification (hardening) and the production of noxious chemicals. These algae are inferior competitors to larger, fleshier seaweeds, so grazing by urchins and fishes on the larger seaweeds allows these algae to persist. Grazing on plants is greatest in the shallow reef areas but decreases with depth, where lower temperatures and light reduce algal growth. The reef is, therefore, a mosaic of microhabitats with different levels of grazing and different algal communities.

An additional complexity arises from the activity of damselfish. Because they are territorial, many damselfish species exclude grazers and other species from certain areas of the reef. Algae grow rapidly in these territories, providing habitat for many small invertebrates but overgrowing the corals. Branching corals tend to dominate in damselfish territories because they are upright and faster growing than the more massive or encrusting forms.

Although less studied than on rocky shores, predation almost certainly has a significant influence on the community structure of coral reefs. Fish and other predators may preferentially prey on such competitors of corals as sponges and gorgonians, giving competitively inferior reef corals an advantage in securing space. Many species of fish, mollusks, and crustaceans also feed directly on coral polyps. Several surgeonfish and parrotfish may actually pass coral skeletons through their digestive tracts and add sediment to the reef. Both fish and invertebrate corallivores (coral-feeding organisms) seem to attack faster-

growing, branching species preferentially, perhaps preventing slower-growing forms from being overgrown. Corallivores, however, rarely ever completely destroy a coral colony except in cases where tropical storms or humans have already done severe damage. The fact that almost all small invertebrates on reefs are so well hidden or highly camouflaged is another indicator of how prevalent predation is on reefs and its importance in determining reef structure.

【Paragraph 1】 Coral reefs are massive underwater structures made from the hard limestone exoskeletons of thousands of tiny living organisms (coral polyps) produced one on top of another in warm, clear, shallow ocean waters. Living polyps extend upward and outward from the coral colony center and live on top of the old dead exoskeletons. Coral reef communities are crowded with other animals representing virtually every major animal phylum. Space is at a premium on reefs, corals, seaweeds (various forms of algae), sponges, or other organisms cover virtually every surface. Because both corals and algae require light to survive, access to light, like space, is also a resource subject to competition.

1. According to paragraph 1, all of the following are true of coral reefs EXCEPT:

- A. Coral reefs grow biggest in the deepest waters of the ocean.
- B. The organisms living around coral reefs compete for limited resources.
- C. There are many different organisms in coral reef communities.
- D. Coral reefs consist of the outer skeletons of small living organisms.

【Paragraph 2】 Fast-growing, branching corals can grow over slower-growing, encrusting, or massive corals and deny them light. In response, the slower-growing forms can extend stinging filaments from their digestive cavity and kill their competitor's polyps. Undamaged polyps on the faster-growing, branching coral, however, may grow very long sweeper tentacles, containing powerful nematocysts (stingers) that kill polyps on the slower-growing form. The faster-growing form repairs the damage and continues to overgrow its competitor. In addition to sweeper tentacles and stinging filaments, corals have several other mechanisms available for attack or defense.

2. According to paragraph 2, how do fast-growing branching corals defend themselves from attacks by slower-growing corals?

- A. By producing stinging sweeper tentacles
- B. By growing on top of the slower-growing corals
- C. By blocking the light to the slower-growing corals
- D. By destroying the stinging filament of the slower-growing corals

【Paragraph 4】 Corals also must compete with other reef organisms, each with its own strategies for survival. Sponges, soft corals, and seaweeds (algae) can overgrow stony corals and smother them. Algae are competitively superior to corals in shallow water but less so at depth. Survival of coral in shallow water, therefore, may depend on grazing by plant-eating echinoderms (starfish and sea urchins) and fishes. In Jamaica, overfishing removed most of the plant-eating fish from coral reefs. Initially, algal growth was **kept in check** by grazing sea urchins, but in 1982, a pathogen reduced the population by 99 percent. Without grazers, the algae were able to completely overgrow the coral.

3. The phrase "**kept in check**" in the passage is closest in meaning to

- A. limited
- B. prevented
- C. allowed
- D. stimulated

4. In paragraph 4, why does the author discuss the effects of removing planteating fish and sea urchins from coral reefs?

- A. To identify a situation that contributes to the dominance of corals in shallow waters
- B. To demonstrate the importance of grazing on seaweeds for the survival of some corals
- C. To provide evidence that seaweeds are better competitors than coral at depth
- D. To argue that sea urchin pathogens also attack corals

5. According to paragraph 4, all of these pairs of organisms are in competition EXCEPT

- A. corals and sponges
- B. algae and corals
- C. echinoderms and corals
- D. sea urchins and algae

【Paragraph 5】 Competition may occur among other reef communities. Grazing by urchins and fishes is important in preventing seaweeds from overgrowing the reef. The dominant algae on a healthy reef are usually fast-growing filamentous forms or coralline algae, well protected by calcification (hardening) and the production of noxious chemicals. These algae are inferior competitors to larger, fleshier seaweeds, so grazing by urchins and fishes on the larger seaweeds allows these algae to persist. Grazing on plants is greatest in the shallow reef areas but decreases with depth, where lower temperatures and light reduce algal growth. The reef is, therefore, a mosaic of microhabitats with different levels of grazing and different algal communities.

6. According to paragraph 5, fast-growing filamentous or coralline algae are usually the dominant algae on healthy coral reefs in part because they

- A. are not affected by noxious chemicals produced by other organisms
- B. are less attractive as food for sea urchins and fishes than bigger seaweeds are
- C. occupy the areas of coral reefs that have lower temperatures and less light
- D. can live in a wider variety of microhabitats than their competitors can

【Paragraph 7】 Although less studied than on rocky shores, predation almost certainly has a significant influence on the community structure of coral reefs. Fish and other predators may preferentially prey on such competitors of corals as sponges and gorgonians, giving competitively inferior reef corals an advantage in securing space. Many species of fish, mollusks, and crustaceans also feed directly on coral polyps. Several surgeonfish and parrotfish may actually pass coral skeletons through their digestive tracts and add sediment to the reef. Both fish and invertebrate corallivores (coral-feeding organisms) seem to attack faster-growing, branching species preferentially, perhaps preventing slower-growing forms from being overgrown. Corallivores, however, rarely ever completely destroy a coral colony except in cases where tropical storms or humans have already done severe damage. **The fact that almost all small invertebrates on reefs are so well hidden or highly camouflaged is another indicator of how prevalent predation is on reefs and its importance in determining reef structure.**

7. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. The presence of only very small invertebrates on a reef is an indication of widespread predation.
- B. Most reefs are structured in a way which allows small invertebrates to remain hidden or camouflaged.
- C. Almost all small invertebrates are hidden or camouflaged, indicating the extent and importance of predation to reef structure.
- D. Almost all of the small invertebrates on reefs are difficult to find because they are so highly camouflaged.

8. Paragraph 7 mentions all of the following as effects of predation on the community structure of coral reefs EXCEPT

- A. Corals are advantaged when predators prefer to attack competitors of corals.
- B. Faster-growing corals are prevented from overgrowing slower-growing corals when faster-growing species are preferred by competitors.
- C. Predation contributes to the sediment deposit of the reef.
- D. Small invertebrates are exposed to competitively superior organisms.

【Paragraph 3】 In general, slower-growing corals are more aggressive than fast-growing species. ■In cases where a competitor cannot be overcome, however, corals may survive by taking advantage of differences in local habitats. ■Massive corals are generally more shade tolerant and able to survive at greater depths. ■Therefore, on many reefs it is the fast-growing, branching corals that ultimately dominate at the upper, shallower portion of the reef, whereas more massive forms dominate in deeper areas. ■

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

For example, different species of corals have different needs for light.

Where would the sentence best fit?

10. 【Directions】 An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Coral reef communities include many different organisms that must compete for resources such as space and light.

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Answer Choices

- A. In order to keep from being overgrown, the different species of coral kill each other's polyps, or live in different local habitats within the reef community.
- B. Competition among the different species of corals is more intense than that between corals and other coral reef inhabitants.
- C. Predation shapes reef structure by getting rid of competitors of corals, but coral polyps themselves are also eaten, as are many reef inhabitants.
- D. Coral reefs are divided into a shallow upper portion and a deeper lower portion with branching corals dominating in the lower portion.
- E. Grazing by fishes and urchins prevents algae and seaweeds from overgrowing the corals, although damselfish exclude grazers from some areas.
- F. Fish and invertebrate corallivores are the most common cause of coral colony destruction, followed by tropical storms and damage by humans.

Passage 17 - Sea Turtle Hatchling Strategies for Navigation

Sea turtles' eggs are laid at night to minimize the likelihood of their discovery by predators, and the offspring, when ready to emerge from their eggshells and dig their way out of the sand, hatch at night for the same reason. Since the offspring are especially vulnerable immediately after hatching, it is vital for them to get to the sea as soon as possible. Turtle hatchlings use a number of cues to tell them where the sea is.

The most important cue seems to be light. The night sky is usually brightest over the sea. Cover a turtle hatchling's eyes, and it cannot find the sea even if there is other information available, such as a downward slope of the sand toward the water's edge. The hatchlings respond to light cues covering a vertical range of only about 30° above the horizon or, depending on the species, even less. Responding only to lights that are close to the horizon decreases the risk that hatchlings will become confused. They seem less attracted to yellow light than to other colors -- loggerhead turtles show an aversion to yellow light -- and this preference may keep them from becoming disoriented by the rising Sun.

It is usually safest to have more than one internal compass, and hatchlings seem to be guided by more than light alone. They steer away from sand dunes and vegetation. Possibly these objects merely block light behind them that might mislead turtle hatchlings about where the sea is, but it is also possible that turtles are sensitive to the shape of such objects and process these shapes as signals that the sea is located in some other direction. Such reinforcing cues, however, are not enough to guide hatchlings away from the artificial lights that now burn on many a beach environment. Artificial lighting is often strong enough to completely overcome the signals a hatchling sea turtle is programmed to recognize. Artificial light, if it is bright enough, becomes a stimulus so powerful that the hatchlings respond to nothing else, crawling toward it from hundreds of meters away.

If all goes well and the hatchlings scramble over the sand in the right direction, avoid their enemies, and reach the surf, a new set of orienting mechanisms takes over. As soon as they are afloat, the hatchlings begin to swim at something over 1.5 kilometers per hour. They dive into the path of the wave undertow, where the receding waters sweep them outward, away from the beach. When they surface again, they head for open sea. This time, they are guided not by sight but apparently exclusively by the direction of the incoming waves. Experiments with loggerheads, greens, and leatherbacks have shown that hatchlings swim toward approaching waves; but if the sea is calm, they swim randomly or in circles. Under experimental conditions, hatchlings will swim into the waves even if doing so sends them back to the beach again.

The farther a hatchling gets from shore, the less reliable wave direction becomes as a pointer to the open sea. Researchers have shown that hatchling green sea turtles released from a hatchery in Borneo, East Malaysia, are able to navigate around small islands and keep swimming offshore, even when there are few waves to guide them. They may be relying on yet another internal compass this time oriented to Earth's magnetic field. Recent experiments suggest that leatherback and olive ridley hatchlings "switch on" their geomagnetic compass almost as soon as they are out of the nest. Though the hatchlings position themselves geomagnetically as soon as they leave the nest and appear to be able to use that position as a reference point, they will not follow it automatically if other cues, such as light and sound, are available. Hatchlings find their geomagnetic compass useful only after they have already been able to determine the direction they should swim. A simple directional compass -- one that always sent the turtles westward, for instance—would be useless if the open sea lay in some other direction. Therefore, a magnetic compass does not so much tell a hatchling turtle which way to go as keep it on course once it has determined the direction it should swim from some other cue.

【Paragraph 1】 Sea turtles' eggs are laid at night to minimize the likelihood of their discovery by predators, and the offspring, when ready to emerge from their eggshells and dig their way out of the sand, hatch at night for the same reason. Since the offspring are especially vulnerable immediately after hatching, it is vital for them to get to the sea as soon as possible. Turtle hatchlings use a number of cues to tell them where the sea is.

1. Which of the sentences below best express the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Sea turtle eggs are laid at night and hatch at night for the same reason.
- B. To minimize the likelihood of their discovery by predators, sea turtle hatchlings dig their way out of the sand at night.
- C. To minimize the likelihood of discovery by predators, sea turtle eggs are laid and hatch at night.
- D. Eggs that laid at night and offspring that emerge from the eggs at night are less likely to be discovered by predators.

【Paragraph 2】 The most important cue seems to be light. The night sky is usually brightest over the sea. Cover a turtle hatchling's eyes, and it cannot find the sea even if there is other information available, such as a downward slope of the sand toward the water's edge. The hatchlings respond to light cues covering a vertical range of only about 30° above the horizon or, depending on the species, even less. Responding only to lights that are close to the horizon decreases the risk that hatchlings will become confused. They seem less attracted to yellow light than to other colors -- loggerhead turtles show an aversion to yellow light—and this preference may keep them from becoming disoriented by the rising Sun.

2. In paragraph 2, why does the author provide the information that sea turtle hatchlings cannot find the sea when their eyes are covered?

- A. To identify a major reason that such turtles might not reach the sea
- B. To support the claim that light is an important directional cue for such turtles
- C. To point out the effect of yellow light on the attempts of such turtles to reach the sea
- D. To provide evidence showing that such turtles easily lose their sense of direction

3. According to paragraph 2, which of the following is true of turtle hatchlings that are trying to make their way to the sea?

- A. They are unable to distinguish the light of the rising Sun from other types of light.
- B. They require the presence of yellow light in order to reach the water's edge.
- C. They have trouble crossing downward slopes near the water's edge.
- D. They respond to light only when it is close to the horizon.

【Paragraph 3】 It is usually safest to have more than one internal compass, and hatchlings seem to be guided by more than light alone. They steer away from sand dunes and vegetation. Possibly these objects merely block light behind them that might mislead turtle hatchlings about where the sea is, but it is also possible that turtles are sensitive to the shape of such objects and process these shapes as signals that the sea is located in some other direction. Such reinforcing cues, however, are not enough to guide hatchlings away from the artificial lights that now burn on many a beach environment. Artificial lighting is often strong enough to completely overcome the signals a hatchling sea turtle is programmed to recognize. Artificial light, if it is bright enough, becomes a stimulus so powerful that the hatchlings respond to nothing else, crawling toward it from hundreds of meters away.

4. Which of the following is offered in paragraph 3 as a possible explanation for sea turtle hatchlings' behavior of avoiding sand dunes and vegetation?

- A. Sand dunes and vegetation may provide hiding places for animals that attack hatchlings.
- B. Sand dunes and vegetation may block the pathway between hatchlings and the water's edge.
- C. The shapes of sand dunes and vegetation may indicate the wrong direction to travel in.
- D. The shapes of sand dunes and vegetation may resemble the shapes of some hatchling predators.

5. Paragraph 3 supports which of the following statements about the artificial lights now found on many beaches?

- A. The lights have sometimes helped sea turtle hatchlings find their way to the sea.
- B. The lights can be bright enough to affect sea turtle hatchlings within hundreds of meters of them.
- C. The lights are commonly turned off during periods when sea turtle offspring are hatching.
- D. The lights tend to affect the behavior of sea turtle hatchlings less than other programming signals do.

【Paragraph 5】 The farther a hatchling gets from shore, the less reliable wave direction becomes as a pointer to the open sea. Researchers have shown that hatchling green sea turtles released from a hatchery in Borneo, East Malaysia, are able to navigate around small islands and keep swimming offshore, even when there are few waves to guide them. They may be relying on yet another internal compass this time oriented to Earth's magnetic field. Recent experiments suggest that leatherback and olive ridley hatchlings “**switch on**” their geomagnetic compass almost as soon as they are out of the nest. Though the hatchlings position themselves geomagnetically as soon as they leave the nest and appear to be able to use that position as a reference point, they will not follow it automatically if other cues, such as light and sound, are available. Hatchlings find their geomagnetic compass useful only after they have already been able to determine the direction they should swim. A simple directional compass—one that always sent the turtles westward, for instance—would be useless if the open sea lay in some other direction. Therefore, a magnetic compass does not so much tell a hatchling turtle which way to go as keep it on course once it has determined the direction it should swim from some other cue.

6. In paragraph 5, why does the author provide the information that hatchling green sea turtles can navigate around small islands and keep swimming offshore even when few waves are present?

- A. To point out a benefit of the fact that hatchlings use their geomagnetic compasses almost as soon as they leave the nest
- B. To provide evidence that green sea turtles use different navigational techniques than leatherbacks and olive ridley turtles do
- C. To provide a reason for considering the possibility that sea turtles navigate by detecting Earth's magnetic field
- D. To provide evidence showing that hatchling do not automatically follow their geomagnetic compass if other cues are available

7. The word “**switch on**” in the passage is closest in meaning to

- A. follow
- B. change
- C. control
- D. activate

8. According to paragraph 5, all the following claims about the geomagnetic compass of sea turtle hatchlings are true EXCEPT

- A. In some species it is switched on almost as soon as a turtle hatches.
- B. It helps keep the hatchlings heading in a direction that it is initially determined by some cue such as light or sound.
- C. Its direction is followed automatically to swim toward open water.
- D. It can be used to navigate around islands when the waves stop indicating the direction of the open sea.

【Paragraph 5】 The farther a hatchling gets from shore, the less reliable wave direction becomes as a pointer to the open sea. Researchers have shown that hatchling green sea turtles released from a hatchery in Borneo, East Malaysia, are able to navigate around small islands and keep swimming offshore, even when there are few waves to guide them. They may be relying on yet another internal compass this time oriented to Earth’s magnetic field. Recent experiments suggest that leatherback and olive ridley hatchlings “switch on” their geomagnetic compass almost as soon as they are out of the nest. Though the hatchlings position themselves geomagnetically as soon as they leave the nest and appear to be able to use that position as a reference point, they will not follow it automatically if other cues, such as light and sound, are available. ■ Hatchlings find their geomagnetic compass useful only after they have already been able to determine the direction they should swim. ■ A simple directional compass—one that always sent the turtles westward, for instance—would be useless if the open sea lay in some other direction. ■ Therefore, a magnetic compass does not so much tell a hatchling turtle which way to go as keep it on course once it has determined the direction it should swim from some other cue. ■

9. Look at the four squares [■] that indicate where the following sentence could be added to the passage

This preference for other cues points to the special role of the geomagnetic compass in hatchling navigation.

Where would the sentence best fit?

10. Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

To minimize attacks from predators, turtle hatchlings must quickly find their way to the water’s edge.

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Answer Choices

- A. When light cues are absent, hatchlings use other navigational strategies, such as following the downward slope of the beach to find the water’s edge.
- B. If the incoming waves are too strong to allow hatchlings to reach the open sea, they are carried back to the beach where they wait for calmer waters.
- C. Once hatchlings reach the open sea, they begin to use their geomagnetic compasses as simple directional compasses.
- D. Hatchlings use light and cues such as shapes to help them locate the sea, though strong artificial light on land may lead them in the wrong direction.
- E. After they reach the water, hatchlings rely on incoming waves to indicate the direction in which the open sea is located.
- F. Hatchlings’ geomagnetic compasses can help keep hatchlings on course toward the open sea, once other cues have been used to get them headed in the right direction.

Passage 18 - Temperature Regulation in Marine Organisms

There are two extremes of temperature regulation in organisms. Homeotherms are organisms that regulate body temperature to a constant level, usually above that of the ambient (surrounding) environment. A constant and relatively high body temperature enables biochemical reactions to occur in a relatively constant internal environment and at a relatively high rate. Most birds have a body temperature of about 40°C, whereas the temperature of most marine mammals is about 38 °C. Because such temperatures are much higher than that of most seawater, marine homeotherms lose heat rapidly to the surrounding environment.

There is another completely different style of living. Poikilotherms are organisms whose body temperature conforms to that of the ambient environment. All subtidal marine invertebrates and most fishes fit into this category. There is an interesting intermediate status in which body temperature is usually somewhat higher than ambient temperature. Strong-swimming fishes, such as skipjack tuna and yellowfin tuna, have this intermediate status. Their rise in temperature above ambient conditions stems from metabolic heat generated by muscular activity (swimming) combined with a heat retention mechanism. The temperature rise is probably necessary to generate the increased biochemical reaction rates that are needed for sustained activity. In contrast, some intertidal animals are not true Poikilotherms, they maintain themselves at lower-than-ambient body temperature, using both evaporation and circulation of body fluids to avoid being heated at low tide by the Sun. Their body temperatures, therefore, differ from that of an inanimate object of the same size and shape that might be placed on the shore. Intertidal organisms absorb and lose heat directly to the air. Darker-colored forms can absorb more heat than can light-colored forms; therefore, variation in color can reflect differences in adaptation to the capture of solar energy at different latitudes.

Ocean temperatures are usually less than 27°C and may be less than 0°C in some locations and during some seasons. Therefore, most homeothermic mammals and birds must lose heat continuously to the environment. Their skin is the main pathway of heat loss, especially by direct conduct of heat from the skin to the contacting colder water. Because animals have a circulatory system, heat loss from the body surface also occurs as warm interior blood is transferred and moves into contact with the periphery of the body. Their bodies also radiate heat, usually in the infrared part of the spectrum. Finally, as animals exhale, the resulting evaporation of water involves a considerable loss of heat.

The first line of defense against heat loss is a well-insulated body surface. Marine birds deal with this problem by means of specially adapted feathers. A series of interlocking contour feathers encloses a thick layer of down feathers that traps stationary air, which in turn acts as an insulating layer. Whales, porpoises, and seals are insulated against the lower sea temperatures by a thick layer of subcutaneous fat. Sea otters lack such a layer, but they constantly preen and fluff up a relatively thick layer of fur. Such mechanisms are only partly successful, however, and to generate more body heat to maintain a constant temperature, marine mammals usually must have a higher metabolic rate than similarly sized terrestrial (land) animals.

In marine mammals that have limbs, the limbs are the principal sources of heat loss because they expose a relatively greater amount of body surface area per unit volume to cold water. However, warm arterial blood must be supplied to limbs, such as the flipper of a porpoise. Heat loss in porpoises is minimized by a countercurrent heat exchanger. The arteries are surrounded by veins, within which blood is returning to the core of the animal. At any contact point, the artery, which is on the inside, is warmer than a surrounding vein, so heat is lost to the returning venous blood flow. Heat is thus reabsorbed and returned to the porpoise's body core. This spatial relationship of circulatory vessels minimizes heat loss to the flipper and thence to the water. Although the anatomical details are quite different, fishes such as skipjack tuna have a circulatory anatomy based on the same overall design. Arteries and veins in the near-surface musculature are in contact, and in arteries and veins, respectively, blood flows in opposite directions.

【Paragraph 2】 There is another completely different style of living. Poikilotherms are organisms whose body temperature conforms to that of the ambient environment. All subtidal marine invertebrates and most fishes fit into this category. There is an interesting intermediate status in which body temperature is usually somewhat higher than ambient temperature. Strong-swimming fishes, such as skipjack tuna and yellowfin tuna, have this intermediate status. Their rise in temperature above ambient conditions stems from metabolic heat generated by muscular activity (swimming) combined with a heat retention mechanism. The temperature rise is probably necessary to generate the increased biochemical reaction rates that are needed for sustained activity. In contrast, some intertidal animals are not true Poikilotherms, they maintain themselves at lower-than-ambient body temperature, using both evaporation and circulation of body fluids to avoid being heated at low tide by the Sun. Their body temperatures, therefore, differ from that of an inanimate object of the same size and shape that might be placed on the shore. Intertidal organisms absorb and lose heat directly to the air. Darker-colored forms can absorb more heat than can light-colored forms, therefore, variation in color can reflect differences in adaptation to the capture of solar energy at different latitudes.

1. According to paragraph 2, the body temperature of strong-swimming fishes is usually above that of their surroundings probably so they can

- A. generate heat to warm themselves in cold waters
- B. have enough energy for prolonged activity
- C. generate metabolic heat for muscular activity
- D. retain heat for later use when the surrounding conditions change

【Paragraph 3】 Ocean temperatures are usually less than 27°C and may be less than 0°C in some locations and during some seasons. Therefore, most homeothermic mammals and birds must lose heat continuously to the environment. Their skin is the main pathway of heat loss, especially by direct conduct of heat from the skin to the contacting colder water. Because animals have a circulatory system, heat loss from the body surface also occurs as warm interior blood is transferred and moves into contact with the periphery of the body. Their bodies also radiate heat, usually in the infrared part of the spectrum. Finally, as animals exhale, the resulting evaporation of water involves a considerable loss of heat.

2. According to paragraph 3, all of the following contribute to heat loss in homeothermic animals EXCEPT

- A. heat transfer from the skin to the water
- B. the movement of blood to the animal's periphery
- C. an increase in their activity during certain seasons
- D. the evaporation of water during breathing

【Paragraph 4】 The first line of defense against heat loss is a well-insulated body surface. Marine birds deal with this problem by means of specially adapted feathers. A series of interlocking contour feathers encloses a thick layer of down feathers that traps **stationary** air, which in turn acts as an insulating layer. Whales, porpoises, and seals are insulated against the lower sea temperatures by a thick layer of subcutaneous fat. Sea otters lack such a layer, but they constantly preen and fluff up a relatively thick layer of fur. Such mechanisms are only partly successful, however, and to generate more body heat to maintain a constant temperature, marine mammals usually must have a higher metabolic rate than similarly sized terrestrial (land) animals.

3. The word “**stationary**” in the passage is closest in meaning to

- A. warm
- B. surface
- C. nonmoving
- D. nearby

4. All of the following are mentioned in paragraph 4 as defenses against heat loss EXCEPT

- A. subcutaneous fat
- B. layers of feathers
- C. a thick layer of fur
- D. constant metabolic rates

5. What can be inferred from the comparison of terrestrial animals to marine animals in the last sentence of paragraph 4?

- A. An animal's size is not the only factor affecting its metabolic rate.
- B. An animal's size determines what mechanism can be successfully used to prevent heat loss.
- C. Smaller animals are more successful than larger ones at preventing heat loss.
- D. Terrestrial animals have a wider variety of mechanisms for preventing heat loss than marine animals do.

6. Paragraph 4 expands on paragraph 3 by

- A. presenting various reasons why first-time defenses are inadequate to deal with the problem described in paragraph 3
- B. discussing mechanisms that marine animals use to reduce the problem described in paragraph 3
- C. identifying specific ways that the problem described in paragraph 3 harms marine animals
- D. explaining why the problem described in paragraph 3 harms some marine animals more than others

【Paragraph 5】 In marine mammals that have limbs, the limbs are the principal sources of heat loss because they expose a relatively greater amount of body surface area per unit volume to cold water. However, warm arterial blood must be supplied to limbs, such as the flipper of a porpoise. Heat loss in porpoises is minimized by a countercurrent heat exchanger. The arteries are surrounded by veins, within which blood is returning to the core of the animal. At any contact point, the artery, which is on the inside, is warmer than a surrounding vein, so heat is lost to the returning venous blood flow. Heat is thus reabsorbed and returned to the porpoise's body core. This spatial relationship of circulatory vessels minimizes heat loss to the flipper and thence to the water. Although the anatomical details are quite different, fishes such as skipjack tuna have a circulatory anatomy based on the same overall design. Arteries and veins in the near-surface musculature are in contact, and in arteries and veins, respectively, blood flows in opposite directions.

7. According to paragraph 5, some marine mammals that have limbs minimize heat loss by using a system in which

- A. vessels that return blood to the animal's core absorb heat from warm interior arteries
- B. blood returning to the core is warmer than blood flowing from the core
- C. the placement of the arteries reduces blood flow to the veins
- D. both arteries and veins are in contact with near-surface musculature

8. Why does the author discuss “fishes such as skipjack tuna”?

- A. To explain by contrast why the circulatory anatomy of porpoises is efficient
- B. To show that marine animals other than mammals use a countercurrent exchange system to minimize heat loss
- C. To identify and illustrate a type of circulatory anatomy that is common in fishes
- D. To provide evidence that the amount of heat marine animals lose increases with increased body surface area

【Paragraph 2】 There is another completely different style of living. ■Poikilotherms are organisms whose body temperature conforms to that of the ambient environment. ■All subtidal marine invertebrates and most fishes fit into this category. ■There is an interesting intermediate status in which body temperature is usually somewhat higher than ambient temperature. ■Strong-swimming fishes, such as skipjack tuna and yellowfin tuna, have this intermediate status. Their rise in temperature above ambient conditions stems from metabolic heat generated by muscular activity (swimming) combined with a heat retention mechanism. The temperature rise is probably necessary to generate the increased biochemical reaction rates that are needed for sustained activity. In contrast, some intertidal animals are not true Poikilotherms, they maintain themselves at lower-than-ambient body temperature, using both evaporation and circulation of body fluids to avoid being heated at low tide by the Sun. Their body temperatures, therefore, differ from that of an inanimate object of the same size and shape that might be placed on the shore. Intertidal organisms absorb and lose heat directly to the air. Darker-colored forms can absorb more heat than can light-colored forms, therefore, variation in color can reflect differences in adaptation to the capture of solar energy at different latitudes.

9. Look at the four squares 【■】 that indicate where the following sentence can be added to the passage.

However, not all marine organisms can be easily classified as either homeotherms or poikilotherms.

Where would the sentence best fit?

10. 【Directions】 An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points. Drag your choices to the spaces where they belong.

Marine and other organisms are classified as homeotherms if they maintain a constant body temperature and as poikilotherms if their body temperature matches that of the environment.

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Answer Choices

- A. Although strong-swimming fishes and intertidal organisms have body temperatures that are higher or lower than ambient temperatures, most fishes and subtidal marine organisms are poikilotherms.
- B. There are no homeotherms in cold ocean waters because it is too difficult for homeotherms to prevent heat loss in these environments.
- C. Features such as fur help reduce heat loss, but marine homeotherms require a higher metabolism than do terrestrial homeotherms of similar size to maintain a constant body temperature.
- D. Some organisms are thought to have various methods of heat regulation in order to maintain different body temperatures at different times of year.
- E. Marine homeotherms lose heat to the environment through respiration and other means, the most important being skin contact with colder seawater.
- F. Animals with disadvantage limbs are regarding at a body temperature because their circulatory anatomy is poorly designed for managing heat loss.

Passage 19 - The Brain Size of Bottlenose Dolphins

Large brain size does not always mean that an animal is highly intelligent. Brain size is necessarily associated with overall body size, with large animals having large brains and small animals having small brains. However, it is still necessary for there to be some minimum amount of circuitry (brain cells and processes) present for a species to have the potential to be highly intelligent, whatever way the term intelligence is defined. A measure of relative brain size that has been applied to a variety of species is the encephalization quotient (EQ), the ratio of brain mass to body size. The EQ is calculated by measuring the relative size of different body parts over a wide range of species. An EQ of 1.0 means that the brain is exactly the size one would expect for an animal of a particular size, an EQ higher than 1.0 means that a species is relatively brainy.

Bottlenose dolphins have a very high EQ, about 2.8 or higher. Thus, dolphin brains are not simply absolutely large: they are relatively very large as well. Humans, by the way, have extremely high EQ values, estimated to be in the neighborhood 7.5, making our species the brainiest in existence. Nonetheless, it is worth noting that EQ levels in several species of odontocetes (toothed whales, dolphins, and porpoises) are significantly higher than is the case for any primate except our own species. The EQ value for a species relates to a number of general measures of cognitive processing ability in different mammals, as well as to a number of life history patterns in mammals. EQ may be correlated with life span, home-range size, and social systems that characterize a particular species. Oddly enough, the relationships found between EQ and other factors in primates and some other mammals do not appear to apply as well to cetaceans (whales, dolphins, and porpoises), including the bottlenose dolphin.

The reasons for the larger-than-normal brain of the bottlenose dolphin (and indeed of small odontocetes in general) are not clearly understood. To navigate and detect prey, dolphins emit calls into the environment and then listen to the echoes of the calls that return from nearby objects, a process known as echolocation. Among the more plausible suggestions for large brain size are that the complexity of processing high-frequency echolocation information requires the development of large centers in the cerebral hemispheres, and/or that the degree of sociality exhibited by many species, in which individual animals recognize and have particular long- and short-term relationships with a number of other individuals, has favored the evolutionary development of a large, complex brain. Some authors develop a strong case that extreme development of the auditory (hearing) system may be the primary reason for the dolphin's large brain. This opinion is supported by observations that the auditory regions of the dolphin brain are 7 to 250 times larger than the equivalent regions of the human brain and by observations of very fast auditory brain stem responses to sounds. It should be noted, however, that sperm whales are very social and good echolocators (that is, good at locating objects by emitting sounds and detecting the reflections given back), yet their EQ values are low—only about 0.3. Even some small, less social odontocetes such as Indus river dolphins echolocate well but do not possess the exceptionally large brains that bottlenose dolphins do.

Noted biologist Peter Tyack has studied dolphin brains and argues persuasively that large brains evolved in dolphins to permit complex social functions. As is the case with certain primates, bottlenose dolphins and certain other large-brained odontocetes have developed societies in which there exists a balance between cooperation and competition among particular individuals. The social politics of chimpanzees and dolphins show some remarkable similarities, especially in terms of the importance of social relations extending far beyond the mother-offspring relationship to include individuals of both sexes across the age range. The development of such complex societies may have favored the evolution of large brain size.

The reason that dolphins have a large brain continues to be somewhat elusive but there must be a reason, since maintenance of brain tissue is metabolically expensive. The adult human brain, for example, may only represent 2 percent of the body weight, but it can account for nearly 20 percent of the metabolic rate (the energy used).

【Paragraph 1】 Large brain size does not always mean that an animal is highly intelligent. Brain size is necessarily associated with overall body size, with large animals having large brains and small animals having small brains. However, it is still necessary for there to be some minimum amount of circuitry (brain cells and processes) present for a species to have the potential to be highly intelligent, whatever way the term intelligence is defined. A measure of relative brain size that has been applied to a variety of species is the encephalization quotient (EQ), the ratio of brain mass to body size. The EQ is calculated by measuring the relative size of different body parts over a wide range of species. An EQ of 1.0 means that the brain is exactly the size one would expect for an animal of a particular size, an EQ higher than 1.0 means that a species is relatively brainy.

1. According to paragraph 1, what does it mean for an animal to have an EQ higher than 1.0?

- A. Its brain has more mass than similarly sized brains of other animals.
- B. Its brain is larger than expected for the animal's overall body size.
- C. Its brain is larger than that of most other animals.
- D. Its brain is larger than that of any animal with an EQ of less than 1.0.

【Paragraph 2】 Bottlenose dolphins have a very high EQ, about 2.8 or higher. Thus, dolphin brains are not simply absolutely large: they are relatively very large as well. Humans, by the way, have extremely high EQ values, estimated to be in the neighborhood 7.5, making our species the brainiest in existence. Nonetheless, it is worth noting that EQ levels in several species of odontocetes (toothed whales, dolphins, and porpoises) are significantly higher than is the case for any primate except our own species. The EQ value for a species relates to a number of general measures of cognitive processing ability in different mammals, as well as to a number of life history patterns in mammals. EQ may be correlated with life span, home-range size, and social systems that characterize a particular species. Oddly enough, the relationships found between EQ and other factors in primates and some other mammals do not appear to apply as well to cetaceans (whales, dolphins, and porpoises), including the bottlenose dolphin.

2. Paragraph 2 supports which of the following statements about the EQ levels of various animals?

- A. Bottlenose dolphins have higher EQ levels than other odontocetes do
- B. The EQ levels of bottlenose dolphins are more closely associated with their life history patterns than the EQ levels of primates are.
- C. Bottlenose dolphins belong to a group of animals whose EQ levels are higher than those of any primate except humans.
- D. The brains of bottlenose dolphins are larger for these dolphins' size than brains of humans are for humans' size.

3. Which of the following is NOT identified in paragraph 2 as a factor that may be correlated with EQ?

- A. The species' social organization
- B. The species' ecological role in the environment
- C. The extent of the range that species members need for daily activities
- D. The number of years that species members live on average

4. Paragraph 2 answers which of the following questions about EQ?

- A. Which life history patterns correlate best with EQ values in whales, dolphins, and porpoises?
- B. Is the EQ of bottlenose dolphins significantly higher than that of other dolphins?
- C. What are the differences in EQ levels among different species of odontocetes?
- D. Do the same factors that correlate with EQ in primates correlate well with EQ in bottlenose dolphins?

[Paragraph 3] The reasons for the larger-than-normal brain of the bottlenose dolphin (and indeed of small odontocetes in general) are not clearly understood. To navigate and detect prey, dolphins emit calls into the environment and then listen to the echoes of the calls that return from nearby objects, a process known as echolocation. **Among the more plausible suggestions for large brain size are that the complexity of processing high-frequency echolocation information requires the development of large centers in the cerebral hemispheres, and/or that the degree of sociality exhibited by many species, in which individual animals recognize and have particular long- and short-term relationships with a number of other individuals, has favored the evolutionary development of a large, complex brain.** Some authors develop a strong case that extreme development of the auditory (hearing) system may be the primary reason for the dolphin's large brain. This opinion is supported by observations that the auditory regions of the dolphin brain are 7 to 250 times larger than the equivalent regions of the human brain and by observations of very fast auditory brain stem responses to sounds. It should be noted, however, that sperm whales are very social and good echolocators (that is, good at locating objects by emitting sounds and detecting the reflections given back), yet their EQ values are low—only about 0.3. Even some small, less social odontocetes such as Indus river dolphins echolocate well but do not possess the exceptionally large brains that bottlenose dolphins do.

5. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. It is plausible that the development of high-frequency echolocation, large centers in the cerebral hemispheres, and/or a high degree of sociality may have contributed to the development of large brains.
- B. For an animal to recognize and have long- and short-term relationships with a number of other individuals, the animals must develop large centers in the cerebral hemispheres.
- C. Processing high-frequency echolocation information may have required a large, complex brain that already had the capacity to develop and recognize long- and short-term social relationships with multiple other individuals.
- D. The demands of processing high frequency echolocation information and/or a high degree of sociality may have favored the evolutionary development of a large, complex brain.

6. Why does the author include the information that “some small, less social odontocetes such as Indus river dolphins echolocate well but do not possess the exceptionally large brains that bottlenose dolphins do”?

- A. To argue that in odontocetes, sociality determines whether an animal has a large brain
- B. To argue that echolocation does not necessarily involve exceptionally fast auditory brain stem responses to sounds
- C. To help explain why effective echolocation does not necessarily require extreme development of the auditory system
- D. To provide evidence that weakens the theory that the large brains of bottlenose dolphins are explained by their need to echolocate.

[Paragraph 4] Noted biologist Peter Tyack has studied dolphin brains and argues persuasively that large brains evolved in dolphins to permit complex social functions. As is the case with certain primates, bottlenose dolphins and certain other large-brained odontocetes have developed societies in which there exists a balance between cooperation and competition among particular individuals. The social politics of chimpanzees and dolphins show some remarkable similarities, especially in terms of the importance of social relations extending far beyond the mother-offspring relationship to include individuals of both sexes across the age range. The development of such complex societies may have favored the evolution of large brain size.

7. According to paragraph 4, what is true about bottlenose dolphin societies?

- A. There is far more cooperation than competition among individuals.
- B. Long-term social relationships tend to exist primarily between individuals of the same sex and similar ages.
- C. They are similar to chimpanzee societies in terms of the types of social relationships that exist.
- D. They are far more complex than the societies of any other species of odontocetes.

【Paragraph 5】 The reason that dolphins have a large brain continues to be somewhat **elusive** but there must be a reason, since maintenance of brain tissue is metabolically expensive. The adult human brain, for example, may only represent 2 percent of the body weight, but it can account for nearly 20 percent of the metabolic rate (the energy used)

8. The word “**elusive**” in the passage is closest in meaning to

- A. hard to prove
- B. hard to identify
- C. misunderstood
- D. controversial

【Paragraph 1】 Large brain size does not always mean that an animal is highly intelligent. Brain size is necessarily associated with overall body size, with large animals having large brains and small animals having small brains. ■However, it is still necessary for there to be some minimum amount of circuitry (brain cells and processes) present for a species to have the potential to be highly intelligent, whatever way the term intelligence is defined. ■A measure of relative brain size that has been applied to a variety of species is the encephalization quotient (EQ), the ratio of brain mass to body size. ■The EQ is calculated by measuring the relative size of different body parts over a wide range of species. ■An EQ of 1.0 means that the brain is exactly the size one would expect for an animal of a particular size, an EQ higher than 1.0 means that a species is relatively brainy.

9. Look at the four squares **【■】** that indicate where the following sentence could be added to the passage.

This requirement suggests that having a brain that is large relative to an animal’s size might be a clue to greater intelligence.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Large brain size does not necessarily mean that an animal is especially intelligent.

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Answer Choices

- A. Bottlenose dolphins have a high EQ, a measure of the ratio of brain mass to body mass that correlates with various cognitive abilities and possibly with life-history patterns in animals.
- B. The need to process high-frequency sounds for echolocation has been offered as an explanation for bottlenose dolphins' unusually large brains, but not all good echolocators have high EQs.
- C. The brain size of bottlenose dolphins is strongly correlated with the amount of cooperation and competition in relationships outside the mother-offspring relationship.
- D. Scientists are now using findings from their studies of bottlenose dolphins to determine the connection between the presence of a large brain and the potential for intelligence in other species.
- E. Bottlenose dolphins, like certain other large-brained animals, have complex social relationships, so their large, metabolically expensive brains may have evolved partly to permit complex social functioning.
- F. Biologists disagree about whether the larger-than-usual brain of the bottlenose dolphin makes it more intelligent or more metabolically efficient than other mammals with less brain mass.

Passage 20 - Bird Colonies

About 13 percent of bird species, including most seabirds, nest in colonies. Colonial nesting evolves in response to a combination of two environmental conditions: (1) a shortage of nesting sites that are safe from predators and (2) abundant or unpredictable food that is distant from safe nest sites. Colonial nesting has both advantages and disadvantages. First and foremost, individual birds are safer in colonies that are inaccessible to predators, as on small rocky islands. In addition, colonial birds detect predators more quickly than do small groups or pairs and can drive the predators from the vicinity of the nesting area. Because nests at the edges of breeding colonies are more vulnerable to predators than those in the centers, the preference for advantageous central sites promotes dense centralized packing of nests.

The yellow-rumped cacique, which nests in colonies in Amazonian Peru, demonstrates how colonial birds prevent predation. These tropical blackbirds defend their closed, pouchlike nests against predators in three ways. First, by nesting on islands and near wasp nests, caciques are safe from arboreal mammals such as primates. Second, caciques mob predators (work together as a group to attack predators). The effectiveness of mobbing increases with group size, which increases with colony size. Third, caciques hide their nests from predators by mixing active nests with abandoned nests. Overall, nests in clusters on islands and near wasp nests suffer the least predation.

Coordinated social interactions tend to be weak when a colony is first forming, but true colonies provide extra benefits. Synchronized nesting, for example, produces abundance of eggs and chicks that exceeds the daily needs of local predators. Additionally, colonial neighbors can improve their foraging by watching others. This behavior is especially valuable when the off-site food supplies are restricted or variable in location, as are swarms of aerial insects harvested by swallows. The colonies of American cliff swallows, for example, serve as information centers from which unsuccessful individual birds follow successful neighbors to good feeding sites. Cliff swallows that are unable to find food return to their colony, locate a neighbor that has been successful, and then follow that neighbor to its food source. All birds in the colony are equally likely to follow or to be followed and thus contribute to the sharing of information that helps to ensure their reproductive success. As a result of their enhanced foraging efficiency, parent swallows in large colonies return with food for their nestlings more often and bring more food each trip than do parents in small colonies.

To support large congregations of birds, suitable colony sites must be near rich, clumped food supplies. Colonies of pinyon jays and red crossbills settle near seed-rich conifer forests, and wattled starlings nest in large colonies near locust outbreaks. The huge colonies of guanay cormorants and other seabirds that nest on the coast of Peru depend on the productive cold waters of the Humboldt Current. The combination of abundant food in the Humboldt Current and the vastness of oceanic habitat can support enormous populations of seabirds, which concentrate at the few available nesting locations. The populations crash when their food supplies decline during El Niño years.

Among the costs, colonial nesting leads to increased competition for nest sites and mates, the stealing of nest materials, and increased physical interference among other effects. In spite of food abundance, large colonies sometimes exhaust their local food supplies and abandon their nests. Large groups also attract predators, especially raptors, and facilitate the spread of parasites and diseases. The globular mud nests in large colonies of the American cliff swallow, for example, are more likely to be infested by fleas or other bloodsucking parasites than are nests in small colonies. Experiments in which some burrows were fumigated to kill the parasites showed that these parasites lowered survivorship by as much as 50 percent in large colonies but not significantly in small ones. The swallows inspect and then select parasite-free nests. In large colonies, they tend to build new nests rather than use old, infested ones. On balance, the advantages of colonial nesting clearly outweigh the

disadvantages, given the many times at which colonial nesting has evolved independently among different groups of birds. Still lacking, however, is a general framework for testing different hypotheses for the evolution of coloniality.

【Paragraph 1】 About 13 percent of bird species, including most seabirds, nest in colonies. Colonial nesting evolves in response to a combination of two environmental conditions: (1) a shortage of nesting sites that are safe from predators and (2) abundant or unpredictable food that is distant from safe nest sites. Colonial nesting has both advantages and disadvantages. First and foremost, individual birds are safer in colonies that are inaccessible to predators, as on small rocky islands. In addition, colonial birds detect predators more quickly than do small groups or pairs and can drive the predators from the vicinity of the nesting area. **Because nests at the edges of breeding colonies are more vulnerable to predators than those in the centers, the preference for advantageous central sites promotes dense centralized packing of nests.**

1. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. It is more advantageous for birds to choose central locations for their colonies rather than locations near the edges of their territory.
- B. Compared to nests at the edges of colonies, centrally located nests are preferred for their safety from predators and therefore are more densely packed together.
- C. Predators generally prefer the densely packed, central portion of nesting colonies, which can make this part of the colony more vulnerable to predators.
- D. Birds nesting in colonies that are vulnerable to predators tend to prefer more densely packed nests to those less densely.

【Paragraph 2】 The yellow-rumped cacique, which nests in colonies in Amazonian Peru, demonstrates how colonial birds prevent predation. These tropical blackbirds defend their closed, pouchlike nests against predators in three ways. First, by nesting on islands and near wasp nests, caciques are safe from arboreal mammals such as primates. Second, caciques mob predators (work together as a group to attack predators). The effectiveness of mobbing increases with group size, which increases with colony size. Third, caciques hide their nests from predators by mixing active nests with abandoned nests. Overall, nests in clusters on islands and near wasp nests suffer the least predation.

2. Paragraph 2 implies which of the following about yellow-rumped caciques?

- A. They are comparatively unlikely to be harmed by the wasps that attack their predators.
- B. They are able to protect their nests without using colonies.
- C. Mixing active nests with abandoned nests is the least useful way of defending their nests.
- D. Most of their predators are members of other bird species.

3. Paragraph 2 claims that yellow-rumped cacique colonies defend themselves from predators in all of the following ways EXCEPT

- A. They establish colonies in hard-to-reach places.
- B. They physically attack invading predators.
- C. They hide active nests among previously used ones.
- D. They limit the size of their colonies so they are hard to find.

【Paragraph 3】 Coordinated social interactions tend to be weak when a colony is first forming, but true colonies provide extra benefits. Synchronized nesting, for example, produces abundance of eggs and chicks that exceeds the daily needs of local predators. Additionally, colonial neighbors can improve their foraging by watching others. This behavior is especially valuable when the off-site food supplies are restricted or variable in location, as are swarms of aerial insects harvested by swallows. The colonies of American cliff swallows, for example, serve as information centers from which unsuccessful individual birds follow successful neighbors to good feeding sites. Cliff swallows that are unable to find food return to their colony, locate a neighbor that has been successful, and then follow that neighbor to its food source. All birds in the colony are equally likely to follow or to be followed and thus contribute to the sharing of information that helps to ensure their reproductive success. As a result of their enhanced foraging efficiency, parent swallows in large colonies return with food for their nestlings more often and bring more food each trip than do parents in small colonies.

4. According to paragraph 3, what advantage do birds gain by hatching all the colony's eggs at the same time?
- A. They are able to time the hatching of their chicks for when predators are not likely to be around.
 - B. Chicks hatch when food is abundant, which is generally only a few times a year.
 - C. Even if predators eliminate some of the newly hatched birds, many others will survive.
 - D. Weaker birds gain protection for their young by synchronizing their nesting behavior with that of the more dominant birds of the colony.

【Paragraph 4】 To support large congregations of birds, suitable colony sites must be near rich, clumped food supplies. Colonies of pinyon jays and red crossbills settle near seed-rich conifer forests, and wattled starlings nest in large colonies near locust outbreaks. The huge colonies of guanay cormorants and other seabirds that nest on the coast of Peru depend on the productive cold waters of the Humboldt Current. The combination of abundant food in the Humboldt Current and the vastness of oceanic habitat can support enormous populations of seabirds, which concentrate at the few available nesting locations. The populations crash when their food supplies decline during El Niño years.

5. Which of the following is a probable effect of the fact mentioned in paragraph 4 that there are few available nesting locations near the Humboldt Current?
- A. Seabirds compete with each other for a limited supply of food.
 - B. The number of seabirds at any one site is extremely large.
 - C. Some seabirds nest in conifer forests near locust outbreaks.
 - D. Colonies near the Humboldt Current small numbers of seabirds.

【Paragraph 5】 Among the costs, colonial nesting leads to increased competition for nest sites and mates, the stealing of nest materials, and increased physical interference among other effects. In spite of food abundance, large colonies sometimes exhaust their local food supplies and abandon their nests. Large groups also attract predators, especially raptors, and facilitate the spread of parasites and diseases. The globular mud nests in large colonies of the American cliff swallow, for example, are more likely to be infested by fleas or other bloodsucking parasites than are nests in small colonies. Experiments in which some burrows were fumigated to kill the parasites showed that these parasites lowered survivorship by as much as 50 percent in large colonies but not significantly in small ones. The swallows inspect and then select parasite-free nests. In large colonies, they tend to build new nests rather than use old, infested ones. **On balance**, the advantages of colonial nesting clearly outweigh the disadvantages, given the many times at which colonial nesting has evolved independently among different groups of birds. Still lacking, however, is a general framework for testing different hypotheses for the evolution of coloniality.

6. The phrase “**On balance**” in the passage is closest in meaning to

- A. Nevertheless
- B. Overall
- C. Therefore
- D. Periodically

7. In paragraph 5, why does the author discuss experiments in which some burrows were fumigated?

- A. To demonstrate that parasites have a very negative effect on large colonies
- B. To show that attacks by predators are a worse problem than the spread of parasites
- C. To explain how swallows inspect nests for parasites
- D. To prove that the benefits of colonial nesting outweigh the disadvantages

8. Which of the following questions is NOT answered by paragraph 5?

- A. What causes colonies to have problems with their food supplies?
- B. What are the disadvantages of colonial nesting?
- C. What percentage of cliff swallow nests are infected by parasites?
- D. How can one test the different hypotheses explaining the evolution of bird colonies?

【Paragraph 3】 Coordinated social interactions tend to be weak when a colony is first forming, but true colonies provide extra benefits. ■ Synchronized nesting, for example, produces abundance of eggs and chicks that exceeds the daily needs of local predators. ■ Additionally, colonial neighbors can improve their foraging by watching others. ■ This behavior is especially valuable when the offsite food supplies are restricted or variable in location, as are swarms of aerial insects harvested by swallows. ■ The colonies of American cliff swallows, for example, serve as information centers from which unsuccessful individual birds follow successful neighbors to good feeding sites. Cliff swallows that are unable to find food return to their colony, locate a neighbor that has been successful, and then follow that neighbor to its food source. All birds in the colony are equally likely to follow or to be followed and thus contribute to the sharing of information that helps to ensure their reproductive success. As a result of their enhanced foraging efficiency, parent swallows in large colonies return with food for their nestlings more often and bring more food each trip than do parents in small colonies.

9. Look at the four squares 【■】 that indicates where the following sentence could be added to the passage.

The overall survival of the nest generation is thus enhanced.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

In response to environment pressure, many species of birds have developed the practice of nesting in colonies

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Answer Choices

- A. The abundance of food on rocky islands makes them an attractive environment for bird species that nest in colonies, including the yellow-rumped cacique.
- B. Because they are not able to physically defend themselves from predators, yellow-rumped caciques rely on hiding their active nests among empty nests to confuse predators.
- C. The challenge of protecting nests and newborn chicks from predators is a major contributor to the evolution of large colonies.
- D. Colonial life provides birds with benefits besides protection from predators including help with finding food.
- E. There are some disadvantages associated with life in large colonies like the increased rate of infestation by parasites.
- F. The concentration of bird colonies along coasts makes their inhabitants especially vulnerable to food shortages and weather-related destruction.

Passage 21 - Bison and Humans

When human beings first migrated from Asia into North America at the end of the last ice age, they found an enormous, now extinct creature known as the giant long-horned bison (*Bison priscus*). We know that early Americans hunted these beasts because excavated skeletons of the bison bear stone spear tips. The style of the points dates them to twelve to thirteen thousand years ago, not long after the first wave of human immigrants washed south and east across the continent. These early Americans ate a variety of plants and animals, but judging from the campsite remains, they had a special taste for long-horned bison. It was their favorite prey, perhaps because one animal filled so many stomachs.

The giant horns that gave *Bison priscus* its common name tell us some important things about its lifestyle. Animals with gigantic weapons on their heads usually live alone or in small groups. Animals that live in herds usually have small horns. Horns and antlers help males in several ways. Animals use these horns and antlers to fight with other members of the same species, to increase their appeal to potential mates, and to protect themselves from predators. Fossil bones suggest that giant bison used their long, outward-facing horns to injure their opponents. An individual with longer horns had a better chance of circumventing its opponents' horns and fatally wounding them than one with shorter horns, and females probably preferred to mate with winners of these contests rather than with losers, either because they liked what they saw in the male or because they liked the territory that the male could defend from competitors.

The giant bison's architecture served it well for thousands of years, but its body shrank and changed shape, starting about twelve thousand years ago. The timing gives us an important clue about the cause. Only two major predators, wolves and lions, had hunted giant bison for tens of thousands of years. If they caused the change, it would have happened much earlier. The big change in the bison's environment twelve to thirteen thousand years ago was the arrival of a new predator. This one walked on two feet, hunted in cooperative bands, and carried spears with well-designed stone points. Its remarkable efficiency at hunting seems to have caused a reduction in the body size of other large mammals, too. Over the past ten thousand years, North American sheep, elk, moose, musk ox, bears, antelope, and wolves have all shrunk.

Scholars have offered various explanations for these changes, but it seems likely that these new hunters converted the giant bison's shape and habits from virtues into liabilities. Hunters who needed to get close to their prey, such as wolves and human beings armed with spears, preferred to attack lone individuals rather than many victims at once. Hunting punished solitary, territorial giant bison and rewarded those that stayed close together. Clumps of bison became more common and grew into herds.

Herding is a classic response to heavy predation. It brings a statistical advantage to herd members because the odds that a predator will hone in on any one individual will decrease with the size of the herd. Herds further improved odds for members through cooperative behavior. Members warned each other of danger, and they fought off predators by joining forces (e.g. by forming a circle with vulnerable backsides to the center and dangerous horns facing the periphery).

But bison paid a price for herding. In a given area, the supply of food per individual declined along with the chances of being attacked. Smaller bodies probably resulted from a decline in food availability as bison crowded together. Herding changed the bison's shape as well as size. Now survival depended on the ability to crop grass, bison's main food, quickly. Shifting the head closer to the ground, reducing horn size, and growing a hump to cantilever, or support, the head's weight enabled bison to graze for long periods without strain. Giant horns, which enabled males to defend territory, may also have become a liability as being able to stay close together became more valuable.

【Paragraph 1】 When human beings first migrated from Asia into North America at the end of the last ice age, they found an enormous, now extinct creature known as the giant long-horned bison (*Bison priscus*). We know that early Americans hunted these beasts because excavated skeletons of the bison bear stone spear tips. The style of the points dates them to twelve to thirteen thousand years ago, not long after the first wave of human immigrants washed south and east across the continent. These early Americans ate a variety of plants and animals, but judging from the campsite remains, they had a special taste for long-horned bison. It was their favorite prey, perhaps because one animal filled so many stomachs.

1. According to paragraph 1, which of the following best describes the relationship between humans twelve to thirteen thousand years ago and the giant long-horned bison

- A. Humans first came to the Americas as a result of following long horned bison that were migrating from Asia to the Americas.
- B. Humans in the Americas preferred hunting long-horned bison to hunting other animals.
- C. Humans in the Americas were forced to migrate south and east across the continent as a result of the presence of long-horned bison.
- D. Humans in the Americas generally ate plants and small animals because long-horned bison were difficult to hunt.

【Paragraph 2】 The giant horns that gave *Bison priscus* its common name tell us some important things about its lifestyle. Animals with gigantic weapons on their heads usually live alone or in small groups. Animals that live in herds usually have small horns. Horns and antlers help males in several ways. Animals use these horns and antlers to fight with other members of the same species, to increase their appeal to potential mates, and to protect themselves from predators. Fossil bones suggest that giant bison used their long, outward-facing horns to injure their opponents. **An individual with longer horns had a better chance of circumventing its opponents' horns and fatally wounding them than one with shorter horns, and females probably preferred to mate with winners of these contests rather than with losers, either because they liked what they saw in the male or because they liked the territory that the male could defend from competitors.**

2. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Females may have chosen their mates based on the male's ability to win contests with other males, or perhaps they decided based on territory.
- B. The longer-horned opponent was more likely to win in a fight, which probably made him more attractive to females because of his physical characteristics or his ability to protect territory.
- C. Males engaged in contests in which they tried to wound one another with their horns while avoiding being hit by the horns of their opponent.
- D. An individual that was able to avoid its opponents' horns had a better chance of fatally wounding them and winning the contest for territory or females.

3. According to paragraph 2, the fact that *Bison priscus* had giant horns suggests which of the following about its lifestyle

- A. The bison were probably more concerned with protecting themselves from predators than with fighting each other.
- B. The horns were probably more for display to attract mates than for use as actual weapons.
- C. Those individuals with smaller horns probably banded together to fight the males with larger horns.
- D. Individuals probably lived by themselves or with only a few other bison.

【Paragraph 3】 The giant bison's architecture served it well for thousands of years, but its body shrank and changed shape, starting about twelve thousand years ago. The timing gives us an important clue about the cause. Only two major predators, wolves and lions, had hunted giant bison for tens of thousands of years. If they caused the change, it would have happened much earlier. The big change in the bison's environment twelve to thirteen thousand years ago was the arrival of a new predator. This one walked on two feet, hunted in cooperative bands, and carried spears with well-designed stone points. Its remarkable efficiency at hunting seems to have caused a reduction in the body size of other large mammals, too. Over the past ten thousand years, North American sheep, elk, moose, musk ox, bears, antelope, and wolves have all shrunk.

4. In paragraph 3, why does the author include the information that wolves and lions “had hunted giant bison for tens of thousands of years”?

- A. To emphasize how good the bison's defenses were
- B. To support the claim that only wolves and lions hunted the bison for long enough to cause changes in its evolution
- C. To help explain why predation by wolves and lions cannot account for the changes that occurred in bison twelve thousand years ago
- D. To introduce a discussion of how changes in bison directly affected other large animals in North America

5. Which of the following can be inferred from paragraph 3 about North American sheep, elk, moose, musk ox, bears, antelope, and wolves?

- A. They have all changed as a result of hunting by humans.
- B. They all originated in North America at about the same time.
- C. They all contributed to the change in the bison's environment.
- D. They all contributed to the change in the bison's size and shape.

【Paragraph 4】 Scholars have offered various explanations for these changes, but it seems likely that these new hunters converted the giant bison's shape and habits from virtues into liabilities. Hunters who needed to get close to their prey, such as wolves and human beings armed with spears, preferred to attack lone individuals rather than many victims at once. Hunting punished solitary, territorial giant bison and rewarded those that stayed close together. Clumps of bison became more common and grew into herds.

6. According to paragraph 4, which of the following is true about humans and wolves when hunting large animals?

- A. Both needed to attack their prey when their prey were outside their territory.
- B. Both attacked the animals in the closest part of a herd.
- C. Both preferred to attack animals that were far from others.
- D. Both preferred to attack multiple animals at the same time.

【Paragraph 5】 Herding is a classic response to heavy predation. It brings a statistical advantage to herd members because the odds that a predator will hone in on any one individual will decrease with the size of the herd. Herds further improved odds for members through cooperative behavior. Members warned each other of danger, and they fought off predators by joining forces (e.g. by forming a circle with vulnerable backsides to the center and dangerous horns facing the periphery).

7. Which of the following is NOT one of the reasons given in paragraph 5 for why herding is a classic response to heavy predation?

- A. Herd members can teach one another strategies for avoiding predators.
- B. Herd members can alert one another to approaching predators.
- C. Herd members can fight off predators together.
- D. Being in a herd reduces the chance that any particular individual will be a target.

【Paragraph 6】 But bison paid a price for herding. In a given area, the supply of food per individual declined along with the chances of being attacked. Smaller bodies probably resulted from a decline in food availability as bison crowded together. Herding changed the bison's shape as well as size. ■Now survival depended on the ability to crop grass, bison's main food, quickly. ■Shifting the head closer to the ground, reducing horn size, and growing a hump to cantilever, or support, the head's weight enabled bison to graze for long periods without strain. ■Giant horns, which enabled males to defend territory, may also have become a liability as being able to stay close together became more valuable. ■

8. According to paragraph 6, bison in herds needed to be able to crop grass quickly because

- A. the amount of food available for an individual had decreased
- B. the bison body had become smaller
- C. the chances of being attacked by a predator had increased
- D. bison had grown a hump to support the head's weight

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

In sum, by forcing bison to live in herds, humans encouraged the development of a new kind of bison, the short-horn, humpbacked bison that we know today.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Hunting by humans changed bison’s body structure and the mode of living.

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Answer Choices

- A. Judging from campsite remains, the first wave of immigrants to North America carried with them hunting tools they had successfully used to hunt large animals in Asia.
- B. Fossil bones suggest that several species of the long-horned bison once existed in North America, but by the time humans arrived, most of them had become extinct.
- C. The size of the bison's horns suggest that individuals lived alone or in small groups, a habit that made them attractive prey for human hunters.
- D. The bison began living in herds, which would have provided protection from hunters but also decreased the amount of food available for each individual.
- E. Early Americans preferred hunting long-horned bison for their horns which could be used to create sharp spear tips for hunting other large animals such as moose and musk ox.
- F. When bison began to live close together, this led to other adaptations in size and shape necessary for survival.

Passage 22 - Dinosaurs and Parental Care

From fossil evidence alone the question of whether or not dinosaurs cared for their young is very difficult to answer. Because behaviors are not preserved in the fossil record, we can only make inferences from indirect evidence. Parental care can be divided into two types of behavior: prehatching (building nests and incubating eggs—for example, sitting on top of them so as to warm the eggs and encourage hatching) and post hatching (feeding the young and guarding the nests). Most of our evidence comes from alleged dinosaur rookeries (places where nests are built). Several have been excavated in eastern Montana, where a large concentration of dinosaur nests was found at a place now called Egg Mountain. Most of these probably belonged to the hadrosaur *Maiasaura*. Preserved in these nests are the bones of baby dinosaurs. The finds at Egg Mountain and other sites around the world document that dinosaurs laid their eggs in nests.

The nests at Egg Mountain are reported to be equally spaced, separated by a space corresponding to the length of an adult *Maiasaura*. From this arrangement scientists have inferred that the nests were separated in this way to allow incubation in a tightly packed nesting colony. Although this interpretation is open to challenge, the discovery of *Oviraptor* adults on top of *Oviraptor* egg clutches (as determined by embryos in some eggs), is relatively powerful evidence that at least these dinosaurs incubated their nests.

Evidence for parental care following hatching is much more controversial. Behavioral speculation based on indirect fossil evidence is dangerous because the data is not always as unambiguous as might appear. At Egg Mountain, many nests contain baby dinosaur bones. Not all the dinosaurs in the nest are the same size. Many of the small bones found in the nests are associated with jaws and teeth, teeth that show signs of wear. It seems reasonable to assume that the wear was caused by the chewing of the coarse plants that were the hatchlings' diet. Because the young were still in the nest, this food may have been brought to the rookery by foraging adults. This line of reasoning suggests that these animals had an advanced system of parental care. A closer look at the evidence clouds this interpretation. Analysis of dinosaur embryos indicates that worn surfaces are present on the teeth of juveniles even before hatching. Just as a human baby moves inside the mother before birth, modern-day archosaurs also grind their teeth before birth, wearing the surface in some spots. Thus, the fossil evidence for an advanced parental care system in extinct dinosaurs is suggestive but inconclusive, and it is hard even to imagine the sort of paleontologic discovery that could settle this debate for good.

The strongest evidence that extinct dinosaurs had some form of advanced parental care system is based on an understanding of the phylogenetic relationships among dinosaurs and their closest living relatives. Living dinosaurs (birds), even primitive ones such as ostriches and kiwis, exhibit parental care, so some form of parental care can be inferred to have existed in the last common ancestor of all birds. Although unappreciated, crocodiles are reptiles that are also caring parents. They build nests, guard the nests, and in some cases dig their young out of the nest when they hear the chirping young ones hatching. The young even communicate with each other while still in the egg by high-frequency squeaks (as birds do). Some evidence suggests that this squeaking is a cue for the synchronization of the hatching. Since birds and crocodiles share a common ancestor, the simplest explanation for the characteristics they share (such as nest building and some form of parental care) is that they evolved only once—that these attributes were present in their common ancestor and passed on to its descendants. Because extinct dinosaurs also descended from that ancestor, the simplest and most general theory is that extinct dinosaurs also shared these characteristics, even though they cannot be directly observed, and we cannot be sure how elaborate their parental care was.

【Paragraph 1】 From fossil evidence alone the question of whether or not dinosaurs cared for their young is very difficult to answer. Because behaviors are not preserved in the fossil record, we can only make inferences from indirect evidence. Parental care can be divided into two types of behavior: prehatching (building nests and incubating eggs—for example, sitting on top of them so as to warm the eggs and encourage hatching) and post hatching (feeding the young and guarding the nests). Most of our evidence comes from **alleged** dinosaur rookeries (places where nests are built). Several have been excavated in eastern Montana, where a large concentration of dinosaur nests was found at a place now called Egg Mountain. Most of these probably belonged to the hadrosaur *Maiasaura*. Preserved in these nests are the bones of baby dinosaurs. The finds at Egg Mountain and other sites around the world document that dinosaurs laid their eggs in nests.

1. The word “**alleged**” in the passage is closest in meaning to

- A. scattered
- B. supposed
- C. isolated
- D. exposed

2. Paragraph 1 answers which of the following questions about parental care in dinosaurs?

- A. Which type of parental care was more important for the survival of dinosaur young, prehatching care or post hatching care?
- B. Why were dinosaur remains in eastern Montana preserved rather than destroyed over time?
- C. Did *Maiasaura* hadrosaurs provide types of parental care not provided by other dinosaurs?
- D. What evidence supports the view that *Maiasaura* females laid their eggs in nests?

【Paragraph 2】 The nests at Egg Mountain are reported to be equally spaced, separated by a space corresponding to the length of an adult *Maiasaura*. From this arrangement scientists have inferred that the nests were separated in this way to allow incubation in a tightly packed nesting colony. Although this interpretation is open to challenge, the discovery of *Oviraptor* adults on top of *Oviraptor* egg clutches (as determined by embryos in some eggs), is relatively powerful evidence that at least these dinosaurs incubated their nests.

3. According to paragraphs 1 and 2, the fossil record most clearly shows that dinosaurs engaged in which of the following behaviors?

- A. Laying eggs in nests
- B. Hiding eggs
- C. Feeding young
- D. Storing food

【Paragraph 3】 Evidence for parental care following hatching is much more controversial. Behavioral speculation based on indirect fossil evidence is dangerous because the data is not always as unambiguous as might appear. At Egg Mountain, many nests contain baby dinosaur bones. Not all the dinosaurs in the nest are the same size. Many of the small bones found in the nests are associated with jaws and teeth, teeth that show signs of wear. It seems reasonable to assume that the wear was caused by the chewing of the coarse plants that were the hatchlings' diet. Because the young were still in the nest, this food may have been brought to the rookery by foraging adults. This line of reasoning suggests that these animals had an advanced system of parental care. A closer look at the evidence clouds this interpretation. Analysis of dinosaur embryos indicates that worn surfaces are present on the teeth of juveniles even before hatching. Just as a human baby moves inside the mother before birth, modern-day archosaurs also grind their teeth before birth, wearing the surface in some spots. Thus, the fossil evidence for an advanced parental care system in extinct dinosaurs is suggestive but inconclusive, and it is hard even to imagine the sort of paleontologic discovery that could settle this debate for good.

4. According to paragraph 3, the patterns of wear found on the teeth of young dinosaurs may indicate which of the following?

- A. Baby dinosaurs were eating food brought to them by their parents.
- B. Early development of jaw and teeth varied according to a dinosaur's size.
- C. Dinosaurs went foraging for food at an early age.
- D. Baby dinosaurs did not begin to eat solid food until after they left the nest.

5. In paragraph 3, why does the author mention that baby archosaurs ground their teeth inside the egg?

- A. To support the claim that baby dinosaurs in the egg shared certain behaviors with human babies before birth
- B. To contrast the behavior of baby archosaurs with that of other types of dinosaurs
- C. To cast doubt on the claim that adult dinosaurs fed their hatchlings in the nest
- D. To explain why the teeth of baby archosaurs were more worn than those of other juveniles

【Paragraph 4】 The strongest evidence that extinct dinosaurs had some form of advanced parental care system is based on an understanding of the phylogenetic relationships among dinosaurs and their closest living relatives. Living dinosaurs (birds), even primitive ones such as ostriches and kiwis, exhibit parental care, so some form of parental care can be inferred to have existed in the last common ancestor of all birds. Although unappreciated, crocodiles are reptiles that are also caring parents. They build nests, guard the nests, and in some cases dig their young out of the nest when they hear the chirping young ones hatching. The young even communicate with each other while still in the egg by high-frequency squeaks (as birds do). Some evidence suggests that this squeaking is a cue for the synchronization of the hatching. **Since birds and crocodiles share a common ancestor, the simplest explanation for the characteristics they share (such as nest building and some form of parental care) is that they evolved only once—that these attributes were present in their common ancestor and passed on to its descendants.** Because extinct dinosaurs also descended from that ancestor, the simplest and most general theory is that extinct dinosaurs also shared these characteristics, even though they cannot be directly observed, and we cannot be sure how elaborate their parental care was.

6. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. The simplest explanation for the similarities between birds and crocodiles is that they evolved at the same time.
- B. A common ancestor is probably the source of the shared traits of crocodiles and birds.
- C. The originally similar traits of birds and crocodiles increased after evolving through a shared ancestor.
- D. Only one shared pattern of behavior—that of nest building—was present in the common ancestor of birds and

crocodiles.

7. Paragraph 4 answers all of the following questions about crocodiles EXCEPT

- A. What is the evidence that crocodiles are caring parents?
- B. Why do crocodile parents communicate with the young inside their eggs?
- C. What is a possible reason for the high-frequency sounds that crocodiles make inside their eggs?
- D. How do crocodiles participate in the hatching process of their young?

8. In paragraph 4, the author discusses birds and crocodiles in order to

- A. contrast patterns of parenting behavior in both living and extinct animals
- B. provide evidence that sophisticated parental care behaviors evolved only relatively recently
- C. demonstrate that parental care behaviors have continued to evolve since the time of the dinosaurs
- D. support the theory that extinct dinosaurs probably inherited some kind of parental care system

【Paragraph 1】 From fossil evidence alone the question of whether or not dinosaurs cared for their young is very difficult to answer. ■Because behaviors are not preserved in the fossil record, we can only make inferences from indirect evidence. ■Parental care can be divided into two types of behavior: prehatching (building nests and incubating eggs—for example, sitting on top of them so as to warm the eggs and encourage hatching) and post hatching (feeding the young and guarding the nests). ■Most of our evidence comes from alleged dinosaur rookeries (places where nests are built). ■Several have been excavated in eastern Montana, where a large concentration of dinosaur nests was found at a place now called Egg Mountain. Most of these probably belonged to the hadrosaur *Maiasaura*. Preserved in these nests are the bones of baby dinosaurs. The finds at Egg Mountain and other sites around the world document that dinosaurs laid their eggs in nests.

9. Look at the four squares 【■】 that indicate where the following sentence can be added to the passage.

Evidence of the former is easier to find than that of the latter.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Scientists must use indirect evidence to determine whether extinct dinosaurs cared for their young.

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Answer Choices

- A. Because baby dinosaur bones and eggs were very delicate, there are relatively few preserved as fossils, so little is known about dinosaur young.
- B. Fossils from sites like Egg Mountain indicate that dinosaurs built nests, and perhaps that they incubated their eggs and fed their hatchlings.
- C. Fossil evidence such as the spacing of nests may indicate advanced parental care but can have different interpretations.
- D. Tightly packed Oviraptor rookeries indicate that dinosaurs may have tended to nest in large colonies in order to better protect both eggs and hatchlings.
- E. Discovery of hadrosaur bones of different sizes in the same nest may indicate that, in some species, older siblings took care of younger ones.
- F. The strongest evidence comes from extinct dinosaurs' nearest living relatives, birds and crocodiles, who do engage in many forms of parental care.

Passage 23 - Human Impacts on Biogeography

Biologists, who commonly study the distribution of plant and animal species in different environments—their biogeography—strive to develop interpretations or explanations of the patterns of species distribution, but these may be incorrect if the effects of human beings are not taken into consideration. In some cases, these effects may be accidental; for example, some species of rat were unintentionally transported aboard ships from Europe to the islands of the South Pacific. In other cases, species distributions may have been deliberately modified by human beings. The Polynesians in the South Pacific intentionally moved the kumara (sweet potato) to islands in that region to provide the population with a new food crop.

The relocation of species by humans (and more recently the imposition of restrictions on movement by way of national controls and world conventions) has been primarily for economic reasons and for environmental protection. For example, humans introduced Sitka spruce trees into Scotland and England from North America to use them as a timber crop. Similarly, the Monterey pine tree was introduced into New Zealand in the nineteenth century from California and has become the most widely used species in the timber production industry in that country. The potato has been carried from its native home in the high Andes of South America, modified and developed into many varieties, and transported around the world because it can be used as a food crop. The plant formerly known as the Chinese gooseberry was relocated from its native China to New Zealand where an industry was established around the renamed kiwifruit.

We have extended the distribution of some species because of certain useful traits that make the species desirable beyond their former known range. For example, willows have extensive root systems, can grow relatively quickly, and are now used in several countries worldwide to stabilize river margins as a flood protection measure. The distribution of willows has therefore been influenced considerably by human use in river bank management.

The effects of introduced species can be many and varied and can include effects on the distribution of other species. For example, the North American gray squirrel was introduced into England and has now largely displaced the native red squirrel. The accidental introduction of organisms to new areas may have major pest implications. The South African bronze butterfly, the larva (immature insect forms) of which feed on buds and other parts of geraniums and similar flowers, was accidentally introduced into the Balearic Islands via imported geraniums. In its native South Africa, the distribution and abundance of the butterfly are affected in part by a native wasp that parasitizes (feeds on) the larvae. In the absence of the parasite wasp on the Balearic Islands off the coast of Spain, the butterfly has now spread to mainland Spain where its rapid spread has been accentuated by trade in garden plants and modern transport. The species has become a major pest due to the lack of a natural predator and is now causing great problems for the horticultural industry in Spain.

Human-driven changes in the distribution of some species may result in hybridization (interbreeding) with other species and so have a genetic effect. For example, the North American cord grass was accidentally introduced to the south coast of England in the early nineteenth century. It hybridized with the European cord grass and resulted in the production of a new species, which in this case is also a major pest plant of estuaries in England where it became dominant and extensive.

Information about a species distribution (prior to human modification) maybe applied in pest control programs for the introduced species. Studies of the species in its native habitat may yield information about the factors that limit or influence its distribution and population dynamics. That information may then be applied in the development of strategies to contain and control the spread of pest species. For example, information about the role of the parasitic wasp in the ecology of the bronze butterfly may be utilized in the process of finding control strategies for that species on mainland Spain.

【Paragraph 1】 Biologists, who commonly study the distribution of plant and animal species in different environments -- their biogeography -- strive to develop interpretations or explanations of the patterns of species distribution, but these may be incorrect if the effects of human beings are not taken into consideration. In some cases, these effects may be accidental; for example, some species of rat were unintentionally transported aboard ships from Europe to the islands of the South Pacific. In other cases, species distributions may have been deliberately modified by human beings. The Polynesians in the South Pacific intentionally moved the kumara (sweet potato) to islands in that region to provide the population with a new food crop.

1. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. In biogeography it is common to consider and study the effects of plant and animal species as they are distributed within environments where humans live.
- B. Biologists who study environments in which plants and animals are distributed have arrived at interpretations or explanations for how species succeed, but these may not be correct.
- C. To understand plant and animal distribution patterns correctly, biologists must consider the role of human beings in the biogeography of species
- D. It is common for biologists who try to understand the effects of humans on their environments to be incorrect in their explanations of certain distribution patterns of plants and animals.

2. In paragraph 1, the author makes the point that the relocations of rats and the kumara to new environments differed in

- A. whether or not humans planned to transfer these species to a new environment
- B. how far these species had to be transported to arrive at the new environment
- C. how difficult it was for these species to become established in the new environment
- D. whether or not these species succeeded in the new environment

【Paragraph 2】 The relocation of species by humans (and more recently the imposition of restrictions on movement by way of national controls and world conventions) has been primarily for economic reasons and for environmental protection. For example, humans introduced Sitka spruce trees into Scotland and England from North America to use them as a timber crop. Similarly, the Monterey pine tree was introduced into New Zealand in the nineteenth century from California and has become the most widely used species in the timber production industry in that country. The potato has been carried from its native home in the high Andes of South America, modified and developed into many varieties, and transported around the world because it can be used as a food crop. The plant formerly known as the Chinese gooseberry was relocated from its native China to New Zealand where an industry was established around the renamed kiwifruit.

3. In paragraph 2, the author mentions Chinese gooseberries and the Monterey pine in order to

- A. contrast two plant species transplanted for different reasons
- B. demonstrate how two extremely different species adapt to a similar environment in New Zealand
- C. offer evidence that newly introduced species can have unintended positive effects on the environment
- D. provide examples of species moved for economic purposes

【Paragraph 3】 We have extended the distribution of some species because of certain useful traits that make the species desirable beyond their former known range. For example, willows have extensive root systems, can grow relatively quickly, and are now used in several countries worldwide to stabilize river margins as a flood protection measure. The distribution of willows has therefore been influenced considerably by human use in river bank management.

4. According to paragraph 3, why are willows a species that are now found in different countries worldwide?

- A. They adapt easily to a variety of environments.
- B. They have characteristics that make them useful in preserving river banks during floods.
- C. They have a root system that allows them to reproduce easily and live long.
- D. They require little care or management from humans.

【Paragraph 4】 The effects of introduced species can be many and varied and can include effects on the distribution of other species. For example, the North American gray squirrel was introduced into England and has now largely displaced the native red squirrel. The accidental introduction of organisms to new areas may have major pest implications. The South African bronze butterfly, the larva (immature insect forms) of which feed on buds and other parts of geraniums and similar flowers, was accidentally introduced into the Balearic Islands via imported geraniums. In its native South Africa, the distribution and abundance of the butterfly are affected in part by a native wasp that parasitizes (feeds on) the larvae. In the absence of the parasite wasp on the Balearic Islands off the coast of Spain, the butterfly has now spread to mainland Spain where its rapid spread has been accentuated by trade in garden plants and modern transport. The species has become a major pest due to the lack of a natural predator and is now causing great problems for the horticultural industry in Spain.

5. What can be inferred from paragraph 4 about geraniums in South Africa as compared to geraniums in Spain and the Balearic Islands?

- A. The structural parts and buds of geraniums in South Africa differ from those of geraniums in Spain and the Balearic Islands.
- B. Compared to the geraniums in Spain, the ones in South Africa are less likely to have bronze butterfly larvae as a pest.
- C. Geraniums are less important to the horticulture industry in South Africa than they are to the horticultural industries of Spain and the Balearic Islands.
- D. Geraniums in South Africa are traded more than the geraniums in Spain and the Balearic Islands are.

6. According to paragraph 4, why did the South African bronze butterfly become a major pest in Spain?

- A. Spain has a greater number of flowers for the butterflies to feed on
- B. The butterfly's larvae reach maturity more quickly in Spain than they do elsewhere.
- C. There are no natural predators of bronze butterfly larvae in Spain
- D. The species of geranium that is found in Spain is a more delicate garden plant and easier for pests to consume

7. Paragraph 4 supports which of the following statement about the South African bronze butterfly?

- A. It was deliberately introduced into two new environments at the same time.
- B. Its spread on mainland Spain had a significant economic impact.
- C. It changed its parasitizing behavior when it adapted to new environments.
- D. Its presence on mainland Spain and the Balearic Islands caused other insect populations to increase.

【Paragraph 6】Information about a species distribution (prior to human modification) maybe applied in pest control programs for the introduced species. Studies of the species in its native habitat may yield information about the factors that limit or influence its distribution and population dynamics. That information may then be applied in the development of strategies to contain and control the spread of pest species. For example, information about the role of the parasitic wasp in the ecology of the bronze butterfly may be utilized in the process of finding control strategies for that species on mainland Spain.

8. Paragraph 6 returns to a discussion of the bronze butterfly in order to

- A. demonstrate that information about species in their native habitat can be applied to controlling their spread in new habitats
- B. emphasize the negative effects of parasitic wasps on butterflies in general
- C. further support the claim that the bronze butterfly was accidentally introduced to mainland Spain
- D. conclude by recommending the development of careful pest control strategies so that the ecology is not damaged

【Paragraph 2】The effects of introduced species can be many and varied and can include effects on the distribution of other species. For example, the North American gray squirrel was introduced into England and has now largely displaced the native red squirrel. The accidental introduction of organisms to new areas may have major pest implications. ■The South African bronze butterfly, the larva (immature insect forms) of which feed on buds and other parts of geraniums and similar flowers, was accidentally introduced into the Balearic Islands via imported geraniums. ■In its native South Africa, the distribution and abundance of the butterfly are affected in part by a native wasp that parasitizes (feeds on) the larvae.■ In the absence of the parasite wasp on the Balearic Islands off the coast of Spain, the butterfly has now spread to mainland Spain where its rapid spread has been accentuated by trade in garden plants and modern transport. ■The species has become a major pest due to the lack of a natural predator and is now causing great problems for the horticultural industry in Spain.

9. Look at the four squares [■] that indicate where the following sentence could be added to the passage.

Its presence there helps control the bronze butterfly population.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

A variety of factors, including human activity, can affect the distribution of species.

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Answer Choices

- A. Research has shown that the biogeography of species can change even without human interference as can be seen in the wide distribution of willows along a wide range of river banks.
- B. Introducing a species to a new environment can have unintended consequences such as those that occurred when a butterfly was relocated to an environment that lacked its natural predator.
- C. The success of relocating two species together depends on how they help each other survive in a new environment as demonstrated by the South African bronze butterfly and geraniums.
- D. The study of the relocations of certain species to new habitats has been difficult because it is not always clear if the relocations were natural or caused by humans.
- E. Humans have relocated species for a variety of reasons, including obtaining new food sources, creating new industries, and taking advantage of the characteristics of certain species.
- F. Understanding the distribution of a species in its native habitat can be useful in controlling its spread as a pest in its new habitat.

Passage 24 - The Cambrian Explosion

The earliest fossil evidence for eukaryotes complex organisms whose cells contain a distinct nucleus dates to only about 1.2 billion years ago. The fossil record suggests that animal evolution progressed slowly, with relatively little change seen between fossils from 1.2 billion years ago and those from a half-billion years later. But then something quite dramatic happened as can be judged by the many different animal groups that suddenly appear in the fossil record.

Biologists classify animals according to their basic body plans. For example, the basic body plan shared by mammals and reptiles is fundamentally different from that of insects. Animals are grouped by body plan into what biologists call phyla. Mammals and reptiles both belong to the single phylum Chordata, which includes animals with internal skeletons. Insects, crabs, and spiders belong to the phylum Arthropoda, which contains animals with body features such as jointed legs, an external skeleton, and segmented bodies. Classifying animals into phyla is an ongoing project for biologists, but modern animals appear to comprise about 30 different phyla, each representing a different body plan.

Remarkably, nearly all of these different body plans, plus a few others that have gone extinct, make their first known appearance in the geological record during a period spanning only about 40 million years less than about 1 percent of Earth's history. This remarkable flowering of animal diversity appears to have begun about 545 million years ago, which corresponds to the start of the Cambrian period. Hence it is called the Cambrian explosion.

The fact that the Cambrian explosion marks the only major diversification of body plans in the geological record presents us with two important and related questions: Why, so long after the origin of eukaryotes, did the pace of evolution suddenly accelerate dramatically at the beginning of the Cambrian, and why hasn't there been another period of similarly explosive diversification since then?

We can identify at least four factors that might have contributed to the Cambrian explosion. First, the oxygen level in our atmosphere may have remained well below its present level until about the time of the Cambrian explosion. Thus, the rapid diversification in animal life may have occurred at least in part because oxygen reached a critical level for the survival of larger and more energy-intensive life forms.

A second factor that may have been important was the evolution of genetic complexity. As eukaryotes evolved, they developed more and more genetic variation in their DNA. Some scientists believe that the Cambrian explosion marks the point at which organisms developed certain kinds of homeobox genes that control body form and that could be combined in different ways, allowing the evolution of a great diversity of forms over time.

A third factor may have been climate change. Geological evidence points to a series of episodes in which Earth froze over before the Cambrian began. The extreme climate conditions of these episodes eliminated many species, leaving a wide array of ecological niches available into which new species could rapidly evolve when climate conditions eased at the beginning of the Cambrian.

A fourth factor may have been the absence of efficient predators. Early predatory animals were probably not very sophisticated, so some evolving animals that later might have been eliminated by predation were given a chance to survive, making the beginning of the Cambrian period a window of opportunity for many different adaptations to establish themselves in the environment.

This last idea may partly explain why no similar explosion of diversity has taken place since the Cambrian: once predators were efficient and widespread, it may have been virtually impossible for animals with entirely new body forms to find an environmental niche in which they could escape predation. Or it may be that while more body plans may have been possible at some early point in evolution, it was not possible to evolve into those other body plans from the body plans that evolved in the Cambrian. Or perhaps the various body forms that arose during the Cambrian explosion represent the full range of forms possible given the basic genetic resources that characterize all Earth's organisms. In any case, no fundamentally new body forms have emerged since the Cambrian explosion.

【Paragraph 1】 The earliest fossil evidence for eukaryotes complex organisms whose cells contain a distinct nucleus dates to only about 1.2 billion years ago. The fossil record suggests that animal evolution progressed slowly, with relatively little change seen between fossils from 1.2 billion years ago and those from a half-billion years later. But then something quite dramatic happened as can be judged by the many different animal groups that suddenly appear in the fossil record.

1. Paragraph 1 implies which of the following about evolutionary change

- A. Eukaryotes have a very slow rate of evolution.
- B. The fossil record of evolutionary change is incomplete for the first half-billion years of animal evolution.
- C. Evolution has not always proceeded at the same rate.
- D. Evolutionary rates of change in animals were slowing down considerably before a dramatic reversal happened 1.2 billion years ago.

【Paragraph 2】 Biologists classify animals according to their basic body plans. For example, the basic body plan shared by mammals and reptiles is fundamentally different from that of insects. Animals are grouped by body plan into what biologists call phyla. Mammals and reptiles both belong to the single phylum Chordata, which includes animals with internal skeletons. Insects, crabs, and spiders belong to the phylum Arthropoda, which contains animals with body features such as jointed legs, an external skeleton, and segmented bodies. Classifying animals into phyla is an ongoing project for biologists, but modern animals appear to comprise about 30 different phyla, each representing a different body plan.

2. In paragraph 2, why does the author provide the information that Arthropoda represents animals with features like jointed legs, an external skeleton, and segmented body parts

- A. To indicate basic physical differences among insects, crabs, and spiders
- B. To illustrate the types of physical characteristics considered when classifying animals
- C. To show the complexity of features that have evolved in organisms
- D. To demonstrate that some phyla include a wider range of body plans than others do

【Paragraph 3】 Remarkably, nearly all of these different body plans, plus a few others that have gone extinct, make their first known appearance in the geological record during a period spanning only about 40 million years less than about 1 percent of Earth's history. This remarkable flowering of animal diversity appears to have begun about 545 million years ago, which **corresponds to** the start of the Cambrian period. Hence it is called the Cambrian explosion.

3. The phrase “**corresponds to**” in the passage is closest in meaning to

- A. causes
- B. occurs before
- C. differs from

D. matches

【Paragraph 4】 The fact that the Cambrian explosion marks the only major diversification of body plans in the geological record presents us with two important and related questions: Why, so long after the origin of eukaryotes, did the pace of evolution suddenly accelerate dramatically at the beginning of the Cambrian, and why hasn't there been another period of similarly explosive diversification since then?

4. According to paragraphs 3 and 4, what was remarkable about the Cambrian explosion

- A. That the evolution of species occurred so soon after the first eukaryotes appeared
- B. That most of the known animal types appeared in a relatively short period in history
- C. That many of the animal types that appeared in the period have survived until today
- D. That the pace of evolution slowed before it accelerated

5. The function of the two questions in paragraph 4 is to

- A. recognize two common questions that cannot be addressed within the passage
- B. present the two different points of view contrasted in the passage
- C. provide important objections to the central idea of the passage
- D. indicate two important questions that will be explored in the passage

【Paragraph 5】 We can identify at least four factors that might have contributed to the Cambrian explosion. First, the oxygen level in our atmosphere may have remained well below its present level until about the time of the Cambrian explosion. Thus, the rapid diversification in animal life may have occurred at least in part because oxygen reached a critical level for the survival of larger and more energy-intensive life forms.

6. Paragraph 5 implies which of the following about oxygen

- A. It was not essential for the life forms that appeared before the Cambrian period.
- B. It has remained at relatively the same level since the beginning of the fossil record.
- C. Its changes in levels are associated with animal extinctions.
- D. Its levels before the Cambrian period were too low for large animals to survive.

【Paragraph 6】 A second factor that may have been important was the evolution of genetic complexity. As eukaryotes evolved, they developed more and more genetic variation in their DNA. Some scientists believe that the Cambrian explosion marks the point at which organisms developed certain kinds of homeobox genes that control body form and that could be combined in different ways, allowing the evolution of a great diversity of forms over time.

【Paragraph 7】 A third factor may have been climate change. Geological evidence points to a series of episodes in which Earth froze over before the Cambrian began. The extreme climate conditions of these episodes eliminated many species, leaving a wide array of ecological niches available into which new species could rapidly evolve when climate conditions eased at the beginning of the Cambrian.

【Paragraph 8】 A fourth factor may have been the absence of efficient predators. **Early predatory animals were probably not very sophisticated, so some evolving animals that later might have been eliminated by predation were given a chance to survive, making the beginning of the Cambrian period a window of opportunity for many different adaptations to establish themselves in the environment.**

7. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Predators at the beginning of the Cambrian period had to become more sophisticated in order to survive in environments with newly adapted animals.
- B. New adaptations had an opportunity to survive at the beginning of the Cambrian period because early predators were not yet sophisticated enough to eliminate the animals with these adaptations.
- C. Early predatory animals lacked sophisticated adaptations because they did not develop them during a window of opportunity in the early Cambrian period.
- D. Early predators had an opportunity at the beginning of the Cambrian period to remove new adaptations before they established themselves in the environment.

【Paragraph 9】 This last idea may partly explain why no similar explosion of diversity has taken place since the Cambrian: once predators were efficient and widespread, it may have been virtually impossible for animals with entirely new body forms to find an environmental niche in which they could escape predation. Or it may be that while more body plans may have been possible at some early point in evolution, it was not possible to evolve into those other body plans from the body plans that evolved in the Cambrian. Or perhaps the various body forms that arose during the Cambrian explosion represent the full range of forms possible given the basic genetic resources that characterize all Earth's organisms. In any case, no fundamentally new body forms have emerged since the Cambrian explosion.

8. Paragraph 9 suggests all of the following possible explanations for the uniqueness of the Cambrian explosion EXCEPT

- A. the inability of later animals to evolve body plans different from those that appeared during the Cambrian period
- B. the post-Cambrian appearance of efficient predators occupying nearly every environmental niche
- C. the decline in the number of habitats having sufficient resources to support the rapid evolution of new species
- D. the limited range of genetically possible body types

【Paragraph 9】 This last idea may partly explain why no similar explosion of diversity has taken place since the Cambrian: once predators were efficient and widespread, it may have been virtually impossible for animals with entirely new body forms to find an environmental niche in which they could escape predation. ■ Or it may be that while more body plans may have been possible at some early point in evolution, it was not possible to evolve into those other body plans from the body plans that evolved in the Cambrian. ■ Or perhaps the various body forms that arose during the Cambrian explosion represent the full range of forms possible given the basic genetic resources that characterize all Earth's organisms. ■ In any case, no fundamentally new body forms have emerged since the Cambrian explosion. ■

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

After all, evolution of body structure can act only on the structure that already exists.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

The term "Cambrian explosion" refers to the geologically brief period during which all modern animal groups evolved.

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Answer Choices

- A. Biologists want to find out why the rapid diversification of body forms did not happen soon after the appearance of eukaryotes around 1.2 billion years ago.
- B. Biologists classify animals according to their body plans into phyla such as Chordata, animals with a backbone, and Arthropoda, animals with segmented exoskeletons.
- C. The Cambrian explosion was a unique episode in the history of evolution that produced nearly all of the 30 or so animal body plans that have ever been seen.
- D. The Cambrian explosion may have been aided by genes that could yield a variety of body forms and the inability of early predators to eliminate the new forms.
- E. Once predators became efficient after the Cambrian explosion, they were able to eliminate any animals that began to evolve a new body plan.
- F. At the beginning of the Cambrian, an increase in oxygen needed for animal growth and the return of a hospitable climate may have contributed to the Cambrian explosion.

Passage 25 - The Extinction of the Dinosaurs

Geologists define the boundary between sediment layers of the Cretaceous period (144-65million years ago) and the Paleocene period (65-55 million years ago) in part by the types and amounts of rocks and fossils they contain or lack. Before the limit of 65 million years ago, marine strata are rich in calcium carbonate due to accumulations of fossils of microscopic algae deposited on the sea floor. Above the 65-million-year limit, sea-floor sediments contain much less calcium carbonate, and fossils of several families of mollusks are no longer found. In continental sediments, dinosaur fossils, though frequent before 65 million years ago, are totally absent. By contrast, new families of mammals appear, including large mammals for the first time.

Scientists wondered for many years about what could have caused the dinosaurs' rapid disappearance at the end of the Cretaceous period, coming up with a great variety of theories and scenarios. For some, it could have been due to unfavorable genetic changes triggered by a dramatic increase by a factor of 10,100,1000 in cosmic-ray particles reaching the Earth after a supernova explosion somewhere in the neighborhood of the solar system. For these high-energy particles to affect life, they would have to get through the protective barrier of the Earth's magnetosphere, the region of the upper atmosphere controlled by Earth's magnetic field. That could have happened if the cloud of particles from the supernova explosion reached the Earth during a period when the magnetosphere was weakened, something that may happen when the Earth's magnetic field changes direction. And we know that the magnetic north and south poles of the Earth switch on the average twice every million years. However, this is not the only possible explanation for dinosaur destruction.

Other theories have raised the possibility of strong climate changes in the tropics (but they then must be explained). Certainly, if climate changes, the changed distributions of temperature and rainfall modify the conditions that favor one ecosystem over another. The extinction of a particular family, genus, or species may result from a complicated chain of indirect causes and effects. Over thirty years ago, scientist Carl Sagan quoted one suggestion that the demise of the dinosaurs resulted from the disappearance of a species of fern plant that was important for dinosaur digestion. Other theories involved a worldwide cold wave following the spread of a layer of cold but not very salty water in the world's oceans, which floated on the surface because, with its low salinity, the water was less dense.

Proponents of another theory that remains under consideration today postulate that the extinction of the dinosaurs corresponds to a period of intense volcanic activity. It's not a question of just one or even of a thousand eruptions comparable to the explosion of Krakatoa in 1883, one of the largest volcanic events in modern times, but rather of a prolonged period of activity. On the Deccan plateau in India, basalt (volcanic) rocks cover more than 500, 000 square kilometers (nearly 200, 000 square miles), and correspond to massive lava outflows occurring precisely at the end of the Cretaceous. This sort of outflow could correspond to volcanic activity similar to the activity that drives sea-floor spreading, with lava emerging from elongated fractures in the crust rather than from craters.

The volcanic convulsion that buried the Deccan plateau in lava must also have changed the composition of the atmosphere and severely affected climate. Initially, there must have been strong sudden cooling resulting from the blocking of sunlight by sulfate aerosol veils in the stratosphere (part of the Earth's atmosphere). If strong cooling lasted a year after the formation of the aerosols, it would have been the death of tropical species unable to adapt to such a volcanic winter. However, a long period of strong volcanic activity (again, remember thousands of Krakatoas) would at the same time have added a substantial amount of carbon dioxide to the atmosphere, reinforcing the greenhouse effect. This would gradually warm things up, ending the extended cold-snap and producing global warming together with geographic shifts of humid and arid (dry) zones. Certainly things would change to upset living conditions, leading to the extinction of some

species while others would profit, if only from the disappearance of predators.

【Paragraph 1】 Geologists define the boundary between sediment layers of the Cretaceous period (144-65million years ago) and the Paleocene period (65-55 million years ago) in part by the types and amounts of rocks and fossils they contain or lack. Before the limit of 65 million years ago, marine strata are rich in calcium carbonate due to accumulations of fossils of microscopic algae deposited on the sea floor. Above the 65-million-year limit, sea-floor sediments contain much less calcium carbonate, and fossils of several families of mollusks are no longer found. In continental sediments, dinosaur fossils, though frequent before 65 million years ago, are totally absent. By contrast, new families of mammals appear, including large mammals for the first time.

1. According to paragraph 1, which of the following is true of Paleocene sediments?

- A. They lack fossils from some families of mammals found in Cretaceous sediments.
- B. They contain fossils of dinosaurs.
- C. They contain fossils of some animals that did not exist during the Cretaceous.
- D. They contain fossils of more kinds of mollusks than are found in Cretaceous sediments.

【Paragraph 2】 Scientists wondered for many years about what could have caused the dinosaurs' rapid disappearance at the end of the Cretaceous period, coming up with a great variety of theories and scenarios. For some, it could have been due to unfavorable genetic changes triggered by a dramatic increase by a factor of 10,100,1000 in cosmic-ray particles reaching the Earth after a supernova explosion somewhere in the neighborhood of the solar system. For these high-energy particles to affect life, they would have to get through the protective barrier of the Earth's magnetosphere, the region of the upper atmosphere controlled by Earth's magnetic field. That could have happened if the cloud of particles from the supernova explosion reached the Earth during a period when the magnetosphere was weakened, something that may happen when the Earth's magnetic field changes direction. And we know that the magnetic north and south poles of the Earth switch on the average twice every million years. However, this is not the only possible explanation for dinosaur destruction.

2. Why does the author include the information that the magnetic north and south poles of the Earth switch on the average twice every million years?

- A. To provide evidence showing that Earth's protective barrier is difficult to get through
- B. To show that it is reasonable to think that particles from a supernova explosion could have reached Earth
- C. To explain why some scientists believe a supernova explosion may have occurred near our solar system
- D. To help explain why some scientists have rejected the theory presented in Paragraph 2

3. According to the theory discussed in paragraph 2, a weakening of Earth's magnetosphere may have

- A. caused a supernova to explode near our solar system
- B. allowed gene-altering particles to reach Earth's surface
- C. forced Earth's magnetic field to change direction
- D. allowed clouds of protective particles to escape from Earth's upper atmosphere

【Paragraph 3】 Other theories have raised the possibility of strong climate changes in the tropics (but they then must be explained). Certainly, if climate changes, the changed distributions of temperature and rainfall modify the conditions that favor one ecosystem over another. The extinction of a particular family, genus, or species may result from a complicated chain of indirect causes and effects. Over thirty years ago, scientist Carl Sagan quoted one suggestion that the demise of the dinosaurs resulted from the disappearance of a species of fern plant that was important for dinosaur digestion. Other theories involved a worldwide cold wave following the spread of a layer of cold but not very salty water in the world's oceans, which floated on the surface because, with its low salinity, the water was less dense.

4. All of the following are mentioned in paragraph 3 as possible causes for the extinction of the dinosaurs EXCEPT

- A. a change in the diet of dinosaurs
- B. a change in the climate of the tropics
- C. a decrease in global temperatures
- D. a decrease in deep ocean salinity

5. In paragraph 3, why does the author include the quotation by Carl Sagan

- A. To explain the connection between dinosaur extinction and the extinction of other animal species
- B. To support the claim about species extinction being due to indirect causes and effects
- C. To show that scientists have revised their ideas greatly in the last thirty years
- D. To identify the differences between the various theories for the extinction of dinosaurs

【Paragraph 4】 Proponents of another theory that remains under consideration today postulate that the extinction of the dinosaurs corresponds to a period of intense volcanic activity. It's not a question of just one or even of a thousand eruptions comparable to the explosion of Krakatoa in 1883, one of the largest volcanic events in modern times, but rather of a prolonged period of activity. On the Deccan plateau in India, basalt (volcanic) rocks cover more than 500, 000 square kilometers (nearly 200, 000 square miles), and correspond to massive lava outflows occurring precisely at the end of the Cretaceous. This sort of outflow could correspond to volcanic activity similar to the activity that drives sea-floor spreading, with lava emerging from elongated fractures in the crust rather than from craters.

6. According to paragraph 4, what was one unusual aspect of the volcanic activity at the end of the Cretaceous?

- A. Some explosions were much larger than Krakatoa.
- B. Eruptions occurred over a long period of time.
- C. Active volcanoes were sometimes separated by many kilometers.
- D. There were active volcanoes in the sea as well as on land.

7. Which of the following is presented in paragraph 4 as evidence that intense volcanic activity occurred at about the time that the dinosaurs became extinct?

- A. The size of the volcanic craters on the Deccan plateau
- B. An increase in sea-floor spreading
- C. The formation in India of large amounts of a type of rock associated with volcanoes
- D. The occurrence of a thousand or more volcanic explosions the size of Krakatoa

【Paragraph 5】 The volcanic convulsion that buried the Deccan plateau in lava must also have changed the composition of the atmosphere and severely affected climate. Initially, there must have been strong sudden cooling resulting from the blocking of sunlight by sulfate aerosol veils in the stratosphere (part of the Earth's atmosphere). If strong cooling lasted a year after the formation of the aerosols, it would have been the death of tropical species unable to adapt to such a volcanic winter. However, a long period of strong volcanic activity (again, remember thousands of Krakatoas) would at the same time have added a substantial amount of carbon dioxide to the atmosphere, reinforcing the greenhouse effect. This would gradually warm things up, ending the extended cold-snap and producing global warming together with geographic shifts of humid and arid (dry) zones. Certainly things would change to upset living conditions, leading to the extinction of some species while others would profit, if only from the disappearance of predators.

8. According to paragraph 5, all of the following are theorized to have occurred as a result of volcanic activity EXCEPT

- A. a decrease in the amount of sunlight reaching Earth's surface
- B. a reduction in the number of sulfate aerosol veils in the stratosphere
- C. increased dryness in some areas that were once more humid
- D. changes in the atmosphere's composition resulting in an increase in temperature

【Paragraph 5】 The volcanic convulsion that buried the Deccan plateau in lava must also have changed the composition of the atmosphere and severely affected climate. Initially, there must have been strong sudden cooling resulting from the blocking of sunlight by sulfate aerosol veils in the stratosphere (part of the Earth's atmosphere). If strong cooling lasted a year after the formation of the aerosols, it would have been the death of tropical species unable to adapt to such a volcanic winter. ■However, a long period of strong volcanic activity (again, remember thousands of Krakatoas) would at the same time have added a substantial amount of carbon dioxide to the atmosphere, reinforcing the greenhouse effect. ■This would gradually warm things up, ending the extended cold-snap and producing global warming together with geographic shifts of humid and arid (dry) zones. ■Certainly things would change to upset living conditions, leading to the extinction of some species while others would profit, if only from the disappearance of predators. ■

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

Thus, ecosystems following periods of extensive volcanic activity necessarily had different combinations of species than earlier ecosystems did.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

For a long time, scientists have argued that the extinction of the dinosaurs was related to climate change.

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Answer Choices

- A. Cosmic rays from a nearby supernova explosion may have penetrated Earth's atmosphere, causing genetic changes that dinosaur populations could not survive.
- B. Climate changes in the tropics may have set off a chain of indirect effects that negatively affected the ecosystems in which dinosaurs lived.
- C. The spread of lava over large parts of previously favored habitats such as the Deccan Plateau may have made these favored areas uninhabitable for many years.
- D. Although the volcanic winter resulting from the formation of sulfate aerosols eventually ended, temperatures may have remained below levels required by dinosaurs to survive.
- E. Temperature changes and geographic shifts in climate zones due to the atmospheric effects of volcanic activity may have been significant enough to cause extinction.
- F. To be convincing, theories about what caused dinosaurs to become extinct must be able to explain the disappearance of other predators in the food chain at the same time.

Passage 26 - The First Eyes

Putting a date on the first appearance of eyes depends on what one means by eye. If the term refers to a multicellular organ, even if it has just a few cells, then by definition, eyes could not form before there were multicellular animals. But many protists (animal-like, plantlike, or fungus-like unicellular organisms that require a water-based environment) can detect light by using aggregations of pigment molecules, and they use this information to modify their metabolic activity or motility (the ability to move spontaneously and independently). One of the familiar living examples, probably known to anyone who has taken a biology class, is the aquatic protozoan *Euglena*, which has an eyespot near its motile flagellum (hair-like structure). Some living protists are very like their ancestral forms embedded in ancient sedimentary rocks, and this similarity suggests that the ability to detect light and modify behavior in response to light has been around for a very long time. Animals arose from one of such unicellular creatures, perhaps from one already specialized for a primitive kind of vision.

An eye is a collection of cells that are specialized for light detection through the presence of photosensitive pigment as well as a means of restricting the direction of incoming light that will strike the photosensitive cells. This definition says nothing about image formation, lenses, eye movements, or any of the other features we associate with our own eyes, but it does recognize the simplest form of functional and anatomical specialization, namely, detection of light. Everything else can be built up from this simple beginning, and some animals appear to have had eyes almost from the beginning of the animal kingdom.

Animals were scarce 600 million years ago in the geological era called the Precambrian. There are very few fossil remains from that time (though more keep turning up), and most evidence of the presence of animals is indirect, such as small tunnels in rock that could be ancient worm burrowings. But just 50 million years or so later, fossilized bits and pieces of animals abound, suggesting that a great burst of evolutionary creativity occurred in the 50-million-year interval. This surge of new life, marked by an abundance of animals, is called the Cambrian explosion.

The first direct evidence for the early origin of eyes comes from fossils that are about 530 million years old, a time shortly after the Cambrian explosion; they were found on a mountainside in British Columbia in a deposit known as the Burgess Shale. The Burgess Shale fossils are extraordinarily important because among them are remains of soft-bodied creatures, many of them lacking shells and other hard parts that fossilize easily. Consequently, their preservation is little short of miraculous (as are the delicate methods used to reconstruct three-dimensional structure from these flattened fossils), and they are one of the few known repositories of early soft-bodied animals.

Not all of the Burgess animals had eyes. However, some did. (Gross features location, size, and hemispheric shape are responsible for the designation of some structures as eyes). The reconstructed eyes of these Burgess animals look superficially like eyes of some living crustaceans, particularly those of shrimp and crabs whose eyes are mounted on stalks that improve the range of vision by raising the eyes above the surface of the head. The eyes of some Burgess organisms sat on stalks; those of others were on or a part of the body surface. One animal, *Opabinia*, had five eyes: two lateral pairs and a single medial eye; at least one of the lateral pairs had stalks that could have been movable. And some trilobite-like animals in the Burgess Shale had faceted eyes much like those of later fossil trilobites.

Although the presence of eyes on some of the Burgess animals indicates that eyes have been around for a very long time, it is unlikely that these were the first eyes; they seem much too large and (potentially) well developed to be brand new inventions. The best we can do is put the origin of eyes somewhere between the beginning of the Cambrian explosion, about 600 million years ago, and the death of the Burgess animals, some 530 million years ago.

【Paragraph 1】 Putting a date on the first appearance of eyes depends on what one means by eye. If the term refers to a multicellular organ, even if it has just a few cells, then by definition, eyes could not form before there were multicellular animals. But many protists (animal-like, plantlike, or fungus-like unicellular organisms that require a water-based environment) can detect light by using aggregations of pigment molecules, and they use this information to modify their metabolic activity or motility (the ability to move spontaneously and independently). One of the familiar living examples, probably known to anyone who has taken a biology class, is the aquatic protozoan *Euglena*, which has an eyespot near its motile flagellum (hair-like structure). Some living protists are very like their ancestral forms embedded in ancient sedimentary rocks, and this similarity suggests that the ability to detect light and modify behavior in response to light has been around for a very long time. Animals arose from one of such unicellular creatures, perhaps from one already specialized for a primitive kind of vision.

1. Paragraph 1 supports all of the following statements about protists EXCEPT:

- A. Some are multicellular.
- B. Some are able to move.
- C. Some have pigment molecules.
- D. They live in environments that contain moisture.

2. According to paragraph 1, what have scientists concluded from the fact that some living protists are very like their ancestral forms?

- A. The eye did not evolve until multicellular organisms arose.
- B. The ability to detect light and change behavior in response to light has existed for a long time.
- C. The ancestral forms of these living protists likely had an eyespot near the motile flagellum.
- D. The ancestral forms of these living protists depended primarily on light as the mechanism for modifying their metabolic activity or motility.

【Paragraph 2】 An eye is a collection of cells that are specialized for light detection through the presence of photosensitive pigment as well as a means of restricting the direction of incoming light that will strike the photosensitive cells. This definition says nothing about image formation, lenses, eye movements, or any of the other features we associate with our own eyes, but it does recognize the simplest form of functional and anatomical specialization, namely, detection of light. Everything else can be built up from this simple beginning, and some animals appear to have had eyes almost from the beginning of the animal kingdom.

3. Paragraph 2 implies which of the following about the early eyes

- A. They were able to detect simple movements almost from the beginning of their evolution.
- B. They were not as sensitive to light as once thought.
- C. They could not form images.
- D. Their cells had more photosensitive pigment than do human eyes.

【Paragraph 3】 Animals were scarce 600 million years ago in the geological era called the Precambrian. **There are very few fossil remains from that time (though more keep turning up), and most evidence of the presence of animals is indirect, such as small tunnels in rock that could be ancient worm burrowings.** But just 50 million years or so later, fossilized bits and pieces of animals abound, suggesting that a great burst of evolutionary creativity occurred in the 50-million-year interval. This surge of new life, marked by an abundance of animals, is called the Cambrian explosion.

4. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage?

Incorrect choices change the meaning in important ways or leave out essential information.

- A. There are few fossils from the Precambrian, though more keep turning up.
- B. Most evidence of animals in the fossil record is indirect and little of it is from the Precambrian.
- C. Tunnels in Precambrian rocks that may have been made by worms provide indirect evidence of these animals existing at that time.
- D. There are very few fossils of animals from the Precambrian and most evidence of animal life from that period is indirect.

[Paragraph 4] The first direct evidence for the early origin of eyes comes from fossils that are about 530 million years old, a time shortly after the Cambrian explosion; they were found on a mountainside in British Columbia in a deposit known as the Burgess Shale. The Burgess Shale fossils are extraordinarily important because among them are remains of soft-bodied creatures, many of them lacking shells and other hard parts that fossilize easily. Consequently, their preservation is **little short of miraculous** (as are the delicate methods used to reconstruct three-dimensional structure from these flattened fossils), and they are one of the few known repositories of early soft-bodied animals.

5. The phrase “**little short of miraculous**” is closest in meaning to

- A. very highly valued
- B. amazing because almost impossible
- C. causing controversy
- D. almost but not quite complete

6. According to paragraph 4, all of the following are true of the Burgess Shale EXCEPT

- A. Its fossils were in a flattened condition when discovered.
- B. Its fossils provide direct evidence about the origin of eyes.
- C. It contains fossils of both Precambrian and Cambrian animals.
- D. It contains fossilized remains of soft-bodied organisms.

[Paragraph 5] Not all of the Burgess animals had eyes. However, some did. (Gross features location, size, and hemispheric shape are responsible for the designation of some structures as eyes). The reconstructed eyes of these Burgess animals look superficially like eyes of some living crustaceans, particularly those of shrimp and crabs whose eyes are mounted on stalks that improve the range of vision by raising the eyes above the surface of the head. The eyes of some Burgess organisms sat on stalks; those of others were on or a part of the body surface. One animal, *Opabinia*, had five eyes: two lateral pairs and a single medial eye; at least one of the lateral pairs had stalks that could have been movable. And some trilobite-like animals in the Burgess Shale had faceted eyes much like those of later fossil trilobites.

7. Why does the author point out that the eyes of some Burgess organisms sat on stalks

- A. To suggest that some Burgess organisms had a greater range of vision than do living shrimp and crabs
- B. To explain why it is thought that one of the lateral pairs of eyes in *Opabinia* may have been movable
- C. To explain why the eyes of some Burgess animals were not recognizable as such before they were reconstructed
- D. To support the statement that the reconstructed eyes of Burgess animals look superficially like the eyes of some living crustaceans

【Paragraph 6】 Although the presence of eyes on some of the Burgess animals indicates that eyes have been around for a very long time, it is unlikely that these were the first eyes; they seem much too large and (potentially) well developed to be brand new inventions. The best we can do is put the origin of eyes somewhere between the beginning of the Cambrian explosion, about 600 million years ago, and the death of the Burgess animals, some 530 million years ago.

8. Paragraph 6 suggests that the first eyes probably

- A. came into existence long before 600 million years ago
- B. came into existence at a late point in the Cambrian period
- C. existed before the animals of the Burgess Shale existed
- D. were larger than those of animals found in the Burgess Shale

【Paragraph 5】 Not all of the Burgess animals had eyes. However, some did. (Gross features location, size, and hemispheric shape are responsible for the designation of some structures as eyes). ■The reconstructed eyes of these Burgess animals look superficially like eyes of some living crustaceans, particularly those of shrimp and crabs whose eyes are mounted on stalks that improve the range of vision by raising the eyes above the surface of the head. ■The eyes of some Burgess organisms sat on stalks; those of others were on or a part of the body surface. ■One animal, *Opabinia*, had five eyes: two lateral pairs and a single medial eye; at least one of the lateral pairs had stalks that could have been movable. ■And some trilobite-like animals in the Burgess Shale had faceted eyes much like those of later fossil trilobites.

9. Look at the four squares **【■】** that indicate where the following sentence could be added to the passage.

***Malaria spinifera* and *H. optata*, both of which lived in water levels beyond the reach of light, fit into this category.**

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

The first eyes originated between the beginning of the Cambrian explosion and the death of the Burgess animals.

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Answer Choices

- A. The ability of some unicellular organisms to detect light and change their behavior accordingly suggests that eyes did not originate with multicellular animals.
- B. The earliest eyes apparently contained molecules that were capable of forming and focusing images.
- C. Too few fossils from the Precambrian have been found to determine which if any Precambrian organisms had eyes.
- D. Evidence from the Burgess Shale suggests that eyes of some early animals were similar to the eyes of living crustaceans.
- E. Fossil evidence suggests that organisms in the Burgess Shale with faceted eyes developed later than organisms in the Burgess Shale with nonfaceted eyes.
- F. The large size and possible complexity of the eyes of some organisms in the Burgess Shale suggest that their eyes were not the first eyes.

Passage 27 - The Geographical Distribution of Gliding Animals

Southeast Asia has a unique abundance and diversity of gliding animals: flying squirrels, flying frogs, and flying lizards with wings of skin that enable them to glide through the tropical forest. What could be the explanation for the great diversity in this region and the scarcity of such animals in other tropical forests? Gliding has generally been viewed as either a means of escaping predators, by allowing animals to move between trees without descending to the ground, or as an energetically efficient way of traveling long distances between scattered resources. But what is special about Southeast Asian rain forests?

Scientists have proposed various theories to explain the diversity of gliding animals in Southeast Asia. The first theory might be called the tall-trees hypothesis. The forests of Southeast Asia are 6 meters taller than forests elsewhere due to the domination of the dipterocarp family: a family of tall tropical hardwood trees. Taller trees could allow for longer glides and the opportunity to build up speed in a dive before gliding. The lower wind speeds in tall-tree forests might also contribute by providing a more advantageous situation for gliding between trees. This argument has several flaws, however. First, gliding animals are found throughout the Southeast Asian region, even in relatively short-stature forests found in the northern range of the rain forest in China, Vietnam, and Thailand. Some gliders also thrive in low secondary forests, plantations, and even city parks. Clearly, gliding animals do not require tall trees for their activities. In addition, many gliding animals begin their glides from the middle of tree trunks, not even ascending to the tops of trees to take off.

A second theory, which we might call the broken-forest hypothesis, speculates that the top layer of the forest -- the tree canopy -- has fewer woody vines connecting tree crowns in Southeast Asian forests than in New World and African forests. As a result, animals must risk descending to the ground or glide to move between trees. In addition, the tree canopy is presumed to be more uneven in height in Asian forests, due to the presence of the tall dipterocarp trees with lower trees between them, again favoring gliding animals. Yet ecologists who work in different regions of the world observe tremendous local variation in tree height, canopy structure, and abundance of vines, depending on the site conditions of soil, climate, slope elevation, and local disturbance. One can find many locations in Southeast Asia where there are abundant woody vines and numerous connections between trees and similarly many Amazonian forests with few woody vines.

A final theory differs from the others in suggesting that it is the presence of dipterocarp trees themselves that is driving the evolution of gliding species. According to this view, dipterocarp forests can be food-deserts for the animals that live in them. The animals living in dipterocarp forests that have evolved gliding consist of two main feeding groups: leaf eaters and carnivores that eat small prey such as insects and small vertebrates. For leaf-eating gliders the problem is not the absence of any leaves but the desert-like absence of edible leaves. Dipterocarp trees often account for 50 percent or more of the total number of canopy trees in a forest and over 95 percent of the large trees, yet dipterocarp leaves are unavailable to most vertebrate plant eaters because of the high concentration of toxic chemicals in their leaves. Many species of gliding animals avoid eating dipterocarp leaves and so must travel widely through the forest, bypassing the dipterocarp trees, to find the leaves they need to eat. And gliding is a more efficient manner of traveling between trees than descending to the ground and walking or else jumping between trees.

Many carnivorous animals also may need to search more widely for food due to the lower abundance of insects and other prey. This is caused by dipterocarps' irregular flowering and fruiting cycles of two- to seven-year intervals, causing a scarcity of the flowers, fruits, seeds, and seedlings that are the starting point of so many food chains. The lower abundance of prey in dipterocarp forests forces animals such as lizards and geckos to move between tree crowns in search of food, with gliding being the most efficient means.

【Paragraph 1】 Southeast Asia has a unique abundance and diversity of gliding animals: flying squirrels, flying frogs, and flying lizards with wings of skin that enable them to glide through the tropical forest. What could be the explanation for the great diversity in this region and the scarcity of such animals in other tropical forests? Gliding has generally been viewed as either a means of escaping predators, by allowing animals to move between trees without descending to the ground, or as an energetically efficient way of traveling long distances between scattered resources. But what is special about Southeast Asian rain forests?

1. According to paragraph 1, it is generally thought that the ability to glide is useful to forest-dwelling species because gliding
- A. allows them to adapt to a wide variety of forest conditions
 - B. eliminates the need to travel long distances in search of food
 - C. provides a rapid, energy-efficient way of descending from the top of a tree to the ground
 - D. enables them to move through the forest without being exposed to predators on the ground

【Paragraph 2】 Scientists have proposed various theories to explain the diversity of gliding animals in Southeast Asia. The first theory might be called the tall-trees hypothesis. The forests of Southeast Asia are 6 meters taller than forests elsewhere due to the domination of the dipterocarp family: a family of tall tropical hardwood trees. Taller trees could allow for longer glides and the opportunity to build up speed in a dive before gliding. The lower wind speeds in tall-tree forests might also contribute by providing a more advantageous situation for gliding between trees. This argument has several flaws, however. First, gliding animals are found throughout the Southeast Asian region, even in relatively short-stature forests found in the northern range of the rain forest in China, Vietnam, and Thailand. Some gliders also thrive in low secondary forests, plantations, and even city parks. Clearly, gliding animals do not require tall trees for their activities. In addition, many gliding animals begin their glides from the middle of tree trunks, not even ascending to the tops of trees to take off.

2. All of the following are mentioned in paragraph 2 in support of the tall-trees hypothesis EXCEPT
- A. Tall trees make longer glides possible.
 - B. Tall trees make building up speed in a dive possible.
 - C. Tall trees make gliding from the middle of tree trunks possible.
 - D. Tall-tree forests have lower wind speeds.
3. Select the TWO answer choices that point to flaws in the tall-trees hypothesis, according to paragraph 2. To receive credit, you must select TWO answers.
- A. Many gliding animals are unable to ascend to the tops of tall trees.
 - B. Gliding animals are not evenly distributed throughout the forests of the Southeast Asian region.
 - C. In Southeast Asia, many gliding animals are found in places where trees tend to be relatively short.
 - D. Many gliding animals begin their glides from positions midway up the trunks of trees.

【Paragraph 3】 A second theory, which we might call the broken-forest hypothesis, speculates that the top layer of the forest -- the tree canopy -- has fewer woody vines connecting tree crowns in Southeast Asian forests than in New World and African forests. As a result, animals must risk descending to the ground or glide to move between trees. In addition, the tree canopy is presumed to be more uneven in height in Asian forests, due to the presence of the tall dipterocarp trees with lower trees between them, again favoring gliding animals. Yet ecologists who work in different regions of the world observe tremendous local variation in tree height, canopy structure, and abundance of vines, depending on the site conditions of soil, climate, slope elevation, and local disturbance. One can find many locations in Southeast Asia where there are abundant woody vines and numerous connections between trees and similarly many Amazonian forests with few woody vines.

4. Paragraph 3 implies which of the following ideas about forests in which there are abundant woody vines connecting tree crowns?

- A. The tree canopy is more even than it is in other forests.
- B. In such forests, animals can move between trees by traveling on vines.
- C. Such forests generally contain a wider diversity of animals than other forests do.
- D. There are likely to be fewer predators on the ground in such forests than in other forests.

5. Paragraph 3 supports the idea that one problem with the broken-forest hypothesis is that

- A. ecologists have found gliding animals in areas of Southeast Asia where trees are connected by vines and not found them in Amazonian forests where trees are not connected by vines
- B. in Southeast Asia, the forests with the fewest woody vines connecting the tops of trees turn out to have the most gliding animals
- C. according to ecologists in different regions of the world, gliding animals are as abundant and varied in some forests of Africa and the New World as they are in Southeast Asian forests
- D. gliding is no easier in broken forests with an uneven canopy structure than it is in forests where the trees are all about the same height

【Paragraph 4】 A final theory differs from the others in suggesting that it is the presence of dipterocarp trees themselves that is driving the evolution of gliding species. According to this view, dipterocarp forests can be food-deserts for the animals that live in them. The animals living in dipterocarp forests that have evolved gliding consist of two main feeding groups: leaf eaters and carnivores that eat small prey such as insects and small vertebrates. For leaf-eating gliders the problem is not the absence of any leaves but the desert-like absence of edible leaves. Dipterocarp trees often account for 50 percent or more of the total number of canopy trees in a forest and over 95 percent of the large trees, yet dipterocarp leaves are unavailable to most vertebrate plant eaters because of the high concentration of toxic chemicals in their leaves. Many species of gliding animals avoid eating dipterocarp leaves and so must travel widely through the forest, bypassing the dipterocarp trees, to find the leaves they need to eat. And gliding is a more efficient manner of traveling between trees than descending to the ground and walking or else jumping between trees.

6. According to paragraph 4, what special difficulty do leaf-eating animals face in a dipterocarp forest

- A. Dipterocarp trees are less leafy than other canopy trees.
- B. There is no efficient method of getting from one tree to another.
- C. Most trees are very tall with leaves that are difficult to reach.
- D. There is a large distance between trees that have edible leaves.

【Paragraph 5】 Many carnivorous animals also may need to search more widely for food due to the lower abundance of insects and other prey. This is caused by dipterocarps' irregular flowering and fruiting cycles of two- to seven-year intervals, causing a scarcity of the flowers, fruits, seeds, and seedlings that are the starting point of so many food chains. The lower abundance of prey in dipterocarp forests forces animals such as lizards and geckos to move between tree crowns in search of food, with gliding being the most efficient means.

7. How does paragraph 5 relate to paragraph 4

- A. Paragraph 5 shows that the food-desert theory introduced in paragraph 4 can account for only part of what needs to be explained.
- B. Paragraph 5 explains why the author calls the theory set out in paragraph 4 the food-desert theory.
- C. Paragraph 5 completes the account of the food-desert theory begun in paragraph 4.
- D. Paragraph 5 outlines an alternative to the food-desert theory described in paragraph 4.

8. According to paragraph 5, what is responsible for the relative scarcity of insects and other prey in dipterocarp forests

- A. The inability of insects and other prey to eat the toxic seeds, flowers, and fruits of dipterocarp trees
- B. The efficiency with which lizards and geckos hunt their prey
- C. The abundance of carnivorous animals in dipterocarp forests
- D. Dipterocarps' irregular flowering and fruiting cycles

【Paragraph 4】 A final theory differs from the others in suggesting that it is the presence of dipterocarp trees themselves that is driving the evolution of gliding species. ■According to this view, dipterocarp forests can be food-deserts for the animals that live in them. ■The animals living in dipterocarp forests that have evolved gliding consist of two main feeding groups: leaf eaters and carnivores that eat small prey such as insects and small vertebrates. ■For leaf-eating gliders the problem is not the absence of any leaves but the desert-like absence of edible leaves. Dipterocarp trees often account for 50 percent or more of the total number of canopy trees in a forest and over 95 percent of the large trees, yet dipterocarp leaves are unavailable to most vertebrate plant eaters because of the high concentration of toxic chemicals in their leaves. ■Many species of gliding animals avoid eating dipterocarp leaves and so must travel widely through the forest, bypassing the dipterocarp trees, to find the leaves they need to eat. And gliding is a more efficient manner of traveling between trees than descending to the ground and walking or else jumping between trees.

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

For each group, a dipterocarp forest is like a desert in that food resources are few and far apart.

Where would the sentence best fit?

10. **【Directions】** Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Various theories have been proposed to explain the unique abundance and diversity of gliding animals in the rain forests of Southeast Asia.

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Answer Choices

- A. One theory is that so many gliding species evolved in Southeast Asia because the forests are exceptionally tall, but there is evidence that calls that theory into question.
- B. The fact that gliding animals are most abundant in the short-stature forests of China, Vietnam, and Thailand shows that gliding did not evolve as an adaptation to an environment of tall trees.
- C. Ecologists have shown that the abundance of gliding animals in different regions of the world corresponds to variations in tree height, canopy structure, and abundance of vines.
- D. The hypothesis that gliding evolved to compensate for a scarcity of vines linking tree canopies overlooks problematic evidence from both Southeast Asian and Amazonian forests.
- E. In forests that are dominated by tall trees, jumping from tree to tree or descending to the ground may be a more efficient way of traveling through the forest than gliding.
- F. Dipterocarp trees create an environment in which many species must travel widely to find food, and gliding may have evolved as a rapid and efficient way of moving between tree crowns.

Passage 28 - Vocalization in Frogs

The tungara frog is a small terrestrial vertebrate that is found in Central America. Tungara frogs breed in small pools, and breeding groups range from a single male to choruses of several hundred males. The advertisement call of a male tungara frog is a strange noise, a whine that starts at a frequency of 900 hertz and sweeps downward to 400 hertz in about 400 milliseconds. The whine may be produced by itself, or it may be followed by one or several chucks or clucking sounds. When a male tungara frog is calling alone in a pond, it usually gives only the whine portion of the call, but as additional males join a chorus, more and more of the frogs produce calls that include chucks. Scientists noted that male tungara frogs calling in a breeding pond added chucks to their calls when they heard the recorded calls of other males played back. That observation suggested that it was the presence of other calling males that incited frogs to make their calls more complex by adding chucks to the end of the whine.

What advantage would a male frog in a chorus gain from using a whine-chuck call instead of a whine? Perhaps the complex call is more attractive to female frogs than the simple call. Michael Ryan and Stanley Rand tested that hypothesis by placing female tungara frogs in a test arena with a speaker at each side. One speaker broadcast a pre-recorded whine call, and the second speaker broadcast a whine-chuck. When female frogs were released individually in the center of the arena, fourteen of the fifteen frogs tested moved toward the speaker broadcasting the whine-chuck call.

If female frogs are attracted to whine-chuck calls in preference to whine calls, why do male frogs give whine-chuck calls only when other males are present? Why not always give the most attractive call possible? One possibility is that whine-chuck calls require more energy than whines, and males save energy by only using whine-chucks when competition with other males makes the energy expenditure necessary. However, measurements of the energy expenditure of calling of male tungara frogs showed that energy cost was not related to the number of chucks. Another possibility is that male frogs giving whine-chuck calls are more vulnerable to predators than frogs giving only whine calls. Tungara frogs in breeding choruses are preyed upon by a species of frog-eating bats, *Trachops cirrhosis*, and it was demonstrated that the bats locate the frogs by homing on their vocalizations.

In a series of playback experiments, Michael Ryan and Merlin Tuttle placed pairs of speakers in the forest and broadcast vocalizations of tungara frogs. One speaker played a recording of a whine and the other a recording of a whine-chuck. The bats responded as if the speakers were frogs: they flew toward the speakers and even landed on them. In five experiments at different sites, the bats approached speakers broadcasting whine-chuck (168 approaches versus 81). Thus, female frogs are not alone in finding whine-chuck calls more attractive than simple whines—an important predator of frogs also responds more strongly to the complex calls.

Ryan and his colleagues measured the rates of predation in tungara frog choruses of different sizes. Large choruses of frogs did not attract more bats than small choruses, and consequently the risk of predation for an individual frog was less in a large chorus than in a small one. Predation was an astonishing 19 percent of the frogs per night in the smallest chorus and a substantial 1.5 percent per night even in the largest chorus. When a male frog shifts from a simple whine to a whine-chuck call, it increases its risk of attracting a female, but it simultaneously increases its rate of attracting a predator. In small choruses, the competition from other males for females is relatively small, and the risk of predation is relatively large. Under these conditions it is apparently advantageous for a male tungara frog to give simple whines. However, as chorus size increases, competition with other males also increases while the risk of predation falls. In that situation, the advantage of giving a complex call apparently outweighs the risks.

【Paragraph 1】 The tungara frog is a small terrestrial vertebrate that is found in Central America. Tungara frogs breed in small pools, and breeding groups range from a single male to choruses of several hundred males. The advertisement call of a male tungara frog is a strange noise, a whine that starts at a frequency of 900 hertz and sweeps downward to 400 hertz in about 400 milliseconds. The whine may be produced by itself, or it may be followed by one or several chucks or clucking sounds. When a male tungara frog is calling alone in a pond, it usually gives only the whine portion of the call, but as additional males join a chorus, more and more of the frogs produce calls that include chucks. Scientists noted that male tungara frogs calling in a breeding pond added chucks to their calls when they heard the recorded calls of other males played back. That observation suggested that it was the presence of other calling males that incited frogs to make their calls more complex by adding chucks to the end of the whine.

1. According to paragraph 1, male tungara frogs add chucks to the whine they produce when

- A. potential mates are unable to hear the frequency of their whine sounds
- B. other males produce louder whine sounds than they do
- C. the frogs breed in large pools rather than small ones
- D. other males are present in their breeding pool

【Paragraph 2】 What advantage would a male frog in a chorus gain from using a whine-chuck call instead of a whine? Perhaps the complex call is more attractive to female frogs than the simple call. Michael Ryan and Stanley Rand tested that hypothesis by placing female tungara frogs in a test arena with a speaker at each side. One speaker broadcast a pre-recorded whine call, and the second speaker broadcast a whine-chuck. When female frogs were released individually in the center of the arena, fourteen of the fifteen frogs tested moved toward the speaker broadcasting the whine-chuck call.

2. What is the relationship of paragraph 2 in the passage to paragraph 1?

- A. Paragraph 2 provides additional support for a scientific hypothesis discussed in paragraph 1.
- B. Paragraph 2 questions the accuracy of a scientific observation discussed in paragraph 1.
- C. Paragraph 2 provides a possible explanation for a scientific observation discussed in paragraph 1.
- D. Paragraph 2 identifies some strengths and weaknesses of a scientific hypothesis discussed in paragraph 1.

【Paragraph 3】 If female frogs are attracted to whine-chuck calls **in preference to** whine calls, why do male frogs give whine-chuck calls only when other males are present? Why not always give the most attractive call possible? **One possibility is that whine-chuck calls require more energy than whines, and males save energy by only using whine-chucks when competition with other males makes the energy expenditure necessary.** However, measurements of the energy expenditure of calling of male tungara frogs showed that energy cost was not related to the number of chucks. Another possibility is that male frogs giving whine-chuck calls are more vulnerable to predators than frogs giving only whine calls. Tungara frogs in breeding choruses are preyed upon by a species of frog-eating bats, *Trachops cirrhosis*, and it was demonstrated that the bats locate the frogs by homing on their vocalizations.

3. To be attracted to whine-chuck calls “**in preference to**” whine calls means

- A. to like whine-chuck calls instead of whine calls
- B. to like whine-chuck calls in addition to whine calls
- C. to like whine-chuck calls followed by whine calls
- D. to like whine-chuck calls more than whine calls

4. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Males may save energy when competing for mates by using only whine-chuck calls rather than both whines and whine-chucks.
- B. Males expend as much of their energy on whine-chuck calls as on whine calls when competing with other males.
- C. Males save energy by using whine-chuck calls only when competing with other males.
- D. Males that save energy by using only whines are less able to compete with other males.

【Paragraph 4】 In a series of playback experiments, Michael Ryan and Merlin Tuttle placed pairs of speakers in the forest and broadcast vocalizations of tungara frogs. One speaker played a recording of a whine and the other a recording of a whine-chuck. The bats responded as if the speakers were frogs: they flew toward the speakers and even landed on them. In five experiments at different sites, the bats approached speakers broadcasting whine-chuck (168 approaches versus 81). Thus, female frogs are not alone in finding whine-chuck calls more attractive than simple whines—an important predator of frogs also responds more strongly to the complex calls.

5. According to paragraph 4, all of the following are true of the playback experiments EXCEPT

- A. Female frogs and predator bats approached the broadcasting speakers.
- B. The bats responded more strongly to the whine-chuck calls than they responded to the whine calls.
- C. Each speaker played a different kind of male frog call.
- D. The same experiment was repeated at different locations.

6. According to paragraph 4, the playback experiments of Ryan and Tuttle demonstrated which of the following?

- A. Tungara frogs use both whines and whine-chucks in their vocalizations.
- B. Female tungara frogs are attracted to both whine and whine-chuck vocalizations.
- C. Female tungara frogs and predators of tungara frogs are attracted to different types of vocalizations.
- D. Frog-eating bats are attracted to whine-chuck calls more than to whine alone.

【Paragraph 5】 Ryan and his colleagues measured the rates of predation in tungara frog choruses of different sizes. Large choruses of frogs did not attract more bats than small choruses, and consequently the risk of predation for an individual frog was less in a large chorus than in a small one. Predation was an astonishing 19 percent of the frogs per night in the smallest chorus and a substantial 1.5 percent per night even in the largest chorus. When a male frog shifts from a simple whine to a whine-chuck call, it increases its risk of attracting a female, but it simultaneously increases its rate of attracting a predator. In small choruses, the competition from other males for females is relatively small, and the risk of predation is relatively large. Under these conditions it is apparently advantageous for a male tungara frog to give simple whines. However, as chorus size increases, competition with other males also increases while the risk of predation falls. In that situation, the advantage of giving a complex call apparently outweighs the risks.

7. According to paragraph 5, all of the following are true about tungara frog vocalizations EXCEPT

- A. The larger the frog chorus, the smaller the chance there is of a particular frog being eaten by a predatory bat.
- B. The larger the frog chorus, the louder each individual frog calls.
- C. The smaller the frog chorus, the easier it is for a frog to attract a female.
- D. The smaller the frog chorus, the more likely it becomes that frog using the whine-chuck vocalization will be attacked

by a bat

8. Which of the following can be inferred from paragraph 5 about the behavior of male tungara frogs?

- A. When in small choruses they use less effective mating calls to decrease their risk of predation.
- B. They avoid joining a large chorus in a breeding pool because it increases the risk of predation.
- C. They avoid the use of the whine-chuck call whenever there is the risk of predators.
- D. They attempt to avoid predation by making their calls at night.

【Paragraph 5】 Ryan and his colleagues measured the rates of predation in tungara frog choruses of different sizes. Large choruses of frogs did not attract more bats than small choruses, and consequently the risk of predation for an individual frog was less in a large chorus than in a small one. Predation was an astonishing 19 percent of the frogs per night in the smallest chorus and a substantial 1.5 percent per night even in the largest chorus. ■When a male frog shifts from a simple whine to a whine-chuck call, it increases its risk of attracting a female, but it simultaneously increases its risk of attracting a predator. ■In small choruses, the competition from other males for females is relatively small, and the risk of predation is relatively large. ■Under these conditions it is apparently advantageous for a male tungara frog to give simple whines. ■However, as chorus size increases, competition with other males also increases while the risk of predation falls. In that situation, the advantage of giving a complex call apparently outweighs the risks.

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

Predation, therefore, is a risk in choruses of all sizes, but the risk varies depending on the type of call used.

Where would the sentence best fit?

10. 【Directions】 An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

In order to attract females, male tungara frogs use two kinds of calls: a whine and a whine-chuck.

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Answer Choices

- A. Tungara frogs generally use simple calls when they wish to attract a mate, and complex calls when they wish to avoid predation.
- B. The hypothesis that whine calls are used to save energy when males are not in immediate competition with each other has been disproved by showing that chuck calls do not require more energy.
- C. Most males gather in groups of several hundreds when calling because the rate of predation from bats is so high in small groups.
- D. Two hypotheses have been put forward about why females and frog-eating bats are more attracted to males using whine-chuck calls.
- E. Tungara females overwhelmingly favor the whine-chuck call used by the males, but so do certain bats that prey upon tungara frogs.
- F. Male tungara frogs use the whine-chuck call in large groups, where their risk of predation is lower, and the whine call

in small groups, where their risk is higher.

Passage 29 - Preventing Overgrowth among Tree Branches

One way trees prevent themselves from having too many branches is simply by shedding (dropping off) branches once they have fulfilled their purpose. This happens as the tree gets bigger and grows new outer layers of foliage that shade the inner and lower branches. In most large trees, the center of the canopy contains only large branches, small branches and fine twigs are found only at the canopy's edge. In the shaded center, the small branches that would once have occupied that space are long gone. Trees like the true cypresses regularly shed small twigs complete with leaves toward the end of summer. Most other trees shed only branches that prove unproductive. If a branch is not producing enough carbohydrate to cover its own running costs—i.e., it needs to be subsidized by other branches because, for example, it is being shaded and receives little light—it will usually be got rid of. This prevents unproductive branches from being a drain on the tree and removes the wind drag (the force of air resistance) from useless branches.

Branches are shed for reasons other than lack of light. In dry parts of the world, it is common for trees and shrubs to lose smaller branches to save water. Small branches have the thinnest bark (the protective outer covering of a tree) and greatest surface area and thus are the source of most water loss once the leaves have been lost. The creosote bush of United States deserts self-prunes, or removes parts of itself, in the face of extreme heat or drought, starting from the highest and most exposed twigs and working downward to bigger and bigger branches; it's a desperate act because if the creosote bush loses too much wood, it dies. Shedding branches can also be useful for self-propagation. Most poplar trees and willow trees characteristic of waterways will readily drop branches, which take root when washed up on muddy banks further downstream.

How are branches shed? In the simplest cases, dead branches rot and fall off, or healthy branches are snapped off by wind, snow, and animals. Some willows have a brittle zone at the base of small branches that encourages breaking in the wind, seemingly for propagation. Other cases of "natural pruning" are more startling: elm trees, and to a certain extent, others, such as oaks, have a reputation for dropping large branches (up to half a meter in diameter) with no warning on calm, hot afternoons. Such dramatic shedding appears to be due to a combination of internal water stress coupled with heat expansion affecting cracks and decayed wood.

Many trees, however, shed branches deliberately. In this situation, branches are shed in the same way as foliage in autumn by the prior formation of a corky layer that leaves the wound sealed over with cork, which in turn is undergrown with wood the following year. In hardwoods, branches up to a meter in length and several centimeters in diameter can be shed normally after the leaves have fallen in the autumn (maples are unusual in casting branches mainly in spring and early summer). Oaks tend to shed small twigs up to the thickness of a pencil, beech may shed larger ones, and birches dump whole branches of dead twigs. Pine trees shed their clusters of needles (which really are short branches), and members of the redwood family shed their small branchlets with leaves. Typically, in hardwood trees, something around 10 percent of terminal branches are lost each year through a mixture of deliberate shedding and being broken off.

Another way of reducing potential congestion is to make some branches smaller than others. Branches in the shade grow smaller than those in the sun. But trees can also regulate branch length from within. In many trees there is a clear distinction between long and short branches or shoots. The long shoots build the framework of the tree, making it bigger. The job of the short shoots (called spur shoots by horticulturalists) is to produce leaves, and commonly flowers, at more or less the same position every year. To maintain flexibility, any one shoot can switch from long to short or vice versa depending on internal factors, light levels, and damage.

【Paragraph 1】 One way trees prevent themselves from having too many branches is simply by shedding (dropping off) branches once they have fulfilled their purpose. This happens as the tree gets bigger and grows new outer layers of foliage that shade the inner and lower branches. In most large trees, the center of the canopy contains only large branches, small branches and fine twigs are found only at the canopy’s edge. In the shaded center, the small branches that would once have occupied that space are long gone. Trees like the true cypresses regularly shed small twigs complete with leaves toward the end of summer. Most other trees shed only branches that prove unproductive. **If a branch is not producing enough carbohydrate to cover its own running costs—i.e., it needs to be subsidized by other branches because, for example, it is being shaded and receives little light—it will usually be got rid of.** This prevents unproductive branches from being a drain on the tree and removes the wind drag (the force of air resistance) from useless branches.

1. All of the following situations are mentioned in paragraph 1 for a tree to shed its branches EXCEPT
 - A. endangering other branches
 - B. building up on a tree
 - C. wasting a tree’s resources
 - D. growing larger
2. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.
 - A. A tree will usually shed branches that use more carbohydrate than they produce.
 - B. Branches that are shaded usually do not receive enough light to produce all the carbohydrate they need.
 - C. If a tree gets rid of a branch, it is usually because other branches lack enough carbohydrate to subsidize it.
 - D. If a branch is shaded and cannot produce as much carbohydrate as it needs, it will usually be subsidized by other branches.

【Paragraph 2】 Branches are shed for reasons other than lack of light. In dry parts of the world, it is common for trees and shrubs to lose smaller branches to save water. Small branches have the thinnest bark (the protective outer covering of a tree) and greatest surface area and thus are the source of most water loss once the leaves have been lost. The creosote bush of United States deserts self-prunes, or removes parts of itself, in the face of extreme heat or drought, starting from the highest and most exposed twigs and working downward to bigger and bigger branches; it’s a desperate act because if the creosote bush loses too much wood, it dies. Shedding branches can also be useful for self-propagation. Most poplar trees and willow trees characteristic of waterways will readily drop branches, which take root when washed up on muddy banks further downstream.

3. Which of the following best describes the role of the explanation offered in paragraph 2?
 - A. Paragraph 2 questions this explanation by providing counterexamples of some trees.
 - B. Paragraph 2 presents additional evidence supporting this explanation.
 - C. Paragraph 2 discusses some additional reasons why trees shed branches
 - D. Paragraph 2 points out some additional consequences for trees besides the shedding of branches
4. According to paragraph 2, what is true of the creosote bush of United States deserts?
 - A. It tends to grow small branches during dry parts of the year.
 - B. It loses more water through its bark than through its leaves.
 - C. It loses its lower branches only after losing upper ones.

D. It sheds branches for the purpose of propagating itself.

【Paragraph 3】 How are branches shed? In the simplest cases, dead branches rot and fall off, or healthy branches are snapped off by wind, snow, and animals. Some willows have a brittle zone at the base of small branches that encourages breaking in the wind, seemingly for propagation. Other cases of “natural pruning” are more startling: elm trees, and to a certain extent, others, such as oaks, have a reputation for dropping large branches (up to half a meter in diameter) with no warning on calm, hot afternoons. Such dramatic shedding appears to be due to a combination of internal water stress coupled with heat expansion affecting cracks and decayed wood.

5. All of the following are mentioned in paragraph 3 as a way in which branches can be lost EXCEPT

- A. being broken off by the wind
- B. being shed for propagation
- C. becoming rotten
- D. becoming too large in diameter

6. Which of the following is mentioned in paragraph 3 in the shedding of large branches by oaks on calm, hot afternoons?

- A. The development of a brittle zone at the base of the branches
- B. The enlargement of cracks in the branches due to heat
- C. The rise of sudden bursts of wind that snap off decayed wood
- D. The seasonal need to propagate new trees

【Paragraph 4】 Many trees, however, shed branches deliberately. In this situation, branches are shed in the same way as foliage in autumn by the prior formation of a corky layer that leaves the wound sealed over with cork, which in turn is undergrown with wood the following year. In hardwoods, branches up to a meter in length and several centimeters in diameter can be shed normally after the leaves have fallen in the autumn (maples are unusual in casting branches mainly in spring and early summer). Oaks tend to shed small twigs up to the thickness of a pencil, beech may shed larger ones, and birches dump whole branches of dead twigs. Pine trees shed their clusters of needles (which really are short branches), and members of the redwood family shed their small branchlets with leaves. Typically, in hardwood trees, something around 10 percent of terminal branches are lost each year through a mixture of deliberate shedding and being broken off.

7. According to paragraph 4, what information can be learned from the deliberate shedding of branches by the trees?

- A. Limiting the size of branches being shed to comparatively small ones
- B. Forming a new layer of wood to seal the wounded area immediately after shedding
- C. Shedding leaves at the same time that branches are being shed
- D. Forming a layer of protective tissue before branch shedding begins

【Paragraph 5】 Another way of reducing potential **congestion** is to make some branches smaller than others. Branches in the shade grow smaller than those in the sun. But trees can also regulate branch length from within. In many trees there is a clear distinction between long and short branches or shoots. The long shoots build the framework of the tree, making it bigger. The job of the short shoots (called spur shoots by horticulturalists) is to produce leaves, and commonly flowers, at more or less the same position every year. To maintain flexibility, any one shoot can switch from long to short or vice versa depending on internal factors, light levels, and damage.

8. The word “**congestion**” in the passage is closet in meaning to

- A. loss
- B. damage
- C. overcrowding
- D. stress

【Paragraphs 1-2】 One way trees prevent themselves from having too many branches is simply by shedding (dropping off) branches once they have fulfilled their purpose. This happens as the tree gets bigger and grows new outer layers of foliage that shade the inner and lower branches. In most large trees, the center of the canopy contains only large branches, small branches and fine twigs are found only at the canopy’s edge. In the shaded center, the small branches that would once have occupied that space are long gone. Trees like the true cypresses regularly shed small twigs complete with leaves toward the end of summer. Most other trees shed only branches that prove unproductive. If a branch is not producing enough carbohydrate to cover its own running costs—i.e., it needs to be subsidized by other branches because, for example, it is being shaded and receives little light—it will usually be got rid of. This prevents unproductive branches from being a drain on the tree and removes the wind drag (the force of air resistance) from useless branches. ■

Branches are shed for reasons other than lack of light. ■In dry parts of the world, it is common for trees and shrubs to lose smaller branches to save water. ■Small branches have the thinnest bark (the protective outer covering of a tree) and greatest surface area and thus are the source of most water loss once the leaves have been lost. ■The creosote bush of United States deserts self-prunes, or removes parts of itself, in the face of extreme heat or drought, starting from the highest and most exposed twigs and working downward to bigger and bigger branches, it’s a desperate act because if the creosote bush loses too much food, it dies. Shedding branches can also be useful for self-propagation. Most poplar trees and willow trees characteristic of waterways will readily drop branches, which take root when washed up on muddy banks further downstream.

9. Look at the four squares 【■】 that indicate where the following sentence can be added to the passage.

A tree will also shed branches if its water supply is insufficient.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

For trees to remain healthy as they grow and as circumstances change, tree branches must change in various ways.

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Answer Choices

- A. Trees can benefit from shedding inefficient branches that consume more carbohydrates than they produce or that are a major source of water loss.
- B. Branches can be lost as a result of damage from weather, animals, or disease, but they can also be shed when they are no longer useful, much as leaves are shed in autumn.
- C. While branch shedding is common and may be necessary for a tree's survival, the corky layer that forms at sites where branches have been shed prevents additional growth in those areas for several years.
- D. Shedding large branches is such a desperate act for survival that the creosote bush is one of the few plants to use this mechanism for removing wood.
- E. Larger trees can self-propagate when water stress and heat expansion break off branches, as long as the shed branches fall on or can be transported to a location favorable for taking root.
- F. Trees prevent branch overcrowding in part by varying branch length through internal mechanisms such as having shoots that can switch from long to short or from short to long, as needed.

Passage 30 - Art and Culture of Pacific Northwest Communities

The 1,600-kilometer stretch of the northwestern Pacific coast of North America (from southern Alaska to Washington State) provided an ideal environment for the growth of stable communities. Despite the northerly latitude, the climate is temperate. Natural resources were originally so rich that the inhabitants could subsist by fishing and hunting and gathering, without the need to domesticate stock or cultivate the land. Forests yielded an abundance of wood for buildings, for boats, and for sculpture. Beyond them the Rocky Mountains were an impenetrable barrier against raids. The area appears to have been settled around 500 A.D. by tribes of diverse origins speaking mutually unintelligible languages: from north to south they include the Tlingit, the Haida, the Tsimshian, the Bella Coola, the Kwakiutl, and the Nootka. The culture to which they contributed has, nevertheless, an underlying homogeneity and a distinct visual character.

The peoples of the Northwest engaged in trade as well as warfare with one another, and this may account for the diffusion of cultural traits and artistic motifs throughout the area. Much of their art was concerned with religious ritual objects. But the rest is secular and springs from a preoccupation with the hereditary basis of their complex social structures.

The Tlingit and other nations or language groups were collections of autonomous village communities composed of one or more families, each with its own chief, who inherited his position through matrilineal descent. They had no centralized political or religious organization, but cohesion was given by extensive kinship networks established through marriage, and men and women were obliged to many outside the larger divisions of clans and moiety (tribal subdivisions) into which they were born and into which the social group was divided by matrilineal or patrilineal descent. Thus, families built up riches by marriage without any one family acquiring a dominant position.

Totem poles (see figure below), the most distinctive artistic product of the Northwest, were conspicuous declarations of prestige and of the genealogy (family history) by which it had been attained. These magnificent sculptures that probably originated as funerary monuments were first described by travelers in the late eighteenth century. Each one was carved from a single trunk of cedar, and the increasing availability of metal tools both permitted and encouraged more complex compositions and greater height—up to 27.4 meters. Their superimposed figures—eagles, beavers, whales, and so on—were crests (symbols of identity) that a chief inherited from his lineage, his clan, and his moiety. They were not objects of worship, though the animals carved on them might represent guardian spirits. Poles were designed according to a governing principle of bilateral symmetry, with their various elements interlocked so that they seem to grow organically out of one another, creating a unity of symbolism, form, and surface.

Masks (see figure above) are the most varied of the carvings from the Northwest, where they were an essential part of communal life. In style they range from an almost abstract symbolism to combinations of human and animal features and to a lifelike naturalism sometimes bordering on caricature (a style that strongly exaggerates features or characteristics), taken to its extreme in Tlingit war helmets. Some differences must have been due to those among the cultures in which they were created, but their place of origin cannot always be ascertained as they seem to have passed from one contiguous nation to another in the course of trade or warfare. Although carvers worked according to established conventions, no two masks are identical and those with basic similarities reveal varying degrees of skill.

The major differences between masks were determined by their purpose. Some were representations of chiefs and their ancestors and made to be displayed and treasured as heirlooms. Although they appear to record the styles of facial tattooing customary in different groups, it is difficult to say how far they were intended to be portraits rather than generalized images. Many masks, sometimes quite large, were carved to be worn in dance-dramas that re-enacted and kept alive the cohesive

myths of a culture. Often, Tlingit masks were made for religious leaders and incorporated the animals that were believed to be their spirit helpers. Conjuring up forces of nature from the ocean, the forests, or the sky, they mediated between life on Earth and the inscrutable powers around and above.

【Paragraph 1】 The 1,600-kilometer stretch of the northwestern Pacific coast of North America (from southern Alaska to Washington State) provided an ideal environment for the growth of stable communities. Despite the northerly latitude, the climate is temperate. Natural resources were originally so rich that the inhabitants could subsist by fishing and hunting and gathering, without the need to domesticate stock or cultivate the land. Forests yielded an abundance of wood for buildings, for boats, and for sculpture. Beyond them the Rocky Mountains were an impenetrable barrier against raids. The area appears to have been settled around 500 A.D. by tribes of diverse origins speaking mutually unintelligible languages: from north to south they include the Tlingit, the Haida, the Tsimshian, the Bella Coola, the Kwakiutl, and the Nootka. The culture to which they contributed has, nevertheless, an underlying homogeneity and a distinct visual character.

1. According to paragraph 1, which of the following was NOT one of the factors that made the northwestern Pacific coast perfect for the development of stable communities?

- A. temperate climate
- B. natural protection from raids
- C. abundant natural resources
- D. easily cultivated land

2. When the author states that the tribes speak “mutually unintelligible” languages, this means that the tribes

- A. speak languages of similar difficulty
- B. cannot understand each other’s languages
- C. cannot understand the languages of tribes in neighboring areas
- D. understand the languages of tribes of similar origin

【Paragraph 2】 The peoples of the Northwest engaged in trade as well as warfare with one another, and this may account for the **diffusion** of cultural traits and artistic motifs throughout the area. Much of their art was concerned with religious ritual objects. But the rest is secular and springs from a preoccupation with the hereditary basis of their complex social structures.

3. The word “**diffusion**” in the passage is closest in meaning to

- A. development
- B. variety
- C. similarity
- D. spread

【Paragraph 4】 Totem poles (see figure below), the most distinctive artistic product of the Northwest, were conspicuous declarations of prestige and of the genealogy (family history) by which it had been attained. These magnificent sculptures that probably originated as funerary monuments were first described by travelers in the late eighteenth century. Each one was carved from a single trunk of cedar, and the increasing availability of metal tools both permitted and encouraged more complex compositions and greater height—up to 27.4 meters. Their superimposed figures—eagles, beavers, whales, and so on—were crests (symbols of identity) that a chief inherited from his lineage, his clan, and his moiety. They were not objects of worship, though the animals carved on them might represent guardian spirits. Poles were designed according to a governing principle of bilateral symmetry, with their various elements interlocked so that they seem to grow organically out of one another, creating a unity of symbolism, form, and surface.

4. According to paragraph 4, all of the following were true of totem poles EXCEPT

- A. Each was made from a single tree.
- B. They sometimes featured images of animals thought to provide protection against harm.
- C. Larger numbers began to be made after metal tools became increasingly available.
- D. Their decorative designs became more complex over time.

【Paragraph 5】 Masks (see figure above) are the most varied of the carvings from the Northwest, where they were an essential part of communal life. In style they range from an almost abstract symbolism to combinations of human and animal features and to a lifelike naturalism sometimes bordering on caricature (a style that strongly exaggerates features or characteristics), taken to its extreme in Tlingit war helmets. **Some differences must have been due to those among the cultures in which they were created, but their place of origin cannot always be ascertained as they seem to have passed from one contiguous nation to another in the course of trade or warfare.** Although carvers worked according to established conventions, no two masks are identical and those with basic similarities reveal varying degrees of skill.

5. The author mentions “Tlingit war helmets” in the passage to

- A. explain why masks were an essential part of communal life
- B. provide an example of masks representing a stylistic extreme
- C. identify one of the uses of masks
- D. provide an example of masks characterized by abstract symbolism

6. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Some characteristics of masks must be due to cultural and national factors, such as whether they were made during a period of warfare or of peace and trade.
- B. As one contiguous nation exchanged masks with another during trade or warfare, it became more difficult to determine the place of origin of masks.
- C. Some differences among masks were probably due to their different origins, but because they passed from one nation to another, their origin cannot always be determined.
- D. As masks of different cultural origins passed from one nation to another during trade or warfare, they acquired certain differences depending on how they were used.

【Paragraph 6】 The major differences between masks were determined by their purpose. Some were representations of chiefs and their ancestors and made to be displayed and treasured as heirlooms. Although they appear to record the styles of facial tattooing customary in different groups, it is difficult to say how far they were intended to be portraits rather than generalized images. Many masks, sometimes quite large, were carved to be worn in dance-dramas that re-enacted and kept alive the cohesive myths of a culture. Often, Tlingit masks were made for religious leaders and incorporated the animals that were believed to be their spirit helpers. Conjuring up forces of nature from the ocean, the forests, or the sky, they mediated between life on Earth and the inscrutable powers around and above.

7. What can be inferred from paragraph 6 about masks representing chiefs and their ancestors?

- A. They were made to be exhibited and appreciated rather than used.
- B. They include scenes depicting the heroic achievements of chiefs and their ancestors.
- C. They were made from different materials than were other types of masks.
- D. They were sometimes worn by non-family members during religious rituals.

8. Paragraph 6 mentions all of the following as purposes of masks EXCEPT

- A. They were made to be worn in dance-dramas.
- B. They were used as models for tattoo artists to copy.
- C. They were made for religious leaders and showed their animal spirit helpers.
- D. They were valued family possessions representing chiefs and their ancestors.

【Paragraph 5】 ■Masks (see figure above) are the most varied of the carvings from the Northwest, where they were an essential part of communal life. ■In style they range from an almost abstract symbolism to combinations of human and animal features and to a lifelike naturalism sometimes bordering on caricature (a style that strongly exaggerates features or characteristics), taken to its extreme in Tlingit war helmets. Some differences must have been due to those among the cultures in which they were created, but their place of origin cannot always be ascertained as they seem to have passed from one contiguous nation to another in the course of trade or warfare. ■Although carvers worked according to established conventions, no two masks are identical and those with basic similarities reveal varying degrees of skill. ■

9. Look at the four squares 【■】 that indicate where the following sentence can be added to the passage.

If we consider 100 raven masks made by different carvers, for example, some will have been well executed, others less so, and one may have been made by an exceptional carver.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

The peoples who lived along the northwestern coast of North America had stable communities and a distinctive artistic style.

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Answer Choices

- A. The people lived on food from the sea, animals, and wild plants, and used wood from the forests for building construction, boat making, and sculpture.
- B. In the absence of a central political or religious organization, wide kinship networks established through interclan marriage helped to maintain social cohesion.
- C. Totem poles had a chief's symbols of identity imposed on them, and were thus used as objects of worship, whereas masks were used for secular purposes.
- D. Although the peoples of the northwestern communities came from various language groups, their languages were closely related and they could generally understand one another.
- E. The most remarkable artistic products of the northwestern peoples were totem poles and masks, which often represented families and their spirit guides.
- F. Carvers made masks using a principle of bilateral symmetry that resulted in the creation of a unity of symbolism, form, and surface.

Passage 31 - Domestication

About 10,000 years ago, after nearly 4 million years of human evolution and over 100,000 years of successful foraging for food, human beings, although isolated, nearly simultaneously developed a subsistence strategy that involved domesticated plants and animals. Why? Some scholars seek a single, universal explanation that would be valid for all cases of domestication. Thus, it has been argued that domestication is the outcome of population pressure, as the increasing hunting-and-gathering human population overwhelmed the existing food resources. Others point to climate change or famine, as the post-glacial climate got drier. Increasing archaeological research has made it clear, however, that the evidence in favor of any single-cause, universally applicable explanation, is not strong.

Some scholars have proposed universally applicable explanations that take several different phenomena into account. One such explanation, called the broad-spectrum foraging argument (the argument that humans employed a subsistence strategy based on obtaining a wide range of plants and animals), is based on a reconstruction of the environmental situation that followed the retreat of the most recent glaciers. The very large animals of the Ice Age began to die out and were replaced by increased numbers of smaller animals. As sea levels rose to cover the continental shelves, fish and shellfish became more plentiful in the warmer, shallower waters. The effects on plants were equally dramatic, as forests and woodlands expanded into new areas. Consequently, scholars argue, people had to change their diets from big-game hunting to broad-spectrum foraging for plants and animals by hunting, fishing, and gathering. This broadening of the economy is said to have led to a more secure subsistence base, the emergence of sedentary communities, and a growth in population. In turn, population growth pressured the resource base of the area, and people were forced to eat so-called third-choice foods, particularly wild grain, which was difficult to harvest and process but which responded to human efforts to increase yields.

Although the broad-spectrum foraging argument seems to describe plant domestication in the New World, the most recent evidence from ancient southwestern Asia does not support it. There is also evidence for the development of broad-spectrum foraging in Europe, but domestication did not follow. Rather, domesticated crops were brought into Europe by people from southwestern Asia—where the broad-spectrum revolution had not occurred.

A very different argument comes from Barbara Bender, who argues that before farming began, there was competition between local groups to achieve dominance over each other through feasting and the expenditure of resources on ritual and exchange, engaging in a kind of prehistoric arms race. To meet increasing demands for food and other resources, land use was intensified, and the development of food production followed.

This argument clearly emphasizes social factors, rather than environmental or technical factors, and takes a localized, regional approach. It is supported by ethnography (direct and systematic observations of a human culture) concerning competitive exchange activities, such as the potlatch (traditional celebrations in which groups gather and give gifts) of the indigenous inhabitants of the northwest coast of North America. These people were foragers in a rich environment that enabled them to settle in relatively permanent villages without farming or herding. Competition among neighboring groups led to ever-more elaborate forms of competitive exchange, with increasingly large amounts of food and other goods being given away at each subsequent potlatch. As suggestive as Bender's argument is, however, it is difficult to find evidence for competitive feasting in archaeological remains.

Recently, archaeologists have avoided grand theories claiming that a single, universal process was responsible for domestication wherever it occurred. Many prefer to take a regional approach, searching for causes particular to one area that may or may not apply to other areas. Currently, the most powerful explanations seem to be multiple-strand theories that

consider the combined local effects of climate, environment, population, technology, social organization, and diet on the emergence of domestication.

【Paragraph 1】 About 10,000 years ago, after nearly 4 million years of human evolution and over 100,000 years of successful foraging for food, human beings, although isolated, nearly simultaneously developed a subsistence strategy that involved domesticated plants and animals. Why? Some scholars seek a single, universal explanation that would be valid for all cases of domestication. Thus, it has been argued that domestication is the outcome of population pressure, as the increasing hunting-and-gathering human population overwhelmed the existing food resources. Others point to climate change or famine, as the post-glacial climate got drier. Increasing archaeological research has made it clear, however, that the evidence in favor of any single-cause, universally applicable explanation, is not strong.

1. According to paragraph 1, all of the following have been proposed as the primary cause of the development of subsistence strategies that involved domestication EXCEPT

- A. growing population pressure on existing food sources
- B. the drying of the climate
- C. the movement of human populations to new parts of the world
- D. famine

【Paragraph 2】 Some scholars have proposed universally applicable explanations that take several different phenomena into account. One such explanation, called the broad-spectrum foraging argument (the argument that humans employed a subsistence strategy based on obtaining a wide range of plants and animals), is based on a reconstruction of the environmental situation that followed the retreat of the most recent glaciers. The very large animals of the Ice Age began to die out and were replaced by increased numbers of smaller animals. As sea levels rose to cover the continental shelves, fish and shellfish became more plentiful in the warmer, shallower waters. The effects on plants were equally dramatic, as forests and woodlands expanded into new areas. Consequently, scholars argue, people had to change their diets from big-game hunting to broad-spectrum foraging for plants and animals by hunting, fishing, and gathering. This broadening of the economy is said to have led to a more secure subsistence base, the emergence of sedentary communities, and a growth in population. **In turn, population growth pressured the resource base of the area, and people were forced to eat so-called third-choice foods, particularly wild grain, which was difficult to harvest and process but which responded to human efforts to increase yields.**

2. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Human efforts to increase yields of wild grains relieved the pressure population growth put on the resource base of the area.
- B. The resource base of the area was pressured by population growth because third-choice foods were difficult to harvest and process.
- C. Although wild grains responded to human efforts to increase yields, they were third-choice foods because they were difficult to harvest and process.
- D. Population growth put pressure on available food resources, forcing people to eat foods that were less preferred but that responded to human efforts to increase yields.

3. According to paragraph 2, the broad-spectrum foraging argument holds that humans shifted from big-game hunting to a hunter-gatherer lifestyle primarily because

- A. they had begun developing more sedentary communities
- B. populations required a broader range of food sources
- C. it was easier and more effective to hunt smaller animals
- D. the very large Ice Age animals had begun to die out

【Paragraph 3】 Although the broad-spectrum foraging argument seems to describe plant domestication in the New World, the most recent evidence from ancient southwestern Asia does not support it. There is also evidence for the development of broad-spectrum foraging in Europe, but domestication did not follow. Rather, domesticated crops were brought into Europe by people from southwestern Asia—where the broad-spectrum revolution had not occurred.

4. According to paragraph 3, there is evidence that broad-spectrum foraging

- A. was introduced into Europe by people coming from southwestern Asia
- B. never developed in ancient southwestern Asia
- C. became well established in Europe only shortly before domestication developed there
- D. developed independently in Europe and in southwestern Asia

5. The main purpose of paragraph 3 in the passage's discussion of domestication is to

- A. illustrate why the broad-spectrum argument cannot be applied universally as an explanation of domestication
- B. support the importance of broad-spectrum foraging in contributing to the development of domestication in the New World
- C. call into question the idea that the broad-spectrum foraging ever led to the development of domestication
- D. help explain why domestication and broad-spectrum foraging developed simultaneously

【Paragraph 4】 A very different argument comes from Barbara Bender, who argues that before farming began, there was competition between local groups to achieve dominance over each other through feasting and the expenditure of resources on ritual and exchange, engaging in a kind of prehistoric arms race. To meet increasing demands for food and other resources, land use was intensified, and the development of food production followed.

6. According to the Barbara Bender, what caused prehistoric people to experience “increasing demands for food and other resources”?

- A. the manner in which they used land
- B. their failure to have developed farming
- C. competition among groups to control one another
- D. poor food-production techniques, which led to low yields

【Paragraph 5】 This argument clearly emphasizes social factors, rather than environmental or technical factors, and takes a localized, regional approach. It is supported by ethnography (direct and systematic observations of a human culture) concerning competitive exchange activities, such as the potlatch (traditional celebrations in which groups gather and give gifts) of the indigenous inhabitants of the northwest coast of North America. These people were foragers in a rich environment that enabled them to settle in relatively permanent villages without farming or herding. Competition among neighboring groups led to ever-more elaborate forms of competitive exchange, with increasingly large amounts of food and other goods being given away at each subsequent potlatch. As suggestive as Bender’s argument is, however, it is difficult to find evidence for competitive feasting in archaeological remains.

7. According to paragraph 5, the potlatch activities support which of the following ideas?

- A. Foragers were able to live in permanent villages without farming.
- B. Social factors such as the competitive exchange of food may have led to domestication.
- C. Competition among neighboring groups made a foraging way of life preferable to domestication.
- D. Increasingly large amounts of food were easily available for competitive exchange.

【Paragraph 6】 Recently, archaeologists have avoided grand theories claiming that a single, universal process was responsible for domestication wherever it occurred. Many prefer to take a regional approach, searching for causes particular to one area that may or may not apply to other areas. Currently, the most powerful explanations seem to be multiple-strand theories that consider the combined local effects of climate, environment, population, technology, social organization, and diet on the emergence of domestication.

8. Paragraph 6 supports which of the following ideas about recent theories of the development of domestication?

- A. They are based on the assumption that the causes of domestication are easier to identify in some areas than in others.
- B. They focus on identifying the single process that was primarily responsible for domestication in any particular region.
- C. They assume that the causes of domestication varied according to different regions.
- D. They tend to be poorly supported by archaeological evidence.

【Paragraph 1】 About 10,000 years ago, after nearly 4 million years of human evolution and over 100,000 years of successful foraging for food, human beings, although isolated, nearly simultaneously developed a subsistence strategy that involved domesticated plants and animals. Why? ■Some scholars seek a single, universal explanation that would be valid for all cases of domestication. ■Thus, it has been argued that domestication is the outcome of population pressure, as the increasing hunting-and-gathering human population overwhelmed the existing food resources. ■Others point to climate change or famine, as the post-glacial climate got drier. ■Increasing archaeological research has made it clear, however, that the evidence in favor of any single-cause, universally applicable explanation is not strong.

9. Look at the four squares **【■】** that indicate where the following sentence could be added to the passage.

Scholars have developed a number of hypotheses to explain the historical origins of agriculture.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

About 10,000 years ago, humans living in very different parts of the world nearly simultaneously began domesticating plants and animals.

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Answer Choices

- A. Some theories aim to explain the emergence of domestication everywhere -- either by a single cause or by the interaction of several phenomena—but none are well supported by the evidence.
- B. One scholar does not attribute domestication to environmental or technical factors, arguing instead that it can be explained by a need for ever increasing amounts of food for competitive feasting.
- C. One assumption that all domestication theories have in common is that humans began the process that resulted in domestication only because of pressure from growing population.
- D. According to the broad-spectrum foraging argument, domestication was developed by human groups to provide a subsistence base that would permit the development of sedentary communities.
- E. Theories that take a regional approach to the development of domestication are able to take social factors into account rather than being limited to archaeological evidence.
- F. Currently, the most powerful theories focus on a particular area and try to explain the emergence of domestication there by the combined local effect of climate, environment, population, and other factors.

Passage 32 - Hunting and the Setting of Inner Eurasia

Inner Eurasia refers to the large continental area extending from Russia in the west to the Pacific Ocean, and to the north of Iran, India, and most of China. The first systematic colonization of parts of Inner Eurasia occurred about 80,000 to 90,000 years ago, which is relatively late in human history compared with Africa, Europe, and southern Asia. Why was it difficult to settle?

The long, cold, arid winters of this region's steppes (grass covered plains) posed two distinctive problems for human settlers. The first was how to keep warm. Humans may have used fire even a million years ago. Presumably their ability to scavenge animal carcasses meant that they could use skins or furs for warmth. However, there are no signs of hearths before about 200,000 years ago. This suggests that humans used fire opportunistically and had not yet domesticated it enough to survive the harsh winters of Ice Age Inner Eurasia.

The second, even trickier problem was getting food during the long winters. It was not that Inner Eurasia lacked sources of food. The problem was that the food was of the wrong kind, and it was not always available. Humans could not exploit the abundant grasses of the steppes, and most of the edible plants died off in winter. So, for long periods of each year, it was necessary to rely mainly on meat. However, hunting is a more difficult, dangerous, and unreliable way of life than gathering. Animals, unlike plants, can evade predators and may even fight back. Hunters must also cover more ground than gatherers.

Setting Inner Eurasia meant overcoming these difficulties. Systematic and reliable hunting methods meant more than the development of new technologies, they also demanded new social structures. According to the formulation of archaeologist Lewis Binford, in a typical hunter/collector food-gathering strategy parties of hunters leave camps with very specific goals in mind, based on intimate knowledge of their intended prey. They may be away for days or weeks at a time and will often store their kill at specific storage sites, from which they will bring food back to a base camp when needed. As a result, they move their base camps less often than in forager societies, but they range more widely, their movements are more carefully planned, and so are their methods of storage.

Thus, hunters have to plan in advance and in great detail. They need reliable information about the movements and habits of animal prey over large areas, which can be secured only by maintaining regular contacts with neighboring groups. Finally, they need reliable methods of storage because, where plant foods cannot provide a dietary safety net, planning has to be precise and detailed to ensure that there is enough to tide them over in periods of shortage. Such planning appears in the choice of hunting gear, in the selection of routes and prey, in the choice of companions and timing, in the maintenance of communications with neighbors, and in the methods of storage. Failure at any point can be fatal for the entire group.

Hunting strategies also imply greater social complexity. The regular exchange of information and sometimes of material goods is critical not only within groups, but also between groups scattered over large distances. This increases the importance of symbolic exchanges of both goods and information, and makes it necessary to clarify group identity. Internally, groups may split for long periods as hunting parties travel over great distances. All in all, each group has to exist and survive in several distinct configurations.

For these reasons, archaeologist Clive Gamble has argued that the difficulties of setting the Eurasian heartland arose less from the technological than from the social and organizational features of human communities before 120,000 years ago. There is little or no archaeological evidence that these communities engaged in such practices as detailed planning or widespread contacts. Nor is there any physical evidence for storage, raw materials all come from within a radius of 50 kilometers-and usually less than 5 kilometers-of the sites where they were used.

【Paragraph 3】 The second, even trickier problem was getting food during the long winters. It was not that Inner Eurasia lacked sources of food. The problem was that the food was of the wrong kind, and it was not always available. Humans could not exploit the abundant grasses of the steppes, and most of the edible plants died off in winter. So, for long periods of each year, it was necessary to rely mainly on meat. However, hunting is a more difficult, dangerous, and unreliable way of life than gathering. Animals, unlike plants, can evade predators and may even fight back. Hunters must also cover more ground than gatherers.

1. According to paragraph 3, getting food during the long winters was a problem for humans in Inner Eurasia because

- A. the area lacked sources of food
- B. steppe animals were not suitable for humans to hunt
- C. the animals migrated when the edible plants died off each year
- D. the lack of edible plants in the winter forced humans to depend on meat

【Paragraph 4】 Setting Inner Eurasia meant overcoming these difficulties. Systematic and reliable hunting methods meant more than the development of new technologies, they also demanded new social structures. According to the formulation of archaeologist Lewis Binford, in a typical hunter/collector food-gathering strategy parties of hunters leave camps with very specific goals in mind, based on intimate knowledge of their intended prey. They may be away for days or weeks at a time and will often store their kill at specific storage sites, from which they will bring food back to a base camp when needed. As a result, they move their base camps less often than in forager societies, but they range more widely, their movements are more carefully planned, and so are their methods of storage.

2. Why does the author present an extended discussion of Lewis Binford's formulation of a typical “hunter/collector food-gathering strategy”?

- A. To introduce recent evidence from Inner Eurasia that has changed the archaeological understanding of the daily lives of human hunters
- B. To support the claim that setting Inner Eurasia must have required new social structures
- C. To challenge the claim from the previous paragraph that hunting is a difficult, dangerous, and unreliable way of life
- D. To present a theory about the life of humans in Inner Eurasia that will be contradicted later in the passage

3. All of the following are mentioned in paragraph 4 as behaviors that Lewis Binford considered typical of the hunter /collector food-gathering strategy EXCEPT

- A. having a detailed knowledge of the animals being hunted
- B. ranging over a relatively wide area in search of food
- C. storing extra food at places other than the campsite
- D. hunting away from the campsite for one day or less

【Paragraph 5】 Thus, hunters have to plan in advance and in great detail. They need reliable information about the movements and habits of animal prey over large areas, which can be secured only by maintaining regular contacts with neighboring groups. **Finally, they need reliable methods of storage because, where plant foods cannot provide a dietary safety net, planning has to be precise and detailed to ensure that there is enough to tide them over in periods of shortage.** Such planning appears in the choice of hunting gear, in the selection of routes and prey, in the choice of companions and timing, in the maintenance of communications with neighbors, and in the methods of storage. Failure at any point can be fatal for the entire group.

4. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Precise and detailed diet planning is needed for times when neither fresh plants nor animals are available.
- B. Careful planning for storage is necessary to ensure that there is sufficient food during periods when plant foods are not available.
- C. Planning must be precise and detailed in order to ensure that their supply of plant food is safe.
- D. To survive periods of shortage, they need either reliable methods of storage or precise and detailed planning.

5. According to paragraph 5, hunting trips require precise and detailed planning in terms of each of the following EXCEPT

- A. when to leave and where to go
- B. what animals will be hunted
- C. how the captured prey will be divided among neighboring groups
- D. who will make up the hunting party and what gear they will bring

【Paragraph 6】 Hunting strategies also imply greater social complexity. The regular exchange of information and sometimes of material goods is critical not only within groups, but also between groups scattered over large distances. This increases the importance of symbolic exchanges of both goods and information, and makes it necessary to clarify group identity. Internally, groups may split for long periods as hunting parties travel over great distances. All in all, each group has to exist and survive in several distinct **configurations**.

6. It can be inferred from paragraph 6 that hunting groups differ from other groups in that hunting groups

- A. tend to have the same individuals for longer periods of time
- B. have a greater need to establish a clear identity
- C. generally have social connections only with other hunting groups
- D. are less likely to exchange information with other groups

7. The word “**configurations**” in the passage is closest in meaning to

- A. environments
- B. arrangements
- C. situations
- D. conditions

【Paragraph 7】 For these reasons, archaeologist Clive Gamble has argued that the difficulties of setting the Eurasian heartland arose less from the technological than from the social and organizational features of human communities before 120,000 years ago. There is little or no archaeological evidence that these communities engaged in such practices as detailed planning or widespread contacts. Nor is there any physical evidence for storage, raw materials all come from within a radius of 50 kilometers-and usually less than 5 kilometers-of the sites where they were used.

8. According to paragraph 7, which of the following was true of human communities before 120,000 years ago?

- A. They obtained their raw materials from the area in which these materials were used.
- B. They left little in the way of archaeological evidence that can be used to understand their technologies.
- C. They were usually located less than 5 kilometers from other human communities.
- D. They stored raw materials at multiple locations.

【Paragraph 5】 Thus, hunters have to plan in advance and in great detail. ■They need reliable information about the movements and habits of animal prey over large areas, which can be secured only by maintaining regular contacts with neighboring groups. ■Finally, they need reliable methods of storage because, where plant foods cannot provide a dietary safety net, planning has to be precise and detailed to ensure that there is enough to tide them over in periods of shortage. ■Such planning appears in the choice of hunting gear, in the selection of routes and prey, in the choice of companions and timing, in the maintenance of communications with neighbors, and in the methods of storage. ■Failure at any point can be fatal for the entire group.

9. Look at the four squares **【■】** that indicate where the following sentence can be added to the passage.

The consequences of inadequate planning are serious.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

The long, cold winters of Inner Eurasia made the setting of the region difficult for humans.

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Answer Choices

- A. Although humans had fire and animal skins for warmth, they lacked the technology that would have allowed them to hunt animals over a large territory.
- B. Although humans had sufficient means of storage, they could not gather enough edible plants to last them through the year.
- C. Hunting requires social complexity, since information and goods must be exchanged among groups that are scattered across a large territory and that have different members at different times.
- D. Heavy snowfall and extreme temperatures made hunting impossible in Inner Eurasia for much of the year and forced humans to depend on grasses for survival.
- E. Humans would have needed to survive the winters by hunting, which would have required them to be expert planners and organizers.
- F. The absence of certain kinds of archaeological evidence of / sites suggests that before 120,000 years ago, humans weren't socially sophisticated enough to survive in Inner Eurasia.

Passage 33 - Origins of the Megaliths

Since the days of the earliest antiquarians, scholars have been puzzled by the many Neolithic (4000B.C.~2000B.C.) communal tombs known as megaliths along Europe's Atlantic seaboard. Although considerable variations are found in the architectural form of these impressive monuments, there is a general overriding similarity in design and, particularly, in the use of massive stones.

The construction of such large and architecturally complex tombs by European barbarians struck early prehistorians as unlikely. The Bronze Age seafaring civilizations that lived in the region of the Aegean Sea (3000B.C.~1000B.C.), among whom collective burial and a diversity of stone-built tombs were known, seemed a probable source of inspiration. It was suggested that Aegean people had visited Iberia in southwestern Europe in search of metal ores and had introduced the idea of collective burial in massive tombs, which then spread northward to Brittany, Britain, North Germany, and Scandinavia.

Radiocarbon dates for a fortified settlement of megalith builders at Los Millares in Spain appeared to confirm this picture, though dates for megaliths in Brittany seemed too early. When calibrated, however, it became clear that radiocarbon dates were universally too early to support a Bronze Age Aegean origin. It is now clear that the megaliths are a western and northern European invention, not an introduced idea. Even so, they are still a subject of speculation and inquiry. What induced their builders to invest massive efforts in erecting such monumental tombs? How was the necessary labor force assembled? What underlies their striking similarities?

One answer to the last question was proposed by Professor Grahame Clark, one of Britain's greatest prehistorians. Investigating the megaliths of southern Sweden, he noted that one group was concentrated in coastal locations from which deep-sea fish such as cod, haddock, and ling could have been caught in winter. Historically, much of the Atlantic was linked by the travels of people who fished, and this could well have provided a mechanism by which the "megalith idea" and fashions in the style of tomb architecture spread between coastal Iberia, Brittany, Ireland, western England and Scotland, and Scandinavia. The high concentrations of megaliths on coasts and the surprising number of megaliths found on small islands may support a connection with fishing.

Professor Colin Renfrew of the University of Cambridge, England, however, views the similarities as similar responses to similar needs. At the structural level, the passage that forms a major element of many graves could have been devised independently in different areas to meet the need for repeated access to the interior of these communal tombs. Other structural resemblances could be due to similarities in the raw materials available. In answer to the question of why the idea of building monumental tombs should arise independently in a number of areas, he cites the similarities in their backgrounds.

Most megaliths occur in areas inhabited in the postglacial period by Mesolithic hunter-gatherers (8500B.C.~4000B.C.). Their adoption of agriculture through contact with Neolithic farmers, Renfrew argues, led to a population explosion in the region and consequent competition for farmland between neighboring groups. In the face of potential conflict, the groups may have found it desirable to define their territories and emphasize their boundaries. The construction of megaliths could have arisen in response to this need.

Renfrew has studied two circumscribed areas, the Scottish islands of Arran and Rousay, to examine this hypothesis more closely. He found that a division of the arable land into territories, each containing one megalith, results in units that correspond in size to the individual farming communities of recent times in the same area. Each unit supported between 10

and 50 people. The labor needed to put up a megalith would probably be beyond the capabilities of a community this size. But Renfrew argues that the cooperation of other communities could be secured by some form of recognized social incentive—perhaps a period of feasting at which communal building was one of several activities.

Most megaliths contain collective burials. Different tombs used different arrangements, but there seems to have been an underlying theme: people placed in these tombs were representative of their society, but their identity as individuals was not important. The tombs belonged to the ancestors, through whom the living society laid claim to their land. This interpretation reinforces Renfrew's view of the megaliths as territorial markers.

【 Paragraph 1 】 Since the days of the earliest antiquarians, scholars have been puzzled by the many Neolithic (4000B.C.~2000B.C.) communal tombs known as megaliths along Europe's Atlantic seaboard. Although considerable variations are found in the architectural form of these impressive monuments, there is a general overriding similarity in design and, particularly, in the use of massive stones.

【Paragraph 2】 The construction of such large and architecturally complex tombs by European barbarians struck early prehistorians as unlikely. The Bronze Age seafaring civilizations that lived in the region of the Aegean Sea (3000B.C.~1000B.C.), among whom collective burial and a diversity of stone-built tombs were known, seemed a probable source of inspiration. It was suggested that Aegean people had visited Iberia in southwestern Europe in search of metal ores and had introduced the idea of collective burial in massive tombs, which then spread northward to Brittany, Britain, North Germany, and Scandinavia.

1. According to paragraph 2, early prehistorians thought the Aegean people of the Bronze Age might have influenced megalith building along the Atlantic seaboard because they

- A. had established commercial routes along the Atlantic seaboard
- B. had been in Iberia, where they introduced the idea of burial in very large tombs
- C. were thought to have found megaliths in Iberia when searching for metals
- D. were thought to have passed along the concept of burial in monumental tombs as they explored Brittany, Britain, North Germany and Scandinavia

【Paragraph 3】 Radiocarbon dates for a fortified settlement of megalith builders at Los Millares in Spain appeared to confirm this picture, though dates for megaliths in Brittany seemed too early. When calibrated, however, it became clear that radiocarbon dates were universally too early to support a Bronze Age Aegean origin. It is now clear that the megaliths are a western and northern European invention, not an introduced idea. Even so, they are still a subject of speculation and inquiry. What induced their builders to invest massive efforts in erecting such monumental tombs? How was the necessary labor force assembled? What underlies their striking similarities?

2. In paragraph 3, why does the author discuss the results of radiocarbon dates?

- A. To support the idea that megaliths spread rapidly during the Bronze Age
- B. To question the idea that megaliths have a religious origin
- C. To provide evidence against the theory that Bronze Age Aegeans inspired the megaliths
- D. To argue that the megaliths in Brittany are older than the megaliths in Los Millares

【Paragraph 4】 One answer to the last question was proposed by Professor Grahame Clark, one of Britain's greatest prehistorians. Investigating the megaliths of southern Sweden, he noted that one group was concentrated in coastal locations from which deep-sea fish such as cod, haddock, and ling could have been caught in winter. Historically, much of the Atlantic was linked by the travels of people who fished, and this could well have provided a mechanism by which the "megalith idea" and fashions in the style of tomb architecture spread between coastal Iberia, Brittany, Ireland, western England and Scotland, and Scandinavia. The high concentrations of megaliths on coasts and the surprising number of megaliths found on small islands may support a connection with fishing.

3. According to paragraph 4, what did Professor Clark propose as a result of studying the megaliths of southern Sweden

- A. Swedish megaliths are nearly identical to megaliths elsewhere.
- B. People who traveled for fishing may have been responsible for the spread of megaliths in Europe.
- C. Swedish megaliths were probably built after other European megaliths were built.
- D. Megaliths in Europe were usually located near sites for deep-sea fishing in winter.

【Paragraph 5】 Professor Colin Renfrew of the University of Cambridge, England, however, views the similarities as similar responses to similar needs. At the structural level, the passage that forms a major element of many graves could have been devised independently in different areas to meet the need for repeated access to the interior of these communal tombs. Other structural resemblances could be due to similarities in the raw materials available. In answer to the question of why the idea of building monumental tombs should arise independently in a number of areas, he cites the similarities in their backgrounds.

4. What is the purpose of discussing the passage that forms a major element of many graves

- A. To provide an example of a commonly occurring feature of megaliths that might be related to a similar need
- B. To argue that similarities in raw materials were responsible for the similarity of passages
- C. To explain how repeated access to the interior of the communal tombs was possible
- D. To provide evidence that the builders of the megaliths had similar backgrounds

【Paragraph 6】 Most megaliths occur in areas inhabited in the postglacial period by Mesolithic hunter-gatherers (8500B.C.~4000B.C.). Their adoption of agriculture through contact with Neolithic farmers, Renfrew argues, led to a population explosion in the region and consequent competition for farmland between neighboring groups. In the face of potential conflict, the groups may have found it desirable to define their territories and emphasize their boundaries. The construction of megaliths could have arisen in response to this need.

5. According to paragraph 6, Professor Renfrew has argued that one factor leading to the rise of megaliths in Europe was

- A. the adoption of farming by Mesolithic hunter-gatherers
- B. the transition from a glacial to a postglacial climate
- C. the relocation of Mesolithic populations from one region to another
- D. the conflict over whether areas inhabited by Mesolithic peoples would be used for farming

【Paragraph 7】Renfrew has studied two circumscribed areas, the Scottish islands of Arran and Rousay, to examine **this hypothesis** more closely. He found that a division of the arable land into territories, each containing one megalith, results in units that correspond in size to the individual farming communities of recent times in the same area. Each unit supported between 10 and 50 people. The labor needed to put up a megalith would probably be beyond the capabilities of a community this size. But Renfrew argues that the cooperation of other communities could be secured by some form of recognized social incentive—perhaps a period of feasting at which communal building was one of several activities.

6. The phrase “**this hypothesis**” in the passage refers to the idea that

- A. there was competition for territory between Mesolithic hunter-gathers and invading Neolithic farmers
- B. a population explosion brought about a division of the region’s Neolithic farmers into neighboring groups
- C. the need of neighboring groups to define their territories led to the construction of megaliths
- D. the construction of megaliths was a way of competing for farmland

7. According to paragraph 7, what did Renfrew conclude about the megaliths of Arran and Rousay?

- A. Each megalith was associated with a specific agricultural community.
- B. Each megalith was built by between 10 and 50 people.
- C. Some megaliths were built using stones quarried at other places.
- D. Some megaliths were built gradually over time rather than all at once.

【Paragraph 8】Most megaliths contain collective burials. Different tombs used different arrangements, but there seems to have been an underlying theme: people placed in these tombs were representative of their society, but their identity as individuals was not important. The tombs belonged to the ancestors, through whom the living society laid claim to their land. This interpretation reinforces Renfrew’s view of the megaliths as territorial markers.

8. According to the passage, all of the following were true of the megaliths along the Atlantic seaboard EXCEPT

- A. They often had a main passageway.
- B. They identified the individuals buried within them.
- C. They were built before the Aegean Bronze Age.
- D. They differed somewhat in style from region to region.

【Paragraph 7】Renfrew has studied two circumscribed areas, the Scottish islands of Arran and Rousay, to examine this hypothesis more closely. ■He found that a division of the arable land into territories, each containing one megalith, results in units that correspond in size to the individual farming communities of recent times in the same area. ■Each unit supported between 10 and 50 people. ■The labor needed to put up a megalith would probably be beyond the capabilities of a community this size. ■But Renfrew argues that the cooperation of other communities could be secured by some form of recognized social incentive—perhaps a period of feasting at which communal building was one of several activities.

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

So it might seem that megaliths could not have been used by an individual community to mark its land.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Megaliths found along Europe's Atlantic seaboard have long puzzled scholars.

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Answer Choices

- A. The Bronze Age Aegeans most probably built some of the tombs in Iberia.
- B. Scientific evidence supports the idea that the megaliths were a western and northern European invention.
- C. Most megaliths are found in coastal regions, suggesting that people fishing may have used them to guide their travels.
- D. Archeologists have found enough indicators to believe that the layout of tombs in the landscape reflects each community's social organization.
- E. The high proportion of coastal megaliths has given rise to the idea that megalith building was related to fishing.
- F. It has been suggested that megaliths arose in response to the spread of agriculture and competition for farmland.

Passage 34 - Consolidated Industry in the United States

Laws of incorporation passed in the United States in the 1830s and 1840s made it easier for business organizations to raise money by selling stock to members of the public. The ability to sell stock to a broader public made it possible for entrepreneurs to gather vast sums of capital and undertake large projects. This led to the emergence of modern corporations as a major force in the United States after 1865. These large, national business enterprises needed more systematic administrative structures. As a result, corporate leaders introduced a set of managerial techniques that relied on systematic division of responsibilities, a carefully designed hierarchy of control, careful cost-accounting procedures, and perhaps above all a new breed of business executive: the middle manager, who formed a layer of command between workers and owners. Efficient administrative capabilities helped make possible another major feature of the modern corporation: consolidation (combining many things into one).

Businessmen created large, consolidated organizations primarily through two methods. One was horizontal integration—the combining of multiple firms engaged in the same enterprise into a single corporation. The consolidation of many different railroad lines into one company was an example. Another method, which became popular in the 1890s, was vertical integration—the taking over of all the different businesses on which a company relied for its primary function. Thus, Carnegie steel controlled mines and railroads as well as steel mills.

The most celebrated corporate empire of the late nineteenth century was John D. Rockefeller's Standard Oil. Shortly after 1865, Rockefeller launched a refining company in Cleveland, Ohio, and immediately began trying to eliminate his competition. Allying himself with other wealthy capitalists, he proceeded methodically to buy out competing refineries. In 1870, he formed the Standard Oil Company of Ohio, which in a few years had acquired twenty of the twenty-five refineries in Cleveland, as well as plants in Pittsburgh, Philadelphia, New York, and Baltimore. He built his own barrel factories, warehouses, and pipelines. Standard Oil owned its own railroad freight cars and developed its own marketing organization. By the 1880s, Rockefeller had established such dominance within the petroleum industry that to much of the nation he served as a leading symbol of monopoly.

Rockefeller and other industrialists saw consolidation as a way to cope with what they believed was the greatest curse of the modern economy, "cutthroat competition." Most businessmen claimed to believe in free enterprise and a competitive marketplace, but in fact they feared that substantial competition could result in instability and ruin for all. As the movement toward consolidation accelerated, new vehicles emerged to facilitate it. The railroads began with so-called pool arrangements—informal agreements among various companies to stabilize rates and divide markets. But if even a few firms in an industry were unwilling to cooperate (as was almost always the case), the pool arrangements collapsed. The failure of the pools led to new techniques of consolidation. At first, the most successful such technique was the creation of the "trust"—pioneered by Standard Oil in the early 1880s and perfected by the banker J. P. Morgan. Under a trust agreement, stockholders in individual corporations transferred their stocks to a small group of trustees in exchange for shares in the trust itself. Owners of trust certificates often had no direct control over the decisions of the trustees, they simply received a share of the profits of the combination. The trustees themselves, on the other hand, might literally own only a few companies but could exercise effective control over many.

In 1889, the state of New Jersey helped produce a third form of consolidation by changing its laws of incorporation to permit companies to buy up the stock of other companies. Other states soon followed. These changes made the trust unnecessary and permitted actual corporate mergers. Rockefeller, for example, quickly relocated Standard Oil to New Jersey and created there what became known as a holding company—a central corporate body that would buy up the stock of various members of the

Standard Oil trust and establish direct, formal ownership of the corporations in the trust.

【Paragraph 1】 Laws of incorporation passed in the United States in the 1830s and 1840s made it easier for business organizations to raise money by selling stock to members of the public. The ability to sell stock to a broader public made it possible for entrepreneurs to gather vast sums of capital and undertake large projects. This led to the emergence of modern corporations as a major force in the United States after 1865. These large, national business enterprises needed more systematic administrative structures. **As a result, corporate leaders introduced a set of managerial techniques that relied on systematic division of responsibilities, a carefully designed hierarchy of control, careful cost-accounting procedures, and perhaps above all a new breed of business executive: the middle manager, who formed a layer of command between workers and owners.** Efficient administrative capabilities helped make possible another major feature of the modern corporation: consolidation (combining many things into one).

1. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Corporate leaders expanded the role of middle managers, who now had the responsibility to introduce systematic techniques of cost-accounting and a carefully designed hierarchy of control.
- B. Corporate leaders replaced the former hierarchy of control with a new system, the main advantage of which was that it divided responsibilities among middle managers.
- C. Corporate leaders were transformed into middle managers as a result of innovations such as the systematic division of responsibilities and the introduction of careful cost-accounting procedures.
- D. Corporate leaders introduced a variety of innovative managerial techniques, the most important probably being the middle manager, a new executive layer below owners.

【Paragraph 2】 Businessmen created large, consolidated organizations primarily through two methods. One was horizontal integration—the combining of multiple firms engaged in the same enterprise into a single corporation. The consolidation of many different railroad lines into one company was an example. Another method, which became popular in the 1890s, was vertical integration—the taking over of all the different businesses on which a company relied for its primary function. Thus, Carnegie steel controlled mines and railroads as well as steel mills.

2. Why does the author provide the information that “Carnegie Steel controlled mines and railroads as well as steel mills”?

- A. To challenge the idea that railroads generally integrated horizontally
- B. To help explain vertical integration by providing an example of a company using it
- C. To help explain how a company’s primary function influenced the method of integration it used
- D. To show that vertical integration was a much more effective technique for consolidation than horizontal integration was

【Paragraph 3】 The most celebrated corporate empire of the late nineteenth century was John D. Rockefeller’s Standard Oil. Shortly after 1865, Rockefeller launched a refining company in Cleveland, Ohio, and immediately began trying to eliminate his competition. Allying himself with other wealthy capitalists, he proceeded methodically to buy out competing refineries. In 1870, he formed the Standard Oil Company of Ohio, which in a few years had acquired twenty of the twenty-five refineries in Cleveland, as well as plants in Pittsburgh, Philadelphia, New York, and Baltimore. He built his own barrel factories, warehouses, and pipelines. Standard Oil owned its own railroad freight cars and developed its own marketing organization. By the 1880s, Rockefeller had established such dominance within the petroleum industry that to much of the nation he served as a leading symbol of monopoly.

3. According to paragraph 3, which of the following was true of John D. Rockefeller?

- A. He acquired most of the oil refineries in Cleveland, Ohio.
- B. He bought some companies solely because they made supplies for competing oil refineries.
- C. He limited sales of Standard Oil petroleum to companies associated with competing refineries.
- D. He built many more new oil refineries than he bought.

4. According to paragraph 3, the Standard Oil Company of Ohio owned all of the following EXCEPT

- A. a marketing organization
- B. railroad freight cars
- C. railroad lines
- D. barrel factories

【Paragraph 4】Rockefeller and other industrialists saw consolidation as a way to cope with what they believed was the greatest curse of the modern economy, “cutthroat competition.” Most businessmen claimed to believe in free enterprise and a competitive marketplace, but in fact they feared that substantial competition could result in instability and ruin for all. As the movement toward consolidation accelerated, new vehicles emerged to facilitate it. The railroads began with so-called pool arrangements—informal agreements among various companies to stabilize rates and divide markets. But if even a few firms in an industry were unwilling to cooperate (as was almost always the case), the pool arrangements collapsed. The failure of the pools led to new techniques of consolidation. At first, the most successful such technique was the creation of the “trust”—pioneered by Standard Oil in the early 1880s and perfected by the banker J. P. Morgan. Under a trust agreement, stockholders in individual corporations transferred their stocks to a small group of trustees in exchange for shares in the trust itself. Owners of trust certificates often had no direct control over the decisions of the trustees, they simply received a share of the profits of the combination. The trustees themselves, on the other hand, might literally own only a few companies but could exercise effective control over many.

5. According to paragraph 4, many industrialists in the 1880s worried that

- A. pool arrangements would divide markets
- B. new vehicles for pool arrangements would fail
- C. too much competition would destroy the modern economy
- D. trusts would be unable to exert adequate control over companies

6. According to paragraph 4, which of the following was a problem with pool arrangements?

- A. They were effective only with railroads.
- B. They could succeed only if all the firms in an industry cooperated.
- C. They were effective only in situations where rates had already been stabilized.
- D. They could be implemented only in industries with a large number of firms.

7. It can be inferred from paragraph 4 that trusts were more successful than pool arrangements at

- A. exercising effective control over the participating companies
- B. excluding less profitable companies
- C. allowing small stockholders to participate in decision making
- D. limiting the amount of money paid to the owners of individual corporations

【Paragraph 5】 In 1889, the state of New Jersey helped produce a third form of consolidation by changing its laws of incorporation to permit companies to buy up the stock of other companies. Other states soon followed. These changes made the trust unnecessary and permitted actual corporate mergers. Rockefeller, for example, quickly relocated Standard Oil to New Jersey and created there what became known as a holding company—a central corporate body that would buy up the stock of various members of the Standard Oil trust and establish direct, formal ownership of the corporations in the trust.

8. According to paragraph 5, why did Rockefeller move Standard Oil to New Jersey?

- A. To be in a better position to pressure the state to change its laws of incorporation
- B. To increase the number of corporations under his control in the Standard Oil trust
- C. To raise the needed amounts of money for the establishment of his new holding company
- D. To acquire direct, legal ownership of the corporations in the Standard Oil trust

【Paragraph 3】 The most celebrated corporate empire of the late nineteenth century was John D. Rockefeller's Standard Oil. Shortly after 1865, Rockefeller launched a refining company in Cleveland, Ohio, and immediately began trying to eliminate his competition. Allying himself with other wealthy capitalists, he proceeded methodically to buy out competing refineries. ■ In 1870, he formed the Standard Oil Company of Ohio, which in a few years had acquired twenty of the twenty-five refineries in Cleveland, as well as plants in Pittsburgh, Philadelphia, New York, and Baltimore. ■ He built his own barrel factories, warehouses, and pipelines. ■ Standard Oil owned its own railroad freight cars and developed its own marketing organization. ■ By the 1880s, Rockefeller had established such dominance within the petroleum industry that to much of the nation he served as a leading symbol of monopoly.

9. Look at the four squares **【■】** that indicate where the following sentence could be added to the passage.

In addition to expanding horizontally, Rockefeller's company expanded vertically as well.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Businesses' increased ability to raise capital by selling stock led to the emergence of large corporations as a major force in the United States after 1865.

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Answer Choices

- A. Large businesses developed more efficient administrative structures, which allowed them to consolidate through horizontal integration, vertical integration, or both.
- B. Even though consolidation initially developed in manufacturing, it was J. P. Morgan in the banking industry who came up with the most successful consolidation technique.
- C. The most famous corporation was Rockefeller's Standard Oil, which acquired many competing businesses and controlled its supply sources, eventually establishing itself as a holding company.
- D. In order to limit competition as effectively as they could, industrialists created pool arrangements and then later trusts and holding companies.
- E. The rise of corporations as the dominant force in the American economy forced certain states to pass new laws that resulted in direct state control over consolidation.
- F. Corporate consolidation was an extremely complex process, and required enormous amounts of capital for carrying out various integration procedures.

Passage 35 - Costs of Quitting a Job

Economic theory predicts that when the costs of quitting one's job are relatively low, mobility is more likely. This observation underlines the analysis of the rise in quit rates during periods of prosperity, and the effects of mobility costs can be seen when looking at residential location and job turnover. Industries with high concentrations of employment in urban areas, where a worker's change of employer does not necessarily require investing in a change of residence, appear to have higher rates of job turnover than industries concentrated in nonmetropolitan areas do.

Beyond the costs that can be associated with such measurable characteristics as age and residential location are those that are psychic in nature. These latter costs, though unobservable to the researcher, are very likely to differ widely across individuals. Some people adapt more quickly to new surroundings than others do, for example. Recent studies have found considerable heterogeneity among workers in their propensity to change jobs, with one study reporting that almost half of all permanent separations that took place over a three-year period involved a small number (13 percent) of workers who had three or more separations during the period (in contrast, 31 percent of workers had no separations at all during the period).

It is also possible that the costs of job changing by employees vary internationally. Data suggest that workers in the United States may well be more likely to change employers than workers elsewhere may be. Indeed, data confirm that, on average, American workers have been with their current employers fewer years than workers in most other developed countries, particularly workers in Europe and Japan, have been with theirs. It is not known why Americans are more mobile than most others are, but one possibility relates to the lower levels of company training received by American workers. Another possibility, however, is that the costs of mobility are lower in the United States (despite the fact that Japan and Europe are more densely populated and hence more urban). What would create these lower costs?

One hypothesis that has received at least some investigation is that housing policies in Europe and Japan increase the costs of residential, and therefore job, mobility. Germany, the United Kingdom, and Japan, for example, have controls on the rent increases that proprietors can charge to existing renters while tending to allow proprietors the freedom to negotiate any mutually agreeable rent on their initial lease with the renter. Thus, it is argued that renters who move typically face very large rent increases in these countries. Similarly, subsidized housing is much more common in these countries than in the United States, but since it is limited relative to the demand for it, those British, German, or Japanese workers fortunate enough to live in subsidized units are reluctant (it is argued) to give them up. The empirical evidence on the implications of housing policy for job mobility, however, is both limited and mixed.

It could also be hypothesized that the United States, Australia, and Canada, all of which exhibit shorter job tenures than do most European countries or Japan, are large, sparsely populated countries that historically have attracted people willing to emigrate from abroad or resettle internally over long distances. In a country of "movers," moving may not be seen by either worker or employer as an unusual or especially traumatic event.

While questions remain about the causes of different job mobility rates across countries, the social desirability of job mobility can also be debated. On one hand, mobility can be seen as socially useful because it promotes both individual well-being and the quality of job matches. Moreover, the greater the number of workers and employers "in the market" at any given time, the more flexibility an economy has in making job matches that best adapt to a changing environment. Indeed, when focusing on this aspect of job mobility, economists have long worried whether economies have enough mobility. On the other hand, lower mobility costs (and therefore greater mobility) among workers may well serve to reduce the incentives of their employers to provide job training. Whether the presence of job changing costs is a social boon or bane, these costs and the mobility associated with them are factors with which all employers must contend.

【Paragraph 1】 Economic theory predicts that when the costs of quitting one’s job are relatively low, mobility is more likely. This observation underlines the analysis of the rise in quit rates during periods of prosperity, and the effects of mobility costs can be seen when looking at residential location and job turnover. **Industries with high concentrations of employment in urban areas, where a worker’s change of employer does not necessarily require investing in a change of residence, appear to have higher rates of job turnover than industries concentrated in nonmetropolitan areas do.**

1. According to paragraph 1, people are more likely to quit their jobs in which TWO of the following situations? To receive credit, you must select TWO answers.

- A. They are living in good economic times.
- B. They are moving from urban areas to non-urban areas.
- C. They are living in urban areas.
- D. They do not like their employers.

2. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Workers in urban areas change jobs less frequently than do those in nonmetropolitan areas because the costs associated with a change of residence are higher in urban areas.
- B. Industries located in urban areas experience higher rates of job turnover than do those in nonmetropolitan areas because workers can often change employers without having to change where they live.
- C. Industries located in urban areas tend to have lower rates of job turnover than do those in nonmetropolitan areas because they are more likely to invest in residences for workers.
- D. Workers in urban industries are likely to change jobs more frequently than are those in nonmetropolitan industries because it is less costly for workers to change residences in urban than in nonmetropolitan areas.

【Paragraph 2】 Beyond the costs that can be associated with such measurable characteristics as age and residential location are those that are psychic in nature. These latter costs, though unobservable to the researcher, are very likely to differ widely across individuals. Some people adapt more quickly to new surroundings than others do, for example. Recent studies have found considerable heterogeneity among workers in their propensity to change jobs, with one study reporting that almost half of all permanent separations that took place over a three-year period involved a small number (13 percent) of workers who had three or more separations during the period (in contrast, 31 percent of workers had no separations at all during the period).

3. Why does the author note that “Some people adapt more quickly to new surroundings than others do”?

- A. To argue that some people experience little psychic cost when they change jobs
- B. To support the claim that the psychic cost of changing jobs is likely to differ widely between individuals
- C. To illustrate why some psychic costs are unobservable to researchers
- D. To argue that psychic costs alone cannot fully explain changes in mobility rates

【Paragraph 4】 One hypothesis that has received at least some investigation is that housing policies in Europe and Japan increase the costs of residential, and therefore job, mobility. Germany, the United Kingdom, and Japan, for example, have controls on the rent increases that proprietors can charge to existing renters while tending to allow proprietors the freedom to negotiate any mutually agreeable rent on their initial lease with the renter. Thus, it is argued that renters who move typically face very large rent increases in these countries. Similarly, subsidized housing is much more common in these countries than in the United States, but since it is limited relative to the demand for it, those British, German, or Japanese workers fortunate enough to live in subsidized units are reluctant (it is argued) to give them up. The empirical evidence on the implications of housing policy for job mobility, however, is both limited and mixed.

4. According to paragraph 4, what may contribute to high mobility costs in Germany, the United Kingdom, and Japan?

- A. Rent control does not apply to a renter's first lease on a property.
- B. Governments have significantly reduced housing subsidies.
- C. There is little control on the rent increases that can be charged after the initial agreement.
- D. When a renter leaves a housing unit that has been subsidized, the unit will not be subsidized for the next renter.

5. What is the author's purpose in using the parenthetical phrases "it is argued" ?

- A. To indicate that the view that workers are reluctant to leave subsidized housing is widely accepted
- B. To suggest that the view that workers are reluctant to leave subsidized housing has not been proved true
- C. To emphasize that the view that workers are reluctant to leave subsidized housing was based on careful reasoning
- D. To oppose the view that workers are reluctant to leave subsidized housing

【Paragraph 5】 It could also be hypothesized that the United States, Australia, and Canada, all of which exhibit shorter job tenures than do most European countries or Japan, are large, sparsely populated countries that historically have attracted people willing to emigrate from abroad or resettle internally over long distances. In a country of "movers," moving may not be seen by either worker or employer as an unusual or especially **traumatic** event.

6. Paragraph 5 supports which of the following ideas about mobility costs for American workers compared with mobility costs for workers in most European countries?

- A. Mobility costs are higher for American workers because they have shorter job tenures.
- B. American workers get more help from employers in covering the costs of moving to a new job.
- C. The psychic costs of resulting internally to take a job are lower for American workers
- D. The economic costs of emigrating to take a job are higher for American workers

7. The word "**traumatic**" in the passage is closest in meaning to

- A. important
- B. unreasonable
- C. expensive
- D. upsetting

【Paragraph 6】 While questions remain about the causes of different job mobility rates across countries, the social desirability of job mobility can also be debated. On one hand, mobility can be seen as socially useful because it promotes both individual well-being and the quality of job matches. Moreover, the greater the number of workers and employers "in the market" at any given time, the more flexibility an economy has in making job matches that best adapt to a changing environment. Indeed, when focusing on this aspect of job mobility, economists have long worried whether economies have enough mobility. On the other hand, lower mobility costs (and therefore greater mobility) among workers may well serve to reduce the incentives of their employers to provide job training. Whether the presence of job changing costs is a social boon or bane, these costs and the mobility associated with them are factors with which all employers must contend.

8. According to paragraph 6, high job mobility rates may benefit an economy by

- A. making it more likely that the economic environment will change significantly
- B. encouraging employers to increase the sizes of their workforces
- C. making it more likely that jobs will be filled by people who are suited to them
- D. encouraging workers to improve their skills

【Paragraph 6】 While questions remain about the causes of different job mobility rates across countries, the social desirability of job mobility can also be debated. On one hand, mobility can be seen as socially useful because it promotes both individual well-being and the quality of job matches. ■ Moreover, the greater the number of workers and employers “in the market” at any given time, the more flexibility an economy has in making job matches that best adapt to a changing environment. ■ Indeed, when focusing on this aspect of job mobility, economists have long worried whether economies have enough mobility. ■ On the other hand, lower mobility costs (and therefore greater mobility) among workers may well serve to reduce the incentives of their employers to provide job training. ■ Whether the presence of job changing costs is a social boon or bane, these costs and the mobility associated with them are factors with which all employers must contend.

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage

According to this view, greater mobility could result in a less skilled workforce.

Where would the sentence best fit?

10. 【Directions】 An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selected THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

According to economic theory, workers are more likely to change jobs when the associated costs are low.

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Answer Choices

- A. Since job changes by a minority of workers can radically alter overall job mobility rates, job mobility rates tell us little about the mobility costs facing the average worker
- B. Residential location and individual psychic factors could account for some differences in job mobility among workers
- C. Economists argue strongly for job mobility despite the social and economic costs associated with it.
- D. Outside of the United States, subsidized housing and controls on rent increases explain why there is less job mobility in urban areas than in nonmetropolitan areas.
- E. Possibly due to housing and other differences, mobility costs may be lower in the United States than in most other developing nations, which could help account for differences in job mobility.
- F. High job mobility arguably has both benefits, in terms of individual well-being and economic flexibility, and economic costs.

Passage 36 - Controversy about Causing Emotion

The fact that we react to certain experiences with “Emotion” is obvious. For example, the feeling of embarrassment, which triggers a physiological response that may cause blushing, is caused by a foolish act committed in the company of friends. Although this description of an embarrassed reaction seems logical, the American psychologist William James, in 1884, believed that the course of an emotional experience follows another sequence of events.

Following the argument of James, what subjective experience tells us is completely opposite to the sequence of events in an emotional experience. First, he insisted that both physiological excitement and physical reaction are generated by an incident. Only then does the individual perceive or interpret the physical response as an emotion. That is, we associate blushing that caused by physical reaction with embarrassment, such as saying something silly may cause us to blush. In 1890, James went on to claim that “people feel sorry because they cry, furious because they strike, afraid because they shudder.” Simultaneously with James’ proposition, Carl Lange, a Danish physiologist and psychologist, independently formulated virtually similar theory. The James-Lange theory of emotion (Lange and James, 1922) suggests that different patterns of arousal in the autonomic nervous system create the different emotions people feel, and that physiological arousal occurs prior to perceiving the emotion.

In 1927, another early theory of emotion that challenged the James-Lange theory was proposed by Walter Cannon. He claimed that physical changes caused by the diverse emotions are not sufficiently distinct to allow people to distinguish one emotion from another. After Cannon stated his original theory, in 1934, it was further developed by physiologist Philip Bard. The Cannon-Bard theory suggests that the following chain of events takes place when an emotion is felt. Stimuli which trigger emotion are received by the senses and then are relayed simultaneously to the cerebral cortex, which imparts the conscious mental experience of the emotion, and to the sympathetic nervous system, which generates the physiological state of arousal. In other words, the feeling of emotion occurs roughly the same time when the physiological arousal is experienced. One does not cause the other.

In 1962, Schachter and Singer proposed a two-factor theory. Stanley Schachter thought that the early theories of emotion excluded a critical component that the subjective cognitive interpretation of why a state of arousal has occurred. According to this theory, two things must happen in order for a person to feel an emotion. At first, the person must experience physiological arousal. Then, for the person can label it as specific emotion, there must be a cognitive interpretation or explanation. Thus, Schachter delivered the conclusion that a true emotion can appear only if a person is physically aroused and can find the reason for it. When people are in a state of physiological arousal but do not know why they are aroused, they tend to label the state as an emotion that is appropriate to their situation at the time. There were several attempts to replicate the findings of this theory, but they have not been successful.

Richard Lazarus, in the 1990, proposed the emotion theory that most heavily emphasizes the cognitive aspect. According to his theory, the first step in an emotional response is cognitive appraisal, and all other aspects of emotion, including physiological arousal, rely on the cognitive appraisal. This theory is most compatible with the subjective experience of an emotion’s sequence of events-the sequence that William James reversed long ago. People first appraise a stimulus, or an event, when they encounter it. This cognitive appraisal determines whether the person will have an emotional response, and, if so, what type of response. From this appraisal, the physiological arousal and all other aspects of the emotion arise. In brief, Lazarus contends that emotions are roused when cognitive appraisals of events or circumstances are positive or negative-but not neutral. Some critics criticize the Lazarus theory by saying that some emotional reactions are instantaneous, which means they occur too rapidly to pass through a cognitive appraisal. In respond to the criticisms, Lazarus remarks that some mental

processing occurs without conscious awareness, meaning that a person should not know what he or she is responding to or what emotion to feel, or else, some form of cognitive realization must manifest but brief.

【Paragraph 1】 The fact that we react to certain experiences with “Emotion” is obvious. For example, the feeling of embarrassment, which triggers a physiological response that may cause blushing, is caused by a foolish act committed in the company of friends. Although this description of an embarrassed reaction seems logical, the American psychologist William James, in 1884, believed that the course of an emotional experience follows another sequence of events.

1. The author mentions a foolish act committed in the company of friends in order to
- A. give an idea that most people easily get embarrassed in a social environment
 - B. show that most experiences activate a physiological reaction
 - C. insist that an embarrassed reaction is usually unwarranted
 - D. provide an example of an experience that generates emotion

【Paragraph 2】 Following the argument of James, what subjective experience tells us is completely opposite to the sequence of events in an emotional experience. First, he insisted that both physiological excitement and physical reaction are generated by an incident. Only then does the individual perceive or interpret the physical response as an emotion. That is, we associate blushing that caused by physical reaction with embarrassment, such as saying something silly may cause us to blush. In 1890, James went on to claim that “people feel sorry because they cry, furious because they strike, afraid because they shudder.” Simultaneously with James’ proposition, Carl Lange, a Danish physiologist and psychologist, independently **formulated** virtually similar theory. The James-Lange theory of emotion (Lange and James, 1922) suggests that different patterns of arousal in the autonomic nervous system create the different emotions people feel, and that physiological arousal occurs prior to perceiving the emotion.

2. According to paragraph 2, which of the following is true of what James believed about an emotional experience?
- A. Emotions can be caused only when there is a specific response occurs in the body.
 - B. The sequence of events is not always the same for every emotional experience.
 - C. We are able to figure out the right sequence of events in an emotional experience through subjective experience.
 - D. Both a physical reaction and physiological arousal are triggered by the feeling of an emotion.
3. The word “**formulated**” in paragraph 2 is closest in meaning to
- A. published
 - B. developed
 - C. revealed
 - D. duplicated

【Paragraph 3】 In 1927, another early theory of emotion that challenged the James-Lange theory was proposed by Walter Cannon. He claimed that physical changes caused by the diverse emotions are not sufficiently distinct to allow people to distinguish one emotion from another. After Cannon stated his original theory, in 1934, it was further developed by physiologist Philip Bard. The Cannon-Bard theory suggests that the following chain of events takes place when an emotion is felt. Stimuli which trigger emotion are received by the senses and then are relayed simultaneously to the cerebral cortex, which imparts the conscious mental experience of the emotion, and to the sympathetic nervous system, which generates the physiological state of arousal. In other words, the feeling of emotion occurs roughly the same time when the physiological arousal is experienced. One does not cause the other.

4. According to paragraph 3, Walter Cannon claimed that the James-Lange theory of emotion is not convincing for which of the following reasons?

- A. The body can be affected by different emotions in similar ways.
- B. It is often not easy for people to distinguish one emotion from another.
- C. It is not significant enough for bodily changes to be perceived.
- D. It is often not obvious that bodily changes are caused by emotions or other factors.

【Paragraph 4】 In 1962, Schachter and Singer proposed a two-factor theory. Stanley Schachter thought that the early theories of emotion excluded a critical component that the subjective cognitive interpretation of why a state of arousal has occurred. According to this theory, two things must happen in order for a person to feel an emotion. At first, the person must experience physiological arousal. Then, for the person can label it as specific emotion, there must be a cognitive interpretation or explanation. Thus, Schachter delivered the conclusion that a true emotion can appear only if a person is physically aroused and can find the reason for it. When people are in a state of physiological arousal but do not know why they are aroused, they tend to label the state as an emotion that is appropriate to their situation at the time. There were several attempts to replicate the findings of this theory, but they have not been successful.

5. According to paragraph 4, the Schachter-Singer theory is different from earlier theories of emotion in which of the following ways?

- A. It suggests that there are several steps in an emotional experience.
- B. It shows the reason that people do not understand why they are physiologically aroused.
- C. It says that the first step of an emotional experience is physiological arousal.
- D. It explains that people must decide why they are aroused to experience emotion.

6. According to paragraph 4, what can be inferred about an emotion suggested by Schachter-Singer theory?

- A. It should be occurred just before a person physiologically aroused.
- B. It happens regardless of the fact that people know the reason why they are aroused.
- C. It has to be passed through a stimulation and clarification process, or people can't experience it.
- D. People can experience several emotions at once.

【Paragraph 5】 Richard Lazarus, in the 1990, proposed the emotion theory that most heavily emphasizes the cognitive aspect. According to his theory, the first step in an emotional response is cognitive appraisal, and all other aspects of emotion, including physiological arousal, rely on the cognitive appraisal. This theory is most compatible with the subjective experience of an emotion's sequence of events-the sequence that William James reversed long ago. People first appraise a stimulus, or an event, when they encounter it. This cognitive appraisal determines whether the person will have an emotional response, and, if so, what type of response. From this appraisal, the physiological arousal and all other aspects of the emotion arise. In brief, Lazarus contends that emotions are roused when cognitive appraisals of events or circumstances are positive or negative-but not neutral.

7. According to paragraph 5, which of the following is NOT true of the Lazarus' theory

- A. Interpretation of experience is more emphasized than any other theory.
- B. It indicates that a person first evaluates an event in order to have an emotion.
- C. It explains almost identical sequence of events to that of the subjective experience of an emotion.
- D. The theory of emotion proposed by William James is generally similar to this theory.

8. Which of the following best describes the organization of this passage?

- A. The author draws a comparison among different theories of emotion and claims that the last one is correct.
- B. The author chronologically introduces theories of emotion and identifies criticisms of each theory.
- C. The author verifies several theories of emotion and argues that each theory is not accurate enough.
- D. The author develops his own theory summarizing different theories of an emotional experience.

【Paragraph 3】 In 1927, another early theory of emotion that challenged the James-Lange theory was proposed by Walter Cannon. He claimed that physical changes caused by the diverse emotions are not sufficiently distinct to allow people to distinguish one emotion from another. ■After Cannon stated his original theory, in 1934, it was further developed by physiologist Philip Bard. ■The Cannon-Bard theory suggests that the following chain of events takes place when an emotion is felt. ■Stimuli which trigger emotion are received by the senses and then are relayed simultaneously to the cerebral cortex, which imparts the conscious mental experience of the emotion, and to the sympathetic nervous system, which generates the physiological state of arousal. ■In other words, the feeling of emotion occurs roughly the same time when the physiological arousal is experienced. One does not cause the other.

9. Look at the four squares **【■】** that indicate where the following sentence could be added to the passage.

The emotions of rage and fear, for instance, both include a rapid heartbeat, perspiration, and increased energy supplied to the muscles.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

There has been a controversy among researchers about the sequence of events in an emotional experience.

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Answer Choices

- A. Cognitive appraisal probably does not play a large role in an emotional experience, evidenced by the very brief span of time between an event and an emotional reaction.
- B. Two early theory of emotion both assert that that different emotions result from distinct changes in the body that correspond to particular emotions.
- C. There is a disagreement among researchers who emphasize the cognitive aspect of an emotion about whether cognitive interpretation comes before or after physiological arousal.
- D. Theories in disagreement with each other about the sequence of events in emotional experience concentrate on the extent to which cognition and interpretation are involved in an emotional experience.
- E. Some theories claim that physiological arousal comes either before or at the same time as the feeling of an emotion, and contradict the subjective experience of emotion.
- F. The Lazarus theory emphasized that an emotion comes from a positive or negative appraisal of a physiological arousal.

Passage 37 - Motor Development in Children

Control over one's motor behavior ranks among the infant's greatest achievements. Psychologists who study the acquisition of motor skills in children find it useful to distinguish between gross motor development, that is, motor skills which help children to get around in their environment such as crawling and walking, and fine motor development, which refers to smaller movement sequences like reaching and grasping.

The development of motor skills has implications beyond simply learning how to perform new actions: motor skills can have profound effects on other areas of development. For example, researchers have shown that infants with locomotor experience (experience moving around their environment) were less likely to make errors while searching for hidden objects. The ability to initiate movement around one's environment stimulates the development of memory, making hidden object tasks easier to solve. Psychology professor Carolyn Rovee-Collier argues that the onset of independent locomotion at around nine months old marks an important transition in memory development. Children who can move about the environment develop an understanding of locations such as here and there. Because infant memory is initially highly dependent on context, that is, the similarity between the situation where information is encoded (stored in memory) and where it is recalled, infants who have experience moving about the environment and who learn to spatially encode information become less dependent on context for successful recall. These examples show that gross motor development has implications beyond the immediately apparent benefits of crawling and walking.

Renowned psychologist Jean Piaget argued that the development of reaching and grasping was a key aspect of development because it formed an important link between biological adaptation and intellectual adaptation. Reaching and grasping are voluntary actions under the infant's control, and as such, they open up exciting new possibilities in their ability to explore the environment. An infant who reaches for and grasps an object so as to explore it pushes his development forward as he engages in processes such as adapting his grip to the size and shape of the object. Piaget argued that these early processes drive cognitive development in the first two years of an infant's life.

The development of reaching begins early on in life. Newborn infants seated in an upright position will swipe and reach towards an object placed in front of them, a behavior labeled "prereaching". These poorly coordinated behaviors start to decline around two months of age and are replaced by "directed reaching" which begins at about three months of age. At this time reaching becomes more coordinated and efficient, and improves in accuracy. According to research conducted by Clifton et al., the infant's reaching does not depend simply on the guidance of the hand and arm by the visual system but is controlled by proprioception, the sensation of movement and location based on the stimulation arising from bodily sources such as muscle contractions. By about nine months old, infants can adjust their reaching to take into account a moving object. However, nine-month-olds are far from expert reachers. A good deal of skill must still develop.

Once infants begin reaching they also begin to grasp the objects that are the target of their reaches. The ulnar grasp is seen when infants first engage in directed reaching. The ulnar grasp is a primitive form of grasping in which the infant's fingers close against its palm. The fingers seem to act as a whole, requiring the use of the palm in order to hold an object. Shortly after this accomplishment, when infants can sit upright on their own, they can acquire the ability to transfer objects from hand to hand. Around the end of the first year, infants will have graduated to using the pincer grasp where they use their index finger and thumb in an opposable manner (placing them opposite each other), resulting in a more coordinated and finely tuned grip which allows for the exploration of very small objects or those objects which demand specific actions for their operation, such as the knobs on a stereo system which require turning to the left or right to adjust volume.

【Paragraph 1】 Control over one's motor behavior ranks among the infant's greatest achievements. Psychologists who study the acquisition of motor skills in children find it useful to distinguish between gross motor development, that is, motor skills which help children to get around in their environment such as crawling and walking, and fine motor development, which refers to smaller movement sequences like reaching and grasping.

1. According to paragraph 1, the distinction between gross motor development and fine motor development is based primarily on
- A. how much control the infant has over the motor skills
 - B. when the motor skills are developed
 - C. the size of the movement sequences involved
 - D. the usefulness of the movement sequences involved

【Paragraph 2】 The development of motor skills has implications beyond simply learning how to perform new actions: motor skills can have profound effects on other areas of development. For example, researchers have shown that infants with locomotor experience (experience moving around their environment) were less likely to make errors while searching for hidden objects. The ability to initiate movement around one's environment stimulates the development of memory, making hidden object tasks easier to solve. Psychology professor Carolyn Rovee-Collier argues that the onset of independent locomotion at around nine months old marks an important transition in memory development. Children who can move about the environment develop an understanding of locations such as here and there. Because infant memory is initially highly dependent on context, that is, the similarity between the situation where information is encoded (stored in memory) and where it is recalled, infants who have experience moving about the environment and who learn to spatially encode information become less dependent on context for successful recall. These examples show that gross motor development has implications beyond the immediately apparent benefits of crawling and walking.

2. According to paragraph 2, why do infants with locomotor experience have less trouble locating hidden objects
- A. Moving around their environment helps infants to develop a better memory for spatial locations.
 - B. Moving around their environment increases infants' ability to make use of context to identify objects.
 - C. Moving around their environment gives infants more opportunity to correct their errors when searching for objects.
 - D. Moving around their environment reduces the time infants have to spend spatially encoding information.
3. According to paragraph 2, as a result of developing an understanding of here and there, infants are better able to
- A. describe the locations of objects in space
 - B. feel comfortable in new and unfamiliar situations
 - C. use context as an aid to recalling previously encoded information
 - D. recall information in situations unlike the one in which it was originally encoded

【Paragraph 3】 Renowned psychologist Jean Piaget argued that the development of reaching and grasping was a key aspect of development because it formed an important link between biological adaptation and intellectual adaptation. Reaching and grasping are voluntary actions under the infant's control, and as such, they open up exciting new possibilities in their ability to explore the environment. An infant who reaches for and grasps an object so as to explore it pushes his development forward as he engages in processes such as adapting his grip to the size and shape of the object. Piaget argued that these early processes drive cognitive development in the first two years of an infant's life.

4. What can be inferred from paragraph 3 about the cognitive development of an infant in its first two years of life as described by Piaget

- A. It is a sign of advanced development when an infant is able to control its urges to reach and grasp.
- B. Repeated practice reaching for and grasping objects results in important biological adaptations.
- C. Infants who spend large amounts of time in exciting environments have more difficulty in their intellectual development.
- D. An infant's development will be slower if it is not given the opportunity to reach for and hold objects.

【Paragraph 4】 The development of reaching begins early on in life. Newborn infants seated in an upright position will swipe and reach towards an object placed in front of them, a behavior labeled “prereaching”. These poorly coordinated behaviors start to decline around two months of age and are replaced by “directed reaching” which begins at about three months of age. At this time reaching becomes more coordinated and efficient, and improves in accuracy. According to research conducted by Clifton et al., the infant’s reaching does not depend simply on the guidance of the hand and arm by the visual system but is controlled by proprioception, the sensation of movement and location based on the stimulation arising from bodily sources such as muscle contractions. By about nine months old, infants can adjust their reaching to take into account a moving object. However, nine-month-olds are far from expert reachers. A good deal of skill must still develop.

5. In paragraph 4, why does the author emphasize the point that nine-month-olds are far from expert reacher?

- A. To support the idea that nine-month-olds vary a great deal in their reaching abilities
- B. To distinguish between the directed reaching and the non directed reaching of infants
- C. To stress that an infant's reaching skills continue to improve even after the first nine months
- D. To call into question the accuracy of the results presented by Clifton et al

6. According to paragraph 4, which of the following statements about directed reaching is true

- A. Directed reaching behaviors have typically developed by the time an infant is about two months old.
- B. Directed reaching behaviors do not appear until an infant is able to account for the movement of an object.
- C. Directed reaching is the earliest form of reaching behavior that infants develop.
- D. Directed reaching is controlled both by the visual system and by proprioception.

【Paragraph 5】 Once infants begin reaching they also begin to grasp the objects that are the target of their reaches. The ulnar grasp is seen when infants first engage in directed reaching. The ulnar grasp is a primitive form of grasping in which the infant’s fingers close against its palm. The fingers seem to act as a whole, requiring the use of the palm in order to hold an object. Shortly after this accomplishment, when infants can sit upright on their own, they can acquire the ability to transfer objects from hand to hand. **Around the end of the first year, infants will have graduated to using the pincer grasp where they use their index finger and thumb in an opposable manner (placing them opposite each other), resulting in a more coordinated and finely tuned grip which allows for the exploration of very small objects or those objects which demand specific actions for their operation, such as the knobs on a stereo system which require turning to the left or right to adjust volume.**

7. All of the following statements about the ulnar grasp are true EXCEPT

- A. It is a relatively uncoordinated form of grasping.
- B. It is used by infants when they first engage in directed reaching.
- C. It develops only after infants become able to sit upright on their own.
- D. It makes use of the palm as well as the fingers to hold an object.

8. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Infants of about a year old begin using their index finger and thumb to make more coordinated and finely tuned movements, allowing them to explore and manipulate small objects.
- B. Around the end of the first year, infants begin to use a type of grip on small objects that is more coordinated and finely tuned than was the pincer grasp.
- C. Infants begin handling very small or difficult-to-operate objects at about one year of age, resulting in improvements in their ability to grip objects with their thumb and fingers.
- D. When one-year-old infants begin using the pincer grasp, they become much more interested in very small objects (such as knobs on a stereo system).

【Paragraph 4】 ■The development of reaching begins early on in life. Newborn infants seated in an upright position will swipe and reach towards an object placed in front of them, a behavior labeled “prereaching”. ■These poorly coordinated behaviors start to decline around two months of age and are replaced by “directed reaching” which begins at about three months of age. ■At this time reaching becomes more coordinated and efficient, and improves in accuracy. ■According to research conducted by Clifton et al., the infant’s reaching does not depend simply on the guidance of the hand and arm by the visual system but is controlled by proprioception, the sensation of movement and location based on the stimulation arising from bodily sources such as muscle contractions. By about nine months old, infants can adjust their reaching to take into account a moving object. However, nine-month olds are far from expert reachers. A good deal of skill must still develop.

9. Look at the four squares **【■】** that indicate where the following sentence could be added to the passage.

What accounts for this greater accuracy?

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

The motor development in infants includes gross motor development and the fine motor development.

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Answer Choices

- A. The ability to move around in an environment gives infants an understanding of location and thus reduces the extent to which their memory is dependent on context.
- B. Infants become better at finding hidden objects once they have developed the type of grasp that allows them to handle and explore very small objects in their environment.
- C. Piaget argues that an infant's cognitive development is related to the development of fine motor skills that make it possible for infants to interact with and adapt their actions to their environment.
- D. Fine motor skills tend to develop later than do gross motor skills because fine motor skills require smaller, more finely tuned movements and a great deal of coordination.
- E. When infants first begin to grasp objects, they transfer the objects from hand to hand and firmly close their fingers against their palms.
- F. Reaching and grasping begin early; by about three months, reaching is more coordinated and efficient, and by one year, infants begin to develop a coordinated and finely tuned grip.

Passage 38 - Documenting the Incas

The Incas ruled a vast empire in western South America when the Spaniards encountered them in the sixteenth century. Although the Incas had no writing system of their own, historical information about Incas is available to researchers because early Spaniards wrote documents about them. However, there are drawbacks to use the written record. First, the Spanish writers were describing activities and institutions that were very different from their own, but they often described Inca culture in terms of their own society. As an example, consider the list of kings given by the Incas. As presented in the historical chronology, Spanish sources indicate there were thirteen kings who ruled sequentially. The names were given to them by Inca informants. However, one school of thought in Inca studies suggests that the names were not actual people, but, rather, titles filled by different individuals. Thus, the number of actual kings may have been fewer, and several titles may have been filled at the same time. The early Spanish writers, being unfamiliar with such a system of titles, simply translated it into something they were familiar with (a succession of kings). Given that the Inca empire expanded only during the time of the last four kings, or as a result of the actions of the individuals in those four positions, this question is not deemed significant for an understanding of the Incas. But the example shows that biases and inaccuracies may have been introduced inadvertently from the very beginning of the written Spanish reports about the Incas. Moreover, early writers often copied information from each other---so misinformation was likely to be passed on and accepted as true by later scholars.

Second, both Spanish writers and Incan informants sometimes had motives for being deliberately deceitful. For example, in an effort to gain status in the Spaniards' eyes, Incas might say that they formerly had been more important in the Inca empire than they actually were. Spanish officials as well were occasionally untruthful when it served their purposes. For example, Spaniards might deliberately underreport the productivity of a region under their authority so they could sell the additional products and keep the money, rather than hand it over to the Spanish Crown.

Third, it should be noted that the Spaniards' main sources of information were the Incas themselves, often members of the Inca ruling class. Therefore, what was recorded was the Incas' point of view about their own history and empire. Some modern authorities question whether the history of Incas happened as they said it did. Although some of their history is certainly more myth than truth, many, if not most, scholars agree that the history of the last four Inca kings is probably accurate. The same is true of other things told to the Spanish writers: the more recently an event is said to have occurred, the more likely it is to have actually happened.

A fourth problem relates to the nature of the Inca conquests of the other people in the Americas before the Spanish arrived and how accurate the accounts of those conquests are---whether related by the Spaniards or by the Incas on whom they relied. It was certainly in the Inca's interest to describe themselves as invincible and just. However, lacking accounts by conquered people about their interactions with the Incas, it is unknown how much of the information of the Inca conquest as related by the ruling class is factual.

Finally, there is a certain vagueness in the historical record regarding places and names. Many Spanish writers listed places they had visited within the empire, including both provinces and towns. However, other writers traveling along the same routes sometimes recounted different lists of places. In addition, it is difficult to identify the exact locations of towns and other geographic points of reference because of the widespread movements of people over the past five centuries.

For all these reasons, the historical record must be carefully evaluated to determine whether it is accurate and to verify the locations of past events. One approach is to cross-check information from a number of authors. Another approach is to conduct archaeological research. Regardless of the problems, historical documents review some important information about the Incas.

【Paragraph 1】 The Incans ruled a vast empire in western South America when the Spaniards encountered them in the sixteenth century. Although the Incas had no writing system of their own, historical information about Incas is available to researchers because early Spaniards wrote documents about them. However, there are drawbacks to use the written record. First, the Spanish writers were describing activities and institutions that were very different from their own, but they often described Inca culture in terms of their own society. As an example, consider the list of kings given by the Incas. As presented in the historical chronology, Spanish sources indicate there were thirteen kings who ruled sequentially. The names were given to them by Inca informants. However, one school of thought in Inca studies suggests that the names were not actual people, but, rather, titles filled by different individuals. Thus, the number of actual kings may have been fewer, and several titles may have been filled at the same time. The early Spanish writers, being unfamiliar with such a system of titles, simply translated it into something they were familiar with (a succession of kings). Given that the Inca empire expanded only during the time of the last four kings, or as a result of the actions of the individuals in those four positions, this question is not deemed significant for an understanding of the Incas. But the example shows that biases and inaccuracies may have been introduced inadvertently from the very beginning of the written Spanish reports about the Incas. Moreover, early writers often copied information from each other---so misinformation was likely to be passed on and accepted as true by later scholars.

1. According to paragraph 1, why does the written record about the Incan civilization depend on the reports of Spaniards?
 - A. The Incas destroyed their written records to prevent the Spaniards from benefiting from them.
 - B. The Incas did not have a writing system.
 - C. The Spaniards destroyed all records written by the Incas.
 - D. Incan records were written on materials that do not preserve well.

2. According to paragraph 1, sixteenth century's Spaniards may have been incorrect about which of the following aspects of the Incan empire
 - A. its size during the reigns of the last four kings
 - B. the total number of Incan kings
 - C. the kinds of power that Incan kings were able to exercise
 - D. the extent to which Incan kings were able to control activities within their empire

3. Which of the following can be inferred from paragraph 1 about the Incan system of rulers?
 - A. It was first introduced when the expansion of the Incan empire began.
 - B. It required that multi-rulers share a particular title at the same time.
 - C. It was sometimes confusing to the Incan informants of the Spaniards.
 - D. It was unlike the system used in sixteenth century Spain.

【Paragraph 2】 Second, both Spanish writers and Incan informants sometimes had motives for being deliberately deceitful. For example, in an effort to gain status in the Spaniards' eyes, Incas might say that they formerly had been more important in the Inca empire than they actually were. Spanish officials as well were occasionally untruthful when it served their purposes. For example, Spaniards might deliberately underreport the productivity of a region under their authority so they could sell the additional products and keep the money, rather than hand it over to the Spanish Crown.

4. Which of the following is mentioned in paragraph 2 as a possible motive for deliberate inaccuracy in official Spanish reports of the Incas?

- A. The desire of some Spanish officials to appear more important than they really were
- B. The need to please Spanish rulers by making productivity seem greater than it really was
- C. The desire of the Incas to make their empire seem more successful than it really was
- D. The desire of most Spanish officials to enrich themselves

【Paragraph 3】 Third, it should be noted that the Spaniards' main sources of information were the Incas themselves, often members of the Inca ruling class. Therefore, what was recorded was the Incas' point of view about their own history and empire. Some modern authorities question whether the history of Incas happened as they said it did. Although some of their history is certainly more myth than truth, many, if not most, scholars agree that the history of the last four Inca kings is probably accurate. The same is true of other things told to the Spanish writers: the more recently an event is said to have occurred, the more likely it is to have actually happened.

5. Why does the author indicate that the Spaniards' main sources of information were the Incas themselves?

- A. To argue that the Spaniards made great efforts to obtain the most information
- B. To explain why some scholars think that the documentary history of the Incan empire may not be correct
- C. To question the idea that more recent events in the Incan empire are more likely to be accurate than are more ancient ones
- D. To explain how scholars are able to determine that the history of the last four Incan kings is probably correct

【Paragraph 4】 A fourth problem relates to the nature of the Inca conquests of the other people in the Americas before the Spanish arrived and how accurate the accounts of those conquests are -- whether related by the Spaniards or by the Incas on whom they relied. It was certainly in the Inca's interest to describe themselves as invincible and just. However, lacking accounts by conquered people about their interactions with the Incas, it is unknown how much of the information of the Inca conquest as related by the ruling class is factual.

6. According to paragraph 4, why is there some doubt whether Spanish accounts of the Incan conquests of other people are accurate?

- A. The Spaniards included some information about which Incan informants disagreed.
- B. The conquered people's tales of the Incan conquests sometimes differed from the Inca's tales of them
- C. The Spanish accounts of the Incan conquest were based on information from Incan informants only.
- D. Some archaeological evidence does not support the Spanish accounts.

【Paragraph 5】 Finally, there is a certain vagueness in the historical record regarding places and names. Many Spanish writers listed places they had visited within the empire, including both provinces and towns. However, other writers traveling along the same routes sometimes recounted different lists of places. In addition, it is difficult to identify the exact locations of towns and other geographic points of reference because of the widespread movements of people over the past five centuries.

7. According to paragraph 5, what is a reason that place names in the historical record are sometimes vague?

- A. When people moved, they often gave new provinces and towns the same names as places they came from.
- B. Different writers in historical record listed different names for places along the same routes.
- C. Most writers of the historical record traveled little within the empire.
- D. The names of provinces and towns often did not reflect geographic points of reference.

【Paragraph 6】 For all these reasons, the historical record must be carefully evaluated to determine whether it is accurate and to verify the locations of past events. One approach is to cross-check information from a number of authors. Another approach is to conduct archaeological research. Regardless of the problems, historical documents review some important information about the Incas.

8. Which of the following is mentioned in paragraph 6 as a method for verifying accuracy of an account of a past event?

- A. Comparing accounts of the event given by different writers
- B. Investigating whether a particular author's accounts of other events have proved accurate
- C. Investigating whether the author of an account actually presented as the event described.
- D. Determining whether the author of an account was able to crosscheck information with multiple informants

【Paragraph 1】 The Incans ruled a vast empire in western South America when the Spaniards encountered them in the sixteenth century. ■Although the Incas had no writing system of their own, historical information about Incas is available to researchers because early Spaniards wrote documents about them. ■However, there are drawbacks to use the written record. ■First, the Spanish writers were describing activities and institutions that were very different from their own, but they often described Inca culture in terms of their own society. ■As an example, consider the list of kings given by the Incas. As presented in the historical chronology, Spanish sources indicate there were thirteen kings who ruled sequentially. The names were given to them by Inca informants. However, one school of thought in Inca studies suggests that the names were not actual people, but, rather, titles filled by different individuals. Thus, the number of actual kings may have been fewer, and several titles may have been filled at the same time. The early Spanish writers, being unfamiliar with such a system of titles, simply translated it into something they were familiar with (a succession of kings). Given that the Inca empire expanded only during the time of the last four kings, or as a result of the actions of the individuals in those four positions, this question is not deemed significant for an understanding of the Incas. But the example shows that biases and inaccuracies may have been introduced inadvertently from the very beginning of the written Spanish reports about the Incas. Moreover, early writers often copied information from each other---so misinformation was likely to be passed on and accepted as true by later scholars.

9. Look at the four squares 【■】 that indicate where the following sentence can be added to the passage.

Official accounts, legal papers, and letters written during that period provide a wealth of information about the Incan empire and the Incas' way of life.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

The accuracy of the historical record concerning the Incas is problematic.

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Answer Choices

- A. Numerous aspects of Incan life were recorded in the sixteenth century but many historical documents created at this time were lost or destroyed.
- B. Many Spaniards were interested primarily in the expansion of the Incan empire and therefore ignored other periods of Incan history.
- C. The fact that the Incan informants remained sources of information about themselves as well as inconsistencies in place names call the sound aspects of the accounts into question.
- D. Descriptions of Incan society may often be influenced by the cultural biases of people writing about Incas.
- E. Incorrect information may sometimes have been knowingly included in historical records because it was advantageous to the person including such information.
- F. The movement of people due to the Incan conquest and the settlement of the Spanish has caused much confusion about place names in the historical record.

Passage 39 - Mesopotamian and Egyptian Settlement Patterns

On the basis of available evidence, there existed in ancient state-level societies a variety of urban types. These have been classified under a number of different headings, ranging from city-states to territorial- or village-states. Mesopotamia and Egypt, for example, traditionally represent the two opposing extremes along a spectrum of possible settlement distributions and types.

Mesopotamian city-state systems were made up of densely populated urban areas that shared a common language, status symbols, and economic systems, but their elites tended to compete with each other, often militarily, to control territory, trade routes, and other resources. Each city-state controlled a relatively small territory, often only a few hundred square kilometers, and had its own capital city, which in many cases was enclosed by a wall. In addition to its capital, a city-state might govern a number of smaller centers, as well as numerous farming villages and hamlets. Ancient Sumer is a classic example of such a system.

In ancient Mesopotamia, urban centers tended to be relatively large, with populations ranging from less than 1,000 to more than 100,000 inhabitants, depending on the ability of a particular city-state to control and collect payments from its neighbors. Often, a considerable number of farmers lived in these centers to secure greater protection for themselves and their possessions. It is estimated that in southern Mesopotamia (circa 2900 - 2350 BC) more than 80 percent of the total population lived in cities.

These cities also supported craft production, which sought to satisfy the demands of the urban elite and society as a whole. The development of craft specialization and commercial exchanges between town and countryside as well as between neighboring urban centers encouraged the growth of public markets. Although the evidence for actual marketplaces is less than clear for southern Mesopotamia, the remnants of shop-lined streets indicate vigorous commercial activity involving large numbers of people. This activity in turn promoted competition among city-states to obtain supplies of exotic raw materials. As a result of widespread access to goods produced by full-time specialists and the development of more intensive agriculture close to urban centers, Mesopotamian city-states were able to support numerous nonfood producers, possibly as high a proportion as 20 percent of the total population.

In contrast to Mesopotamia, ancient Egypt's population has traditionally been perceived as more evenly dispersed across the landscape, a characteristic of village-states. Topography and the formation of the early state were the major factors contributing to this dispersal. Unlike Mesopotamia, Egypt had relatively secure and defined borders, allowing a single state to dominate the area. Additionally, the villages and towns of Egypt, all of which were situated near the Nile on the river's narrow flood plain, had approximately equal access to the river and did not have to compete among themselves for water as their contemporaries in Mesopotamia were forced to do. As the main highway through Egypt, the Nile offered innumerable harbors for shipping and trading, so there was no strong locational advantage to be gained in one area as opposed to another; hence the Egyptian population generally remained dispersed throughout the valley and delta in low densities. Trade specialists apparently were evenly spread throughout Egypt, supported by both independent workshops in small towns and royal patronage in the territorial capitals. In contrast to the defensive walls of Mesopotamian city-states, the walls of Egyptian towns primarily defined and delineated sections of the town (for example, a temple precinct from a residential area).

Egypt, however, was not without urban centers. At points where goods entered the Nile valley via maritime routes or overland routes from the Red Sea via wadis (stream beds that remain dry except during the rainy season), the right circumstances existed for the growth of larger cities. Egyptian cities and towns shared certain characteristics with other contemporary societies but also displayed unique traits influenced by the culture and environment of the Nile valley. Thus, the geopolitical

system that evolved in ancient Egypt was different from that of Mesopotamia; Egypt developed a village or territorial state characterized by dispersed settlements of varying size, a form of urbanism that gave Egypt its distinctive identity.

【Paragraph 1】 On the basis of available evidence, there existed in ancient state-level societies a variety of urban types. These have been classified under a number of different headings, ranging from city-states to territorial- or village-states. Mesopotamia and Egypt, for example, traditionally represent the two opposing extremes along a spectrum of possible settlement distributions and types.

1. According to paragraph 1, which of the following best describes how ancient societies were organized?

- A. Ancient societies were classified as either city-states or village-states.
- B. Most ancient societies started out as city-states and then became territorial- or village-states.
- C. With the exception of Mesopotamia and Egypt, ancient societies were generally not urbanized.
- D. Ancient societies likely followed a number of different urban settlement patterns.

【Paragraph 2】 Mesopotamian city-state systems were made up of densely populated urban areas that shared a common language, status symbols, and economic systems, but their elites tended to compete with each other, often militarily, to control territory, trade routes, and other resources. Each city-state controlled a relatively small territory, often only a few hundred square kilometers, and had its own capital city, which in many cases was enclosed by a wall. In addition to its capital, a city-state might govern a number of smaller centers, as well as numerous farming villages and hamlets. Ancient Sumer is a classic example of such a system.

2. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Although composed of very similar societies, Mesopotamian city-states were also characterized by conflicts among elites over trade, territory, and resources.
- B. City-states that shared a common language, status symbols, and economic systems were more likely to compete militarily than were other city-states.
- C. Most military conflicts among Mesopotamian city-states were about economic issues, such as territory or trade routes, but some were over the status symbols of elites.
- D. Despite the military control of elites, Mesopotamian city-states tended to compete with each other.

3. The author mentions Ancient Sumer as an example of

- A. an unusual settlement that differed from the classic city-state
- B. a small farming village under the control of a large city
- C. a city-state consisting of a capital and outlying settlements
- D. a city-state that was particularly small in size for Mesopotamia

【Paragraph 3】 In ancient Mesopotamia, urban centers tended to be relatively large, with populations ranging from less than 1,000 to more than 100,000 inhabitants, depending on the ability of a particular city-state to control and collect payments from its neighbors. Often, a considerable number of farmers lived in these centers to secure greater protection for themselves and their possessions. It is estimated that in southern Mesopotamia (circa 2900 - 2350 BC) more than 80 percent of the total population lived in cities.

4. According to paragraph 3, what determined the size of an urban center in ancient Mesopotamia?

- A. The number of people defending it
- B. The amount of available space between the city and its nearest neighbor
- C. The extent of its political and economic enforcement power over its neighbors
- D. The number of farmers and the amount of food they produced

【Paragraph 4】 These cities also supported craft production, which sought to satisfy the demands of the urban elite and society as a whole. The development of craft specialization and commercial exchanges between town and countryside as well as between neighboring urban centers encouraged the growth of public markets. Although the evidence for actual marketplaces is less than clear for southern Mesopotamia, the remnants of shop-lined streets indicate vigorous commercial activity involving large numbers of people. This activity in turn promoted competition among city-states to obtain supplies of exotic raw materials. As a result of widespread access to goods produced by full-time specialists and the development of more intensive agriculture close to urban centers, Mesopotamian city-states were able to support numerous nonfood producers, possibly as high a proportion as 20 percent of the total population.

5. According to paragraph 4, which of the following is NOT true of commercial activity in ancient Mesopotamia

- A. Perhaps 20 percent of the population was involved in commercial activity rather than food production.
- B. Commercial exchanges took place not only between urban and rural areas, but also between cities.
- C. Although most urban centers had marketplaces, the largest ones were located in southern Mesopotamia.
- D. Goods were plentiful and widely available to inhabitants of Mesopotamian cities.

【Paragraph 5】 In contrast to Mesopotamia, ancient Egypt's population has traditionally been perceived as more evenly dispersed across the landscape, a characteristic of village-states. Topography and the formation of the early state were the major factors contributing to this dispersal. Unlike Mesopotamia, Egypt had relatively secure and defined borders, allowing a single state to dominate the area. Additionally, the villages and towns of Egypt, all of which were situated near the Nile on the river's narrow flood plain, had approximately equal access to the river and did not have to compete among themselves for water as their contemporaries in Mesopotamia were forced to do. As the main highway through Egypt, the Nile offered innumerable harbors for shipping and trading, so there was no strong locational advantage to be gained in one area as opposed to another; hence the Egyptian population generally remained dispersed throughout the valley and delta in low densities. Trade specialists apparently were evenly spread throughout Egypt, supported by both independent workshops in small towns and royal patronage in the territorial capitals. In contrast to the defensive walls of Mesopotamian city-states, the walls of Egyptian towns primarily defined and delineated sections of the town (for example, a temple precinct from a residential area).

6. In paragraph 5, why does the author provide the information that all Egyptian villages and towns were located near the Nile and had equal access to the river?

- A. To explain why flooding was a frequent problem for the Egyptian people
- B. To identify a contributing cause of the dispersal of Egypt's population
- C. To support the claim that Egypt had well-defined borders
- D. To demonstrate the similarity between Egyptian and Mesopotamian settlement patterns

7. According to paragraph 5, the primary purpose of city walls in ancient Egypt was to

- A. distinguish territorial capitals from other urban areas
- B. prevent the city's population from becoming too spread out
- C. protect the city from outside attack
- D. separate parts of the city designated for different uses

【Paragraph 6】 Egypt, however, was not without urban centers. At points where goods entered the Nile valley via maritime routes or overland routes from the Red Sea via wadis (stream beds that remain dry except during the rainy season), the right circumstances existed for the growth of larger cities. Egyptian cities and towns shared certain characteristics with other contemporary societies but also displayed unique traits influenced by the culture and environment of the Nile valley. Thus, the geopolitical system that evolved in ancient Egypt was different from that of Mesopotamia; Egypt developed a village or territorial state characterized by dispersed settlements of varying size, a form of urbanism that gave Egypt its distinctive identity.

8. Paragraph 6 suggests that Egypt's urban centers were located near stream beds called wadis because these areas

- A. had the most fertile soil
- B. provided opportunities for trade
- C. had increased their water supplies
- D. could easily be protected from invaders

【Paragraph 6】 Egypt, however, was not without urban centers. ■At points where goods entered the Nile valley via maritime routes or overland routes from the Red Sea via wadis (stream beds that remain dry except during the rainy season), the right circumstances existed for the growth of larger cities. ■Egyptian cities and towns shared certain characteristics with other (contemporary societies) but also displayed unique traits influenced by the culture and environment of the Nile valley. ■Thus, the geopolitical system that evolved in ancient Egypt was different from that of Mesopotamia; Egypt developed a village or territorial state characterized by dispersed settlements of varying size, a form of urbanism that gave Egypt its distinctive identity. ■

9. Look at the four squares that indicate where the following sentence could be added to the passage.

For example, Egypt's capital, Memphis, was located at a strategic point near the mouth of the Nile and grew to be one of the largest settlements of its time.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Mesopotamia and Egypt represent two types of ancient settlement distributions.

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Answer Choices

- A. Mesopotamia was characterized by large, densely-populated urban centers, while the population of Egypt was more evenly distributed across the Nile valley.
- B. Unlike Mesopotamian city-states, which were culturally and economically distinct, Egyptian villages and towns shared a common language and economy.
- C. While defense was crucial in Mesopotamian cities due to competition for territory, trade routes, and raw materials, it was less important in Egypt.
- D. Once they realized that craft production was more profitable than crop production, many Mesopotamians moved from rural to urban areas.
- E. Differences in settlement patterns help to explain why the Egyptian central government survived and the Mesopotamian city-states did not.
- F. Trade specialists were evenly spread throughout Egypt, while Mesopotamia's vibrant commercial trade was concentrated in its large urban centers.

Passage 40 - The Collapse of the Maya

The Mayan society of Central America (2000 B.C.-A.D 1500), like other ancient states, was characterized by populations unprecedented both in their size and density. It was not just the number of people that lived in the Mayan city-states but also the relatively small area into which they were concentrated. To support such populations, societies developed various intensive agricultural including large-scale irrigation and hill-slope (the cutting of horizontal ridges into hillsides so they can be farmed). These were designed both to increase yields from a given area and to increase the absolute amount of land under cultivation. These strategies were in essence very successful: they made it possible to feed larger populations than ever before and supported the growth of cities. But they also placed considerable strains on the environment and rendered it increasingly fragile and vulnerable to unexpected climatic events, and even to short-term fluctuations. Thus, the argument is that because of their size and ever more intensive agriculture, the Mayan and other ancient state societies were fundamentally unsustainable.

Claims about environment degradation and disaster have figured prominently in discussion of the collapse of the Mayan city-states of the Central American lowlands. When two explorers came upon the Mayan cities in the 1830s, they were struck by the sight of tall pyramids and elaborately carved stones among luxuriant forest growth. Here was the archetypal picture of a great lost civilization: abandoned cities submerged in vegetation. Theories of catastrophic collapse or apocalyptic overthrow came naturally to mind to explain these dramatic scenes.

Recent studies of the Mayan collapse (beginning around A.D 900) have emphasized the gradual and progressive nature of the process, beginning in the earliest in the South and advancing northward. It was not a single, sudden event, as had once been thought. Warfare and social unrest are thought to have played a part, but these may well have arisen through pressure from other causes. The Mayan cities had, after all, flourished for over 500 years and had frequently been at war with each other.

But what about the possibility of food shortage? These could have come about through either natural or humanly induced changes in the environment. Increasingly fierce competition between Mayan cities led to an upsurge of monument construction during the eighth and ninth centuries A.D, which would have placed added strain on agricultural production and expansion. Interstate rivalry may hence have pushed the Maya toward overexploitation of their fragile ecosystem. Deforestation and soil erosion might ultimately have destroyed the capacity of the land to support the high population levels of the Mayan cities, leading to famine, social unrest, and the collapse of the major Mayan centers.

Yet it may be incorrect to lay the blame entirely on human action. Several of the lowland cities, such as Tikal, appear to have depended heavily on the cultivation of raised fields set in the marshy depressions known as bajos, which today flood intermittently in the rainy season but may originally have been permanent lakes. The raise-field system of intensive cultivation (created by digging surrounding canals and using the soil removed to elevate the fields for planting) allows year-round food production through the constant supply of soil nutrients that erode into the drainage ditches dug around the raised fields, nutrients that are then collected and replaced. Stable water levels were essential to this subsistence system, but evidence from Lake Chichancanab in Yucatan shows that between A.D 800 and A.D 1000 this region suffered its driest period of climate in several thousand years. We may expect that as a result water level fell, and the raised fields in many areas became unusable. But the human response must be viewed through the lens of the social, political, and cultural circumstances. These exerted a powerful mediating effect on the way the Maya endeavored to cope with their difficulties. Had population levels been lower, the impact of the drought may not have been catastrophic, as it was, the Maya were already reaching the limits of the available subsistence capacity, and Mayan elites had espoused certain social and political agendas (including expensive warfare and competition with each other). It was against this specific background that a period of drought led quickly to crisis and collapse.

【Paragraph 1】 The Mayan society of Central America (2000 B.C-A.D 1500), like other ancient states, was characterized by populations unprecedented both in their size and density. It was not just the number of people that lived in the Mayan city-states but also the relatively small area into which they were concentrated. To support such populations, societies developed various intensive agricultural including large-scale irrigation and hill-slope (the cutting of horizontal ridges into hillsides so they can be farmed). These were designed both to increase yields from a given area and to increase the absolute amount of land under cultivation. These strategies were in essence very successful: they made it possible to feed larger populations than ever before and supported the growth of cities. But they also placed considerable strains on the environment and rendered it increasingly fragile and vulnerable to unexpected climatic events, and even to short-term fluctuations. Thus, the argument is that because of their size and ever more intensive agriculture, the Mayan and other ancient state societies were fundamentally unsustainable.

1. Which of the following can be inferred from paragraph 1 about the intensive agricultural methods of the Maya?

- A. They helped the Maya overcome short-term fluctuations in the climate.
- B. They could not supply all of the food required for the growth of Mayan cities.
- C. They strained the environment more than the Maya's previous farming techniques did.
- D. They were invented by the Maya to help them grow new kinds of crops.

【Paragraph 2】 Claims about environment degradation and disaster have figured prominently in discussion of the collapse of the Mayan city-states of the Central American lowlands. When two explorers came upon the Mayan cities in the 1830s, they were struck by the sight of tall pyramids and elaborately carved stones among luxuriant forest growth. Here was the archetypal picture of a great lost civilization: abandoned cities submerged in vegetation. Theories of catastrophic collapse or apocalyptic overthrow came naturally to mind to explain these dramatic scenes.

2. In paragraph 2, the author implies which of the following about the collapse of the Mayan city-states?

- A. The fact that vegetation had grown over the ruins of Mayan buildings indicates that environmental degradation did not contribute to the Mayan collapse.
- B. Early explorers supposed that there was a catastrophic collapse of the Mayan city states largely because this view fit their preconceived ideas about lost civilizations.
- C. The condition of the tall pyramids and carved stones discovered by early explorers proves that Mayan city-states were violently overthrown.
- D. The Mayan cities were abandoned because they became submerged in vegetation.

【Paragraph 3】 Recent studies of the Mayan collapse (beginning around A.D 900) have emphasized the gradual and progressive nature of the process, beginning in the earliest in the South and advancing northward. It was not a single, sudden event, as had once been thought. Warfare and social unrest are thought to have played a part, but these may well have arisen through pressure from other causes. The Mayan cities had, after all, flourished for over 500 years and had frequently been at war with each other.

3. Why does the author include the information that Mayan cities had “flourished for over 500 years and had frequently been at war with each other”?

- A. To identify a possible reason for the eventual collapse of Mayan society
- B. To make the point that war and social unrest alone do not account for the Mayan collapse
- C. To explain why recent studies argue that human actions were responsible for the Mayan collapse
- D. To provide evidence that frequent wars weakened Mayan society only very gradually

4. According to paragraph 3, recent studies claim which of the following about the Mayan collapse?

- A. It was caused primarily by frequent wars between rival city-states.
- B. It was caused by a single sudden event.
- C. It was preceded by social unrest in northern city-states.
- D. It began in southern city-states and spread to others.

【Paragraph 4】 But what about the possibility of food shortage? These could have come about through either natural or humanly induced changes in the environment. Increasingly fierce competition between Mayan cities led to an upsurge of monument construction during the eighth and ninth centuries A.D, which would have placed added strain on agricultural production and expansion. Interstate rivalry may hence have pushed the Maya toward overexploitation of their fragile ecosystem. Deforestation and soil erosion might ultimately have destroyed the capacity of the land to support the high population levels of the Mayan cities, leading to famine, social unrest, and the collapse of the major Mayan centers.

5. All of the following are mentioned in paragraph 4 as possible direct or indirect causes of food shortages EXCEPT

- A. increased monument construction
- B. rivalries between states
- C. deforestation and station
- D. introduction of new crops

【Paragraph 5】 Yet it may be incorrect to lay the blame **entirely** on human action. Several of the lowland cities, such as Tikal, appear to have depended heavily on the cultivation of raised fields set in the marshy depressions known as bajos, which today flood intermittently in the rainy season but may originally have been permanent lakes. The raise-field system of intensive cultivation (created by digging surrounding canals and using the soil removed to elevate the fields for planting) allows year-round food production through the constant supply of soil nutrients that erode into the drainage ditches dug around the raised fields, nutrients that are then collected and replaced. Stable water levels were essential to this subsistence system, but evidence from Lake Chichancanab in Yucatan shows that between A.D 800 and A.D 1000 this region suffered its driest period of climate in several thousand years. We may expect that as a result water level fell, and the raised fields in many areas became unusable. But the human response must be viewed through the lens of the social, political, and cultural circumstances. These exerted a powerful mediating effect on the way the Maya endeavored to cope with their difficulties. Had population levels been lower, the impact of the drought may not have been catastrophic, as it was, the Maya were already reaching the limits of the available subsistence capacity, and Mayan elites had espoused certain social and political agendas (including expensive warfare and competition with each other). It was against this specific background that a period of drought led quickly to crisis and collapse.

6. The word “**entirely**” in the passage is closest in meaning to

- A. generally
- B. clearly
- C. completely
- D. specifically

7. According to paragraph 5, why did the raised fields in many areas become unusable?

- A. The marshy depressions around the fields flooded in the rainy season
- B. Intensive cultivation of the fields drained the soil of nutrients.
- C. The area where the fields were located experienced a drop in water levels.
- D. Unstable design caused the failure of the drainage ditches.

8. According to paragraph 5, all of the following made it more difficult for the Maya to cope with effects of the drought EXCEPT

- A. failure to properly cultivate the fields
- B. high population levels
- C. competition between Mayan groups
- D. warfare

【Paragraph 5】 Yet it may be incorrect to lay the blame entirely on human action. ■Several of the lowland cities, such as Tikal, appear to have depended heavily on the cultivation of raised fields set in the marshy depressions known as bajos, which today flood intermittently in the rainy season but may originally have been permanent lakes. ■The raise-field system of intensive cultivation (created by digging surrounding canals and using the soil removed to elevate the fields for planting) allows year-round food production through the constant supply of soil nutrients that erode into the drainage ditches dug around the raised fields, nutrients that are then collected and replaced. ■Stable water levels were essential to this subsistence system, but evidence from Lake Chichancanab in Yucatan shows that between A.D 800 and A.D 1000 this region suffered its driest period of climate in several thousand years. ■We may expect that as a result water level fell, and the raised fields in many areas became unusable. But the human response must be viewed through the lens of the social, political, and cultural circumstances. These exerted a powerful mediating effect on the way the Maya endeavored to cope with their difficulties. Had population levels been lower, the impact of the drought may not have been catastrophic, as it was, the Maya were already reaching the limits of the available subsistence capacity, and Mayan elites had espoused certain social and political agendas (including expensive warfare and competition with each other). It was against this specific background that a period of drought led quickly to crisis and collapse.

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

Nature apparently also contributed to the food shortages.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Since the discovery of the Mayan ruins in the 1830s, researchers have tried to explain the collapse of Mayan civilization.

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Answer choices

- A. The Mayan attempt to develop intensive agricultural methods to support large populations in relatively small areas probably was unsuccessful and could have caused the Mayan collapse.
- B. The discovery of intact pyramids submerged in vegetation among the Mayan ruins led researchers to believe that Mayan cities were simply overgrown rather than catastrophically destroyed.
- C. Warfare and rivalry between Mayan states may have caused food shortages that contributed to the eventual collapse of Mayan civilization.
- D. Early theories that the Mayan collapse was a sudden, catastrophic event were followed by views that treated the collapse as a gradual process.
- E. The continuing warfare and social unrest that started in the North and spread to the South provided researchers with evidence that the Mayan collapse took hundreds of years to occur.
- F. Drought between A. D. 800 and A.D. 1000 likely caused the Mayan system of intensive irrigated agriculture to fall, which could have brought about a rapid collapse of the Mayan states.

Passage 41 - The Emergence of Civilization

Starting around 8000 B.C.E., the most extensive exploitation of agriculture occurred in river valleys, where there were both good soil and a dependable water supply regardless of the amount of rainfall. In the Near East, this happened in the Fertile Crescent, the region extending up the Nile Valley in Egypt, north through the Levant (Palestine, Lebanon, and Syria), and southeast into the Tigris and Euphrates river valleys of Mesopotamia. The richest soil was located in the deltas at the mouths of the rivers, but the deltas were swampy and subject to flooding. Before they could be farmed, they needed to be drained and irrigated, and flood-control systems had to be constructed. These activities required administrative organization and the ability to mobilize large pools of labor. In Mesopotamia, perhaps as a consequence of a period of drought, massive land-use projects were undertaken after 4000 B.C.E. to cultivate the rich delta soils of the Tigris and Euphrates Rivers. The land was so productive that many more people could be fed, and a great population explosion resulted. Villages grew into cities of tens of thousands of persons.

These large cities needed some form of centralized administration. Archaeological evidence indicates that the organization initially was provided by religion, for the largest building in each city was a massive temple honoring one of the Mesopotamian gods. In Uruk, for example, a 60-foot-long temple known as the White House was built before 3000 B.C.E. There were no other large public buildings, suggesting that the priests who were in charge of the temples also were responsible for governing the city and organizing people to work in the fields and on irrigation projects building and maintaining systems of ditches and dams.

The great concentration of wealth and resources in the river valleys brought with it further technological advances, such as wheeled vehicles, multicolored pottery and the pottery wheel, and the weaving of wool garments. Advances in metal technology just before 2000 B.C.E. resulted in the creation of bronze, a durable alloy (or mixture) of about 90 percent copper and 10 percent tin that provided a sharp cutting edge for weapons.

By 3000 B.C.E., the economies and administrations of Mesopotamia and Egypt had become so complex that some form of record keeping was needed. As a result, writing was invented. Once a society became literate, it passed from the period known as prehistory into the historic period. In fact, the word “history” comes from a Greek word meaning “narrative”—people could not provide a detailed permanent account of their past until they were able to write.

The totality of these developments resulted in the appearance, around 3000 B.C.E., of a new form of culture called civilization. The first civilizations had several defining characteristics. They had economies based on agriculture. They had cities that functioned as administrative centers and usually had large populations. They had different social classes, such as free persons and slaves. They had specialization of labor, that is, different people serving, for example, as rulers, priests, craft workers, merchants, soldiers, and farmers. And they had metal technology and a system of writing. As of 3000 B.C.E., civilization in these terms existed in Mesopotamia, Egypt, India, and China.

This first phase of civilization is called the Bronze Age because of the importance of metal technology. The most characteristic Near Eastern Bronze Age civilizations, those of Mesopotamia and Egypt, were located in river valleys, were based on the extensive exploitation of agriculture, and supported large populations. Bronze was a valuable commodity in these civilizations, the copper and tin needed for its manufacture did not exist in river valleys and had to be imported. Bronze was therefore used mainly for luxury items, such as jewelry or weapons, not for everyday domestic items, which were made from pottery, animal products, wood, and stone. In particular, bronze was not used for farming tools. Thus, early civilizations based on large-scale agriculture, such as those of Mesopotamia and Egypt, were feasible only in soils that could be worked by wooden plows pulled by people or draft animals such as oxen. Other Bronze Age civilizations, however, such as those that arose in the

Levant and eastern Mediterranean took advantage of their location on communication routes to pursue economies based on trade.

【Paragraph 1】 Starting around 8000 B.C.E., the most extensive exploitation of agriculture occurred in river valleys, where there were both good soil and a dependable water supply regardless of the amount of rainfall. In the Near East, this happened in the Fertile Crescent, the region extending up the Nile Valley in Egypt, north through the Levant (Palestine, Lebanon, and Syria), and southeast into the Tigris and Euphrates river valleys of Mesopotamia. The richest soil was located in the deltas at the mouths of the rivers, but the deltas were swampy and subject to flooding. Before they could be farmed, they needed to be drained and irrigated, and flood-control systems had to be constructed. These activities required administrative organization and the ability to mobilize large pools of labor. In Mesopotamia, perhaps as a consequence of a period of drought, massive land-use projects were undertaken after 4000 B.C.E. to cultivate the rich delta soils of the Tigris and Euphrates Rivers. The land was so productive that many more people could be fed, and a great population explosion resulted. Villages grew into cities of tens of thousands of persons.

1. Which of the following helps explain why “the most extensive exploitation of agriculture occurred in river valleys”?

- A. In river valleys farmers did not have to depend on rain for water.
- B. The soil in river valleys did not require irrigation.
- C. Swampy areas in river valleys were easy to drain.
- D. The expanding populations in river valleys provided large pools of labor.

2. Why does the author mention “a period of drought”?

- A. To help explain why the richest soils in the Near East were located in the deltas at the mouths of the Tigris and Euphrates Rivers
- B. To suggest a reason for undertaking the massive effort to make the deltas of the Tigris and Euphrates Rivers farmable
- C. To identify a condition that often affected agricultural production in Mesopotamia
- D. To support the idea that mobilizing large pools of labor after 4000 B.C.E. required significant administrative organization

3. According to paragraph 1, what was one result of the farming systems developed in river deltas in the Near East?

- A. There was a large increase in the overall amount of food produced.
- B. Large pools of labor became available to perform administrative tasks.
- C. The soil in these deltas grew much richer.
- D. The number of farming villages surrounding cities increased.

【Paragraph 2】 These large cities needed some form of centralized administration. Archaeological evidence indicates that the organization initially was provided by religion, for the largest building in each city was a massive temple honoring one of the Mesopotamian gods. In Uruk, for example, a 60-foot-long temple known as the White House was built before 3000 B.C.E. There were no other large public buildings, suggesting that the priests who were in charge of the temples also were responsible for governing the city and organizing people to work in the fields and on irrigation projects building and maintaining systems of ditches and dams.

4. According to paragraph 2, the fact that temples appear to have been the only large public buildings in Mesopotamian cities has been interpreted as evidence that these cities

- A. needed some form of central administration
- B. were initially administered by priests
- C. were all governed from Uruk
- D. had difficulty organizing workers for building projects

【Paragraph 3】 The great concentration of wealth and resources in the river valleys brought with it further technological advances, such as wheeled vehicles, multicolored pottery and the pottery wheel, and the weaving of wool garments. Advances in metal technology just before 2000 B.C.E. resulted in the creation of bronze, a durable alloy (or mixture) of about 90 percent copper and 10 percent tin that provided a sharp cutting edge for weapons.

5. Paragraph 3 indicates that technological advances affected all of the following EXCEPT

- A. transportation
- B. clothing manufacture
- C. warfare and hunting
- D. the distribution of wealth and resources

【Paragraph 4】 By 3000 B.C.E., the economies and administrations of Mesopotamia and Egypt had become so complex that some form of record keeping was needed. As a result, writing was invented. Once a society became literate, it passed from the period known as prehistory into the historic period. In fact, the word “history” comes from a Greek word meaning “narrative”—people could not provide a detailed permanent account of their past until they were able to write.

【Paragraph 5】 The totality of these developments resulted in the appearance, around 3000 B.C.E., of a new form of culture called civilization. The first civilizations had several **defining** characteristics. They had economies based on agriculture. They had cities that functioned as administrative centers and usually had large populations. They had different social classes, such as free persons and slaves. They had specialization of labor, that is, different people serving, for example, as rulers, priests, craft workers, merchants, soldiers, and farmers. And they had metal technology and a system of writing. As of 3000 B.C.E., civilization in these terms existed in Mesopotamia, Egypt, India, and China.

6. The word “**defining**” in the passage is closest in meaning to

- A. important
- B. obvious
- C. identifying
- D. interesting

7. According to paragraph 5, all of the following are true of the first civilizations EXCEPT

- A. Their soldiers and priests also worked as farmers.
- B. Their populations were divided into different social classes.
- C. They had developed technologies for working with metals.
- D. They were typically administered from large cities.

【Paragraph 6】 This first phase of civilization is called the Bronze Age because of the importance of metal technology. The most characteristic Near Eastern Bronze Age civilizations, those of Mesopotamia and Egypt, were located in river valleys, were based on the extensive exploitation of agriculture, and supported large populations. Bronze was a valuable commodity in these civilizations, the copper and tin needed for its manufacture did not exist in river valleys and had to be imported. Bronze was therefore used mainly for luxury items, such as jewelry or weapons, not for everyday domestic items, which were made from pottery, animal products, wood, and stone. In particular, bronze was not used for farming tools. Thus, early civilizations based on large-scale agriculture, such as those of Mesopotamia and Egypt, were feasible only in soils that could be worked by wooden plows pulled by people or draft animals such as oxen. Other Bronze Age civilizations, however, such as those that arose in the Levant and eastern Mediterranean took advantage of their location on communication routes to pursue economies based on trade.

8. According to paragraph 6, which of the following was true of at least some civilizations of the Bronze Age?

- A. They did not develop urban centers with large populations.
- B. They did not use metals to make bronze.
- C. They had an economy that was not based on agriculture.
- D. They did not use bronze for luxury items such as jewelry.

【Paragraph 6】 This first phase of civilization is called the Bronze Age because of the importance of metal technology. The most characteristic Near Eastern Bronze Age civilizations, those of Mesopotamia and Egypt, were located in river valleys, were based on the extensive exploitation of agriculture, and supported large populations. ■Bronze was a valuable commodity in these civilizations, the copper and tin needed for its manufacture did not exist in river valleys and had to be imported. ■Bronze was therefore used mainly for luxury items, such as jewelry or weapons, not for everyday domestic items, which were made from pottery, animal products, wood, and stone. ■In particular, bronze was not used for farming tools. ■Thus, early civilizations based on large-scale agriculture, such as those of Mesopotamia and Egypt, were feasible only in soils that could be worked by wooden plows pulled by people or draft animals such as oxen. Other Bronze Age civilizations, however, such as those that arose in the Levant and eastern Mediterranean took advantage of their location on communication routes to pursue economies based on trade.

9. Look at the four squares **【■】** that indicate where the following sentence can be added to the passage.

This significantly limited the availability of bronze.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

After 4000 B.C.E., organized drainage and flood-control projects in the Fertile Crescent allowed cultivation of river deltas and led to large population increases.

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Answer Choices

- A. Before the rise of large cities with complex economies, there had been no need for any kind of administrative structure to organize workers, and thus religion tended to be the only source of authority.
- B. By 3000 B.C.E., a number of agricultural societies had emerged as civilization characterized by large cities, centralized administrations, specialization of labor, class divisions, metal technology, and writing.
- C. Although river-valley societies had to import the metals for making bronze, the first phase of civilization is known as the Bronze Age because of the importance of metal technology in these societies.
- D. Large cities functioned as administrative centers, creating a concentration of wealth and resources that stimulated technological advances, such as the invention of writing and the creation of bronze.
- E. For a culture to be considered a civilization, it must have independently invented its own form of writing and become generally literate, thereby moving from prehistory into the historic period.
- F. The creation of bronze made it possible for civilizations based on large-scale agriculture to be located far away from the river valleys.

Passage 42 - The Multiplier Effect

The causes behind the rapid development of the Minoan and Mycenaean civilizations in the Aegean during the late third and second millennia B.C.E. have intrigued scholars for years. Until recently, most explanations attributed Aegean development to outside influence. Civilization had emerged in Mesopotamia by 3000 B.C.E, and, some archeologists argued, Mesopotamian trade introduced civilized ideas and technological innovations into nearby, less advanced areas. Others hypothesized that civilization was brought to the Aegean by invasion from some adjacent region, of which Anatolia in modern Turkey seemed the most plausible.

In a work published in 1972, Professor Colin Renfrew approached the problem from a different viewpoint. He argued that the scanty available evidence for invasion or immigration from Anatolia into Greece in the early Bronze Age (about 3300-2200 B.C.E.) showed that, at most, such incursion was limited, and that it could not be regarded as responsible for the transformation of society there. Trade, though clearly documented, was also an inadequate explanation in itself. To understand the major changes in social organization and complexity that took place, it was necessary, said Renfrew, to determine the impact that new variables emerging in the early Bronze Age may have had on every interrelated aspect of the local social system. The two new major developments he considered were changes in the subsistence economy and the introduction of bronze metallurgy.

The economy of Neolithic Greece was based on growing grains and raising sheep. Early in the third millennium B.C.E., cultivation of grape vines and olive trees also became important in southern Greece and the Aegean Islands. Both crops were eminently suitable for trade and storage in the form of olive oil and wine. They were grown on land that was not suitable for grain farming. Their cultivation required work at a different time of year from that needed by grain crops, and much of this work, such as harvesting, was relatively light. As a result, agricultural yields were substantially increased without disrupting established agricultural practice. That increase in turn allowed, or stimulated, population growth. For the first time there was enough demand for specialized crafts and services to justify the existence of full-time craftspeople, who could be supported from the extra agricultural output.

Some copper artifacts were made during the fourth millennium B.C.E, but there were not many of them and they had little economic or social significance. When, in the third millennium, copper began to be mixed with tin to produce the relatively hard alloy bronze, demand for metal goods grew. Bronze could be used to make a range of useful new tools and weapons and a variety of impressive ornaments. The demand for metalwork stimulated further specialization in crafts such as toolmaking and jewelry making. The new tools promoted the development of other crafts, like carpentry and shipbuilding. Competition for prestigious or useful craft products and for control of their producers helped to heighten both social differences within communities and conflicts between them, resulting in the emergence of local chieftains, who were also in many instances warriors. These chieftains regulated agricultural and craft production, operating a distribution system through which the farmers could obtain tools or ornaments they needed or wanted. The organizational demands of controlled distribution made it necessary to develop methods of measurement and recording, which led to the development of writing.

Renfrew argued that any single innovation would have had a limited or negligible effect on social organization because the inherently conservative nature of societies acts to minimize change. However, the interaction of several simultaneous developments created a multiplier effect. In the Aegean, increased agricultural productivity provided the means to support craft specialization, while bronze metallurgy provided the technology for producing highly valued new products. These factors set in motion a series of changes in other subsystems of society. Those changes in turn resulted in what, in a term borrowed from electronics, are called positive feedback loops—alterations in the workings of a social system that serve to reinforce themselves. Thus, Aegean society was transformed from one consisting of basically self-sufficient and egalitarian farming

villages to one of prosperous, hierarchical chiefdoms, with palace-dwelling rulers, actively competing with one another both at home and in international trade.

【Paragraph 1】 The causes behind the rapid development of the Minoan and Mycenaean civilizations in the Aegean during the late third and second millennia B.C.E. have intrigued scholars for years. Until recently, most explanations attributed Aegean development to outside influence. Civilization had emerged in Mesopotamia by 3000 B.C.E, and, some archeologists argued, Mesopotamian trade introduced civilized ideas and technological innovations into nearby, less advanced areas. Others hypothesized that civilization was brought to the Aegean by invasion from some adjacent region, of which Anatolia in modern Turkey seemed the most plausible.

1. Paragraph 1 implies which of the following about traditional scholarship concerning the development of Aegean civilizations?

- A. It focused on the influence of Aegean trade on more advanced civilization rather than the invasion of the Aegean by a technologically advanced culture.
- B. The development of Minoan civilization was thought to require a different explanation from that for the development of Mycenaean civilization.
- C. It maintained that the rapid development of Aegean civilization could be explained only through external influence.
- D. There was general agreement that Anatolia and Mesopotamia were both responsible for the development of civilization in the Aegean.

【Paragraph 2】 In a work published in 1972, Professor Colin Renfrew approached the problem from a different viewpoint. He argued that the scanty available evidence for invasion or immigration from Anatolia into Greece in the early Bronze Age (about 3300-2200 B.C.E.) showed that, at most, such incursion was limited, and that it could not be regarded as responsible for the transformation of society there. Trade, though clearly documented, was also an inadequate explanation in itself. **To understand the major changes in social organization and complexity that took place, it was necessary, said Renfrew, to determine the impact that new variables emerging in the early Bronze Age may have had on every interrelated aspect of the local social system.** The two new major developments he considered were changes in the subsistence economy and the introduction of bronze metallurgy.

2. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Renfrew said that local variables affected the complex social organization of the early Bronze Age.
- B. Renfrew said that the major changes in social organization could be understood only by examining the effects of the new developments that took place in the early Bronze Age.
- C. The early Bronze Age, Renfrew said, was a time in which there were major changes to many interrelated aspects of local social systems.
- D. To understand the social organization and complexity of the early Bronze Age, it was necessary, said Renfrew, first to determine what new variables had emerged.

【Paragraph 3】 The economy of Neolithic Greece was based on growing grains and raising sheep. Early in the third millennium B.C.E., cultivation of grape vines and olive trees also became important in southern Greece and the Aegean Islands. Both crops were eminently suitable for trade and storage in the form of olive oil and wine. They were grown on land that was not suitable for grain farming. Their cultivation required work at a different time of year from that needed by grain crops, and much of this work, such as harvesting, was relatively light. As a result, agricultural yields were substantially increased without disrupting established agricultural practice. That increase in turn allowed, or stimulated, population growth. For the first time there was enough demand for specialized crafts and services to justify the existence of full-time craftspeople, who could be supported from the extra agricultural output.

3. According to paragraph 3, growing grape vines and olive trees increased agricultural yields because
- A. grapes and olives were mostly used for trade rather than for competing with established crops in local markets
 - B. grape vines and olive trees could be cultivated on land that was also used for raising sheep
 - C. growing grapes and olives did not require the services of specialized workers
 - D. grape vines and olive trees did not compete with other crops for land or labor
4. According to paragraph 3, the increased importance of grape and olive cultivation led to which of the following changes in Greece?
- A. An increase in the number of inhabitants
 - B. An increase in the amount of grain traded
 - C. An increase in the percentage of farmers in the population
 - D. The development of new methods of storing foods

【Paragraph 4】 Some copper artifacts were made during the fourth millennium B.C.E, but there were not many of them and they had little economic or social significance. When, in the third millennium, copper began to be mixed with tin to produce the relatively hard alloy bronze, demand for metal goods grew. Bronze could be used to make a range of useful new tools and weapons and a variety of impressive ornaments. The demand for metalwork stimulated further specialization in crafts such as toolmaking and jewelry making. The new tools promoted the development of other crafts, like carpentry and shipbuilding. Competition for prestigious or useful craft products and for control of their producers helped to heighten both social differences within communities and conflicts between them, resulting in the emergence of local chieftains, who were also in many instances warriors. These chieftains regulated agricultural and craft production, operating a distribution system through which the farmers could obtain tools or ornaments they needed or wanted. The organizational demands of controlled distribution made it necessary to develop methods of measurement and recording, which led to the development of writing.

5. According to paragraph 4, why did the invention of bronze lead to increased conflict?
- A. It resulted in more effective weapons for warriors.
 - B. It led to competition for the control of skilled craftspeople and their products.
 - C. It left the craftspeople who had been involved in making copper products without any occupation.
 - D. It led to competition for available supplies of tin to be used in the production of bronze.
6. All of the following are discussed in paragraph 4 as changes in Greek society after bronze was introduced EXCEPT
- A. Social differentiation within communities increased.
 - B. Metalcraft workers became more specialized.
 - C. Methods were invented for documenting the distribution of goods.

D. Craft workers gained greater independence from local chieftains.

【Paragraph 5】Renfrew argued that any single innovation would have had a limited or negligible effect on social organization because the inherently conservative nature of societies acts to minimize change. However, the interaction of several simultaneous developments created a multiplier effect. In the Aegean, increased agricultural productivity provided the means to support craft specialization, while bronze metallurgy provided the technology for producing highly valued new products. These factors set in motion a series of changes in other subsystems of society. Those changes in turn resulted in what, in a term borrowed from electronics, are called positive feedback loops—alterations in the workings of a social system that serve to reinforce themselves. Thus, Aegean society was transformed from one consisting of basically self-sufficient and egalitarian farming villages to one of prosperous, hierarchical chiefdoms, with palace-dwelling rulers, actively competing with one another both at home and in international trade.

7. What role does the idea of a “multiplier effect” serve in Renfrew’s explanation of the development of civilization in the Aegean?

- A. It allows him to argue that the combined effect of individual developments can lead to a major transformation of a social organization.
- B. It allows him to explain the idea of a positive feedback loop.
- C. It allows him to explain the inherently conservative nature of societies.
- D. It allows him to explain how the changes in agriculture, bronze metallurgy, and craft specialization came about.

8. According to paragraph 5, the transformation of Aegean society involved all the following EXCEPT

- A. interdependence of the society’s various social and economic structures
- B. economic success
- C. competition between chiefdoms for economic dominance
- D. social and political equality

【Paragraph 2】In a work published in 1972, Professor Colin Renfrew approached the problem from a different viewpoint. ■He argued that the scanty available evidence for invasion or immigration from Anatolia into Greece in the early Bronze Age (about 3300-2200 B.C.E.) showed that, at most, such incursion was limited, and that it could not be regarded as responsible for the transformation of society there. ■Trade, though clearly documented, was also an inadequate explanation in itself. ■To understand the major changes in social organization and complexity that took place, it was necessary, said Renfrew, to determine the impact that new variables emerging in the early Bronze Age may have had on every interrelated aspect of the local social system. ■The two new major developments he considered were changes in the subsistence economy and the introduction of bronze metallurgy.

9. Look at the four squares [■] that indicate where the following sentence could be added to the passage.

Instead, Renfrew emphasized the complex internal dynamics of change.

Where would the sentence best fit?

10. Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Colin Renfrew’s explanation of the rise of Aegean civilization rejected traditional views that the cause was one or another external influence on the developing society.

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Answer Choices

- A. The emergence of Aegean civilization was the result of internal factors interacting with each other in a way that multiplied each other’s effects.
- B. An increase in population created a shortage of agricultural land that increased social tensions and forced many farmers to become warriors for local chieftains.
- C. More effective bronze weapons increased the power of local chieftains, who imposed a system in which they collected farm and craft products in exchange for protecting their subjects.
- D. Once people began producing bronze, it surpassed wine and olive oil as the most important good traded in the Aegean.
- E. Agricultural surpluses from the production of olive oil and wine and the introduction of bronze technology together supported population growth, the development of crafts, and economic expansion.
- F. As the economy diversified and grew, a higher level of social organization was required, a need that encouraged the emergence of chieftains who regulated the distribution of economic goods.

Passage 43 - The Western Roman Empire in the Fifth Century

Shortly after the death of emperor Theodosius in 395 A.D., the Roman Empire was permanently divided into Eastern and Western empires. By the fifth century A.D., the power of the Western Roman Empire had declined considerably, though the Eastern Roman Empire centered in Byzantium continued to flourish. Various problems contributed to this undermining of the West.

The accessions of Arcadius and Honorius, sons of Theodosius, as emperors in the East and West, respectively, illustrate the unfortunate pattern of child heirs that had unfavorable effects for both empires. When Arcadius died in 408, he was succeeded by his seven-year-old son, Theodosius II. Reigning until 423, Honorius was succeeded by his nephew Valentinian III, who was only five. Because of their young ages, Theodosius' sons and grandsons could not rule without older advisors and supervising regents upon whom they naturally became dependent and from whom they were unable to break away after reaching maturity. As powerful individuals vied for influence and dominance at court, the general welfare was often sacrificed to private rivalries and ambitions. Moreover, it was the women of the dynasty who were the more capable and interesting characters. Holding the keys to succession through birth and inheritance, they became active players in the political arena.

Compared with the East, however, the West faced a greater number of external threats along more permeable frontiers. Whereas the East could pursue war and diplomacy more effectively with their enemies on the long eastern frontier, the West was exposed to the more volatile tribal Germanic peoples on a frontier that stretched along the Rhine and Danube rivers for 1,000 miles. The East, however, only had to guard the last 500 miles of the Danube. In addition, the East had many more human and material resources with which to pursue its military and diplomatic objectives. The East also had a more deeply rooted unity in the Greek culture of the numerous Greek and Near Eastern cities that Rome had inherited from earlier Grecian empires. Latin culture had not achieved comparable penetration of the less urbanized West outside of Italy. The penetration of Germanic culture from the north had been so extensive along the permeable Rhine-Danube frontier that it was often difficult to distinguish between barbarians (speakers of German and other languages unrelated to Latin) and Romans in those regions by the fifth century anyway.

One of the most outstanding features at the beginning of this period was the prominence of Germanic generals in the high command of the Roman Imperial army. The trend became significant, and several practical reasons can explain it. The foremost probably was the sheer need for military manpower that made it attractive to recruit bands of Germanic peoples for the armies, which, in turn, gave chieftains and warlords the opportunity to gain Imperial favor and advance in rank. Second, one way to turn Germanic chieftains from potential enemies into loyal supporters was to offer them a good position in the Roman military. Third, although Theodosius had risen to power as a military leader, he was also a cultured aristocrat and preferred to emphasize the civilian role of the emperor and to rely for protection on Germanic generals whose loyalties were primarily to him, their patron.

Unfortunately, the high positions achieved by Germanic officers often aroused the jealousy and hostility of high-ranking Roman military and civilian officials. Such positions also gave their Germanic holders a chance to act on both personal and tribal animosities in the arena of Imperial politics. Internal Roman rivalries and power struggles aggravated the situation. Rival factional leaders often granted Imperial titles and conceded territory to one Germanic leader or another in return for help against fellow Romans. While the Romans were thus distracted by internal conflict, other tribes seized the opportunity to cross into Roman territory unopposed. When the Romans could not dislodge them, peace was bought with further titles and territorial concessions as allies. In the midst of it all, alliances and coalitions between Roman emperors or powerful commanders and various tribes or tribal kings were made, unmade, and remade so often that it is nearly impossible to follow

their course. Accordingly, all of these situations proved dangerous to the peace and safety of the West.

【Paragraph 2】The accessions of Arcadius and Honorius, sons of Theodosius, as emperors in the East and West, respectively, illustrate the unfortunate pattern of child heirs that had unfavorable effects for both empires. When Arcadius died in 408, he was succeeded by his seven-year-old son, Theodosius II. Reigning until 423, Honorius was succeeded by his nephew Valentinian III, who was only five. **Because of their young ages, Theodosius' sons and grandsons could not rule without older advisors and supervising regents upon whom they naturally became dependent and from whom they were unable to break away after reaching maturity.** As powerful individuals vied for influence and dominance at court, the general welfare was often sacrificed to private rivalries and ambitions. Moreover, it was the women of the dynasty who were the more capable and interesting characters. Holding the keys to succession through birth and inheritance, they became active players in the political arena.

1. According to paragraph 2, which of the following was one result of the pattern of rule by child emperors?

- A. The common people lost respect for the position of emperor.
- B. Regents and advisors attempted to put an end to traditional rivalries for dominance within the court.
- C. Women within the dynasty gained increased influence and power.
- D. Traditional rules of succession by inheritance were changed.

2. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage?

Incorrect choices change the meaning in important ways or leave out essential information.

- A. As young rulers, the sons and grandsons of Theodosius necessarily depended on older advisors, and as adults, they were unable to rule independently of these advisors.
- B. The sons and grandsons of Theodosius were too young when they came to power to rule without the assistance of older advisors.
- C. On reaching maturity, the sons and grandsons of Theodosius attempted to break away from the older officials who had advised them since childhood.
- D. Because the sons and grandsons of Theodosius were young when they became rulers, older advisors were able to prevent them from breaking away.

【Paragraph 3】Compared with the East, however, the West faced a greater number of external threats along more permeable frontiers. Whereas the East could pursue war and diplomacy more effectively with their enemies on the long eastern frontier, the West was exposed to the more volatile tribal Germanic peoples on a frontier that stretched along the Rhine and Danube rivers for 1,000 miles. The East, however, only had to guard the last 500 miles of the Danube. In addition, the East had many more human and material resources with which to pursue its military and diplomatic objectives. The East also had a more deeply rooted unity in the Greek culture of the numerous Greek and Near Eastern cities that Rome had inherited from earlier Grecian empires. Latin culture had not achieved comparable penetration of the less urbanized West outside of Italy. The penetration of Germanic culture from the north had been so extensive along the permeable Rhine-Danube frontier that it was often difficult to distinguish between barbarians (speakers of German and other languages unrelated to Latin) and Romans in those regions by the fifth century anyway.

3. In describing the frontiers of the Western Empire as more permeable the author means that these frontiers

- A. had more places where crossings could occur
- B. were more distant from the center
- C. were more likely to be changed
- D. were more poorly equipped

4. Which of the following is NOT identified in paragraph 3 as a factor contributing to the greater stability and success of the Eastern empire?

- A. shorter border subject to invasion by Germanic tribes
- B. greater cultural unity among the inhabitants
- C. more resources available for achieving political goals
- D. lower population densities outside of urban areas

5. In paragraph 3, why does the author discuss the Germanic culture

- A. To compare the less urbanized West outside of Italy to the more urbanized East
- B. To explain why Roman military and political objectives necessarily changed in the fifth century
- C. To emphasize that the Romans had more of a cultural disadvantage in the West than in the East
- D. To explain why there were as many speakers of German as there were Romans on the western frontier

【Paragraph 4】 One of the most outstanding features at the beginning of this period was the prominence of Germanic generals in the high command of the Roman Imperial army. The trend became significant, and several practical reasons can explain it. The foremost probably was the sheer need for military manpower that made it attractive to recruit bands of Germanic peoples for the armies, which, in turn, gave chieftains and warlords the opportunity to gain Imperial favor and advance in rank. Second, one way to turn Germanic chieftains from potential enemies into loyal supporters was to offer them a good position in the Roman military. Third, although Theodosius had risen to power as a military leader, he was also a cultured aristocrat and preferred to emphasize the civilian role of the emperor and to rely for protection on Germanic generals whose loyalties were primarily to him, their patron.

6. Which of the following is NOT identified in paragraph 4 as a reason the practice arose of making Germanic chieftains generals in the Roman high command?

- A. It helped reduce the number of possible enemies against the empire.
- B. It helped make it possible to maintain an imperial military force of sufficient size.
- C. It was cheaper than recruiting and training Roman generals.
- D. It gave Theodosius confidence that his generals would remain loyal while he focused on other matters.

【Paragraph 5】 Unfortunately, the high positions achieved by Germanic officers often aroused the jealousy and hostility of high-ranking Roman military and civilian officials. Such positions also gave their Germanic holders a chance to act on both personal and tribal animosities in the arena of Imperial politics. Internal Roman rivalries and power struggles aggravated the situation. Rival factional leaders often granted Imperial titles and conceded territory to one Germanic leader or another in return for help against fellow Romans. While the Romans were thus distracted by internal conflict, other tribes seized the opportunity to cross into Roman territory unopposed. When the Romans could not dislodge them, peace was bought with further titles and territorial concessions as allies. In the midst of it all, alliances and coalitions between Roman emperors or powerful commanders and various tribes or tribal kings were made, unmade, and remade so often that it is nearly impossible to follow their course. Accordingly, all of these situations proved dangerous to the peace and safety of

the West.

7. Which of the following is identified in paragraph 5 as a negative consequence of making Germanic chieftains high-ranking officers in the Roman army

- A. Romans no longer sought achievement through the military.
- B. Germanic generals sometimes used their military power to advance their own and their tribes' interests.
- C. Germanic soldiers focused on achieving imperial titles rather than military success.
- D. Greater divisions developed between the Western Empire and the Eastern Empire, which lacked military leadership.

8. According to paragraph 5, what is one way that internal conflict in Rome endangered the peace and safety of the West?

- A. The conflict made it more difficult to make peace through the process of granting imperial titles and territorial concessions.
- B. The conflict made it easier for invaders to cross the frontier and enter Roman territory.
- C. The conflict discouraged Roman leaders from creating alliances and coalitions with Germanic tribes.
- D. The conflict made it nearly impossible to track the activities of enemy tribes outside Roman territory.

【Paragraph 5】 Unfortunately, the high positions achieved by Germanic officers often aroused the jealousy and hostility of high-ranking Roman military and civilian officials. Such positions also gave their Germanic holders a chance to act on both personal and tribal animosities in the arena of Imperial politics. Internal Roman rivalries and power struggles aggravated the situation. Rival factional leaders often granted Imperial titles and conceded territory to one Germanic leader or another in return for help against fellow Romans. While the Romans were thus distracted by internal conflict, other tribes seized the opportunity to cross into Roman territory unopposed. ■ When the Romans could not dislodge them, peace was bought with further titles and territorial concessions as allies. ■ In the midst of it all, alliances and coalitions between Roman emperors or powerful commanders and various tribes or tribal kings were made, unmade, and remade so often that it is nearly impossible to follow their course. ■ Accordingly, all of these situations proved dangerous to the peace and safety of the West. ■

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

Once within Roman borders, they proved difficult to remove.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Shortly after separation, the West Roman Empire became more vulnerable than its eastern counterpart.

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Answer Choices

- A. The division of the Roman Empire into two parts was particularly damaging for the Western Empire because it relied on the Eastern Empire for economic support.
- B. The heirs of Theodosius came to the throne as young children, allowing them to be dominated by advisors who competed for influence at the expense of the empire's welfare.
- C. Western emperors after Theodosius were unable to emphasize their civilian role because of their need to rely on the protection of Germanic generals loyal to them.
- D. Compared to the Eastern Empire, the Western Empire had many disadvantages, including more foreign enemies and fewer material and human resources.
- E. Resentment against Germanic chieftains achieving high rank in the Roman military and factionalism among Roman leaders were among the causes of the period's considerable instability.
- F. As the resources needed to secure Rome's borders increased, serious conflicts developed among Roman leaders over how best to protect Roman territory against invading tribes.

Passage 44 - Newspaper in Western Europe

By the eighteenth century, newspapers had become firmly established as a means of spreading news of European and world affairs, as well as of local concerns, within European society. One of the first true newspapers was the Dutch paper *Nieuwe Tijdingen*. It began publication in the early seventeenth century at about the same time that the overseas trading company called the Dutch East India Company was formed. The same ships that brought goods back from abroad brought news of the world, too.

Dutch publishers had an advantage over many other publishers around Europe because the Netherlands' highly decentralized political system made its censorship laws very difficult to enforce. Throughout Europe in the seventeenth century, governments began recognizing the revolutionary potential of the free press and began requiring licenses of newspapers—to control who was able to publish news. Another tactic, in France and elsewhere on the continent from the 1630s onward, was for governments to sponsor official newspapers. These state publications met the increasing demand for news but always supported the government's views of the events of the day.

By the eighteenth century, new conditions allowed newspapers to flourish as never before. First, demand for news increased as Europe's commercial and political interests spread around the globe—merchants in London, Liverpool, or Glasgow, for example, came to depend on early news of Caribbean harvests and gains and losses in colonial wars. Europe's growing commercial strength also increased distribution networks for newspapers. There were more and better roads, and more vehicles could deliver newspapers in cities and convey them to outlying towns. Newspaper publishers made use of the many new sites where the public expected to read, as newspapers were delivered to cafes and sold or delivered by booksellers.

Second, many European states had established effective postal systems by the eighteenth century. It was through the mail that readers outside major cities and their environs—and virtually all readers in areas where press censorship was exercised firmly—received their newspapers. One of the most successful newspapers in Europe was a French-language paper (one of the many known as *La Gazette*), published in Leiden, in the Netherlands, which boasted a wide readership in France and among elites throughout Europe.

Finally, press censorship faltered in one of the most important markets for news—England—at the turn of the eighteenth century after 1688. Debate raged about whether the Parliament or the Crown had the right to control the press, and in the confusion the press flourished. The emergence of political parties further hampered control of the press because political decisions in Parliament now always involved compromise, and many members believed that an active press was useful to that process. British government's control of the press was reduced to taxing newspapers, a tactic that drove some papers out of business.

Eighteenth-century newspapers were modest products by modern Western standards. Many were published only once or twice a week instead of every day, in editions of only a few thousand copies. Each newspaper was generally only four pages long. Illustrations were rare, and headlines had not yet been invented. Hand-operated wooden presses were used to print the papers, just as they had been used to print pamphlets and books since the invention of printing in the fifteenth century.

Yet these newspapers had a dramatic impact on their reading public. Regular production of newspapers (especially of many competing newspapers) meant that news was presented to the public at regular intervals and in manageable amounts. Even strange and threatening news from around the world became increasingly easy for readers to absorb and interpret. Newspaper readers also felt themselves part of the public life about which they were reading. This was true partly because newspapers,

available in public reading rooms and in cafes, were one kind of reading that occupied an increasing self-aware and literate audience. Newspapers also were uniquely responsive to their readers. They began to carry advertisements, which both produced revenue for papers and widened readers' exposure to their own communities. Even more important was the inauguration of letters to the editor in which readers expressed their opinions about events. Newspapers **thus** became venues for the often rapid exchange of news and opinions.

[Paragraph 1] By the eighteenth century, newspapers had become firmly established as a means of spreading news of European and world affairs, as well as of local concerns, within European society. One of the first true newspapers was the Dutch paper *Nieuwe Tijdingen*. It began publication in the early seventeenth century at about the same time that the overseas trading company called the Dutch East India Company was formed. The same ships that brought goods back from abroad brought news of the world, too.

1. According to paragraph 1, what was true about the Dutch paper *Nieuwe Tijdingen*?

- A. It reported news mainly about ships and trade goods.
- B. It was established in the eighteenth century.
- C. It was among the first real newspapers in Europe.
- D. It was published by an overseas trading company.

[Paragraph 2] Dutch publishers had an advantage over many other publishers around Europe because the Netherlands' highly decentralized political system made its censorship laws very difficult to enforce. Throughout Europe in the seventeenth century, governments began recognizing the revolutionary potential of the free press and began requiring licenses of newspapers—to control who was able to publish news. Another tactic, in France and elsewhere on the continent from the 1630s onward, was for governments to sponsor official newspapers. These state publications met the increasing demand for news but always supported the government's views of the events of the day.

2. Paragraph 2 suggests that the main reason why governments began to license newspapers was

- A. to make sure that newspapers were of high quality
- B. to provide their countries' publishers with an advantage over other European publishers
- C. to reduce competition among government-sponsored newspapers
- D. to help control the public's attitudes about the news

3. According to paragraph 2, what was true about official government newspapers?

- A. They made censorship laws more difficult to enforce
- B. They expanded the revolutionary potential of the press
- C. They appeared first in the Netherlands
- D. They always agreed with the government's opinion.

【Paragraph 3】 By the eighteenth century, new conditions allowed newspapers to flourish as never before. First, demand for news increased as Europe’s commercial and political interests spread around the globe—merchants in London, Liverpool, or Glasgow, for example, came to depend on early news of Caribbean harvests and gains and losses in colonial wars. Europe’s growing commercial strength also increased distribution networks for newspapers. There were more and better roads, and more vehicles could deliver newspapers in cities and convey them to outlying towns. Newspaper publishers made use of the many new sites where the public expected to read, as newspapers were delivered to cafes and sold or delivered by booksellers.

4. According to paragraph 3, why did demand for news increase in the eighteenth century?

- A. People wanted to read about the new books being sold by booksellers.
- B. Governments wanted to make sure their colonies were being governed efficiently.
- C. Merchants needed to know how their businesses would be affected by events in other countries.
- D. Owners of cafes needed to predict how foreign harvests might affect food prices.

【Paragraph 4】 Second, many European states had established effective postal systems by the eighteenth century. It was through the mail that readers outside major cities and their environs—and virtually all readers in areas where press censorship was exercised firmly—received their newspapers. One of the most successful newspapers in Europe was a French-language paper (one of the many known as *La Gazette*,) published in Leiden, in the Netherlands, which boasted a wide readership in France and among elites throughout Europe.

5. In paragraph 4, why does the author mention a French language paper that was published in Leiden?

- A. To show that the most successful newspapers in Europe tended to be French-language newspapers
- B. To illustrate the important role played by the mail in the distribution of newspapers
- C. To provide evidence that newspapers were being read by the elites of Europe
- D. To establish that the Netherlands had one of the most effective postal systems in Europe

【Paragraph 5】 Finally, press censorship faltered in one of the most important markets for news—England—at the turn of the eighteenth century after 1688. Debate raged about whether the Parliament or the Crown had the right to control the press, and in the confusion the press flourished. The emergence of political parties further hampered control of the press because political decisions in Parliament now always involved compromise, and many members believed that an active press was useful to that process. British government’s control of the press was reduced to taxing newspapers, a tactic that drove some papers out of business.

6. According to paragraph 5, many members of Parliament held which of the following views about the English press?

- A. It had the effect of increasing tensions between Parliament and the monarchy.
- B. It created pressure that encouraged political opponents to reach agreement.
- C. It helped create the confusion that led to the emergence of political parties.
- D. It could be more effectively controlled by compromise than by taxing newspapers.

【Paragraph 6】 Eighteenth-century newspapers were modest products by modern Western standards. Many were published only once or twice a week instead of every day, in editions of only a few thousand copies. Each newspaper was generally only four pages long. Illustrations were rare, and headlines had not yet been invented. Hand-operated wooden presses were used to print the papers, just as they had been used to print pamphlets and books since the invention of printing in the fifteenth century.

7. According to paragraph 6, all of the following are true of eighteenth-century newspapers EXCEPT

- A. They usually were published no more than twice a week.
- B. They generally consisted of four pages.
- C. They included numerous illustrations.
- D. They had no headlines.

【Paragraph 7】 Yet these newspapers had a dramatic impact on their reading public. Regular production of newspapers (especially of many competing newspapers) meant that news was presented to the public at regular intervals and in manageable amounts. Even strange and threatening news from around the world became increasingly easy for readers to absorb and interpret. Newspaper readers also felt themselves part of the public life about which they were reading. This was true partly because newspapers, available in public reading rooms and in cafes, were one kind of reading that occupied an increasing self-aware and literate audience. Newspapers also were uniquely responsive to their readers. They began to carry advertisements, which both produced revenue for papers and widened readers' exposure to their own communities. Even more important was the inauguration of letters to the editor in which readers expressed their opinions about events. Newspapers thus became venues for the often rapid exchange of news and opinions.

8. According to paragraph 7, newspapers had all of the following effects on their readers EXCEPT

- A. They found it easier to understand news from other countries.
- B. They became more successful in business than those who did not read newspapers.
- C. They became better connected to their local communities.
- D. They could write about their own opinions on current events.

【Paragraph 2】 Dutch publishers had an advantage over many other publishers around Europe because the Netherlands' highly decentralized political system made its censorship laws very difficult to enforce. ■ Throughout Europe in the seventeenth century, governments began recognizing the revolutionary potential of the free press and began requiring licenses of newspapers—to control who was able to publish news. ■ Another tactic, in France and elsewhere on the continent from the 1630s onward, was for governments to sponsor official newspapers. ■ These state publications met the increasing demand for news but always supported the government's views of the events of the day. ■

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

And even when it was possible to apply laws limiting speech, authorities were reluctant to do so because of the growing economic importance of the commercial book market.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

By the eighteenth century, newspapers had become established as a means of spreading news of European affairs within European society.

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Answer Choices

- A. Governments tried to control what news got published by sponsoring official newspapers, taxing publishers, requiring newspapers to be licensed, and instituting press-censorship laws.
- B. England was the most Important market for news, but disruptions caused by conflict over how the government should control the press resulted in many British newspapers being driven out of business.
- C. Censorship laws were established and enforced differently across Europe because of differences in the political systems of the various countries.
- D. Europe's expanding commercial and political interests led to increased demand for news and also to improved systems for distributing newspapers.
- E. Although eighteenth-century newspapers were modest by modern standards, they made current events accessible to the reading public and facilitated the rapid exchange of news and opinions.
- F. Newspapers' regular presentation of strange and threatening news from around the world had the effect of making their readers feel more closely connected to their own local communities.

Passage 45 - Effects of the Commercial Revolution

In the third and the second millennia B.C. long-distance trade supposedly had the character of an expedition. By the start of the last millennium B.C., however, a new approach to engaging in such trade emerged. Based on the principle of colonization, it was pioneered by the Phoenicians and Greeks, who established colonies along the Mediterranean Sea. The new approach to long-distance trade, known as the commercial revolution, led to changes in a number of political and economic patterns.

For the first time, the planting of colonies in distant lands became possible. The Phoenician settlements in the central and western Mediterranean, such as Carthage, and the slightly later establishment of Greek colonies are early examples, while the settlement of south Arabians in Eritrea around the middle of the last millennium marks the subsequent spread of this sort of commercial consequence to the Horn of Africa. In the third or second millennia B. C., a state such as Egypt might colonize areas outside its heartland, such as Nubia. But this colonization comprised military outposts and ethnic settlements that were planted to hold the contiguous territories of a land empire, not distant localities far separated from the home country.

The commercial revolution constructed the economic basis as well for a new kind of town or city, an urban center that above all serviced trade and was home to the crafts and occupational specializations that went along with commercial development. The urban locations of earlier times commonly drew trade simply because their populations had included a privileged elite of potential consumers. Such towns had arisen in the first place as political and religious centers of the society, they attracted population because power and influence reside there and access to position and wealth could be gained through service to the royal or priestly leadership.

Wherever the effects of the commercial revolution penetrated over the last millennium B. C., kings and emperors increasingly lost their ability to treat trade as a royalty sponsored activity, who intended to preserve the commodities of trade as the privileges of immemorial power and position. Instead, their policies shifted toward controlling geographical accessibility to the products of commerce and to ensuring security and other conditions that attracted and enhanced the movement of goods. No longer could kings rely on agriculturally supported and religiously based claims to an ability to protect their lands and people; now they also had to overtly support the material prosperity of their people compared to other societies. And rather than exerting a monopoly over prestige commodities, as had Egyptian kings of the third and second millennia, and redistributing such commodities in ways designed to reinforce the allegiance of their subjects and enhance the awesomeness of their position, rulers turned to the taxation of trade and to the creation and control of currency, more and more relying on duties and other revenues to support the apparatus of the state. It was no historical accident that the first metal coinage in the world began to be made in eighth-century Anatolia (modern Turkey) and that the use of coins rapidly spread with the expanding commercial revolution. The material bases and the legitimizations of state authority as we know them today had begun to take shape.

The commercial revolution tended also to spread a particular pattern of exchange. The early commercial centers of the Mediterranean most characteristically offered manufactured goods—purple dye, metal goods, wine, olive oil, and so forth—for the raw materials or the partially processed natural products of other regions. As the commercial revolution spread, this kind of exchange tended to spread with it, with the recently added areas of commerce providing new kinds of raw materials or new sources for familiar products of the natural world, and the longer established commercial centers—which might themselves have lain at the margins of this transformation—producing, or acting as the intermediaries in the transmission of manufactured commodities. India, for instance, had developed by the turn of the era into a major exporter of its own cotton textiles, as well as naturally occurring materials, such as gems of various kinds, and at the same time its merchants were the intermediaries of the silk trade.

【Paragraph 1】 In the third and the second millennia B.C. long-distance trade supposedly had the character of an expedition. By the start of the last millennium B.C., however, a new approach to engaging in such trade emerged. Based on the principle of colonization, it was **pioneered** by the Phoenicians and Greeks, who established colonies along the Mediterranean Sea. The new approach to long-distance trade, known as the commercial revolution, led to changes in a number of political and economic patterns.

1. The word “**pioneered**” in the passage is closet in meaning to

- A. adopted
- B. described
- C. demonstrated
- D. introduced

【Paragraph 2】 For the first time, the planting of colonies in distant lands became possible. The Phoenician settlements in the central and western Mediterranean, such as Carthage, and the slightly later establishment of Greek colonies are early examples, while the settlement of south Arabians in Eritrea around the middle of the last millennium marks the subsequent spread of this sort of commercial consequence to the Horn of Africa. In the third or second millennia B. C., a state such as Egypt might colonize areas outside its heartland, such as Nubia. But this colonization comprised military outposts and ethnic settlements that were planted to hold the contiguous territories of a land empire, not distant localities far separated from the home country.

2. All of the following groups are mentioned in paragraph 2 as establishing distant trading outposts in the last millennium

B. C. EXCEPT

- A. the Greeks
- B. the Egyptians
- C. the Phoenicians
- D. the south Arabians

3. In paragraph 2, why does the author mention the colonization of Nubia by the Egyptians?

- A. To prove that colonization was first carried out by the military
- B. To indicate that Egypt was a major military power in the third and second millennia B. C.
- C. To illustrate how large the geographic area of colonization had become over several millennia
- D. To show that the purpose of colonization during the third and second millennia B.C. differed from that of the last millennium B. C.

【Paragraph 3】 The commercial revolution constructed the economic basis as well for a new kind of town or city, an urban center that above all serviced trade and was home to the crafts and occupational specializations that went along with commercial development. The urban locations of earlier times commonly drew trade simply because their populations had included a privileged elite of potential consumers. Such towns had arisen in the first place as political and religious centers of the society, they attracted population because power and influence reside there and access to position and wealth could be gained through service to the royal or priestly leadership.

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4. According to paragraph 3, before the emergence of the commercial revolution, trade
- A. enabled craftspeople and occupational specialists to gain power and influence in society
 - B. centered on the ruling elite and those groups closely associated with them
 - C. was primarily conducted by people serving the royal and religious leadership
 - D. was a major reason why urban centers were established

【Paragraph 4】 Wherever the effects of the commercial revolution penetrated over the last millennium B. C., kings and emperors increasingly lost their ability to treat trade as a royalty sponsored activity, who intended to preserve the commodities of trade as the privileges of immemorial power and position. Instead, their policies shifted toward controlling geographical accessibility to the products of commerce and to ensuring security and other conditions that attracted and enhanced the movement of goods. No longer could kings rely on agriculturally supported and religiously based claims to an ability to protect their lands and people; now they also had to overtly support the material prosperity of their people compared to other societies. And rather than exerting a monopoly over prestige commodities, as had Egyptian kings of the third and second millennia, and redistributing such commodities in ways designed to reinforce the allegiance of their subjects and enhance the awesomeness of their position, rulers turned to the taxation of trade and to the creation and control of currency, more and more relying on duties and other revenues to support the apparatus of the state. It was no historical accident that the first metal coinage in the world began to be made in eighth-century Anatolia (modern Turkey) and that the use of coins rapidly spread with the expanding commercial revolution. The material bases and the legitimizations of state authority as we know them today had begun to take shape.

5. According to paragraph 4, as the commercial revolution expanded, rulers focused on
- A. taxation and the development and control of money
 - B. monopolizing prestige commodities
 - C. distributing prestige commodities to ensure the allegiance of their subjects
 - D. protecting their land to legitimize their authority
6. What can be inferred from paragraph 4 about Anatolia?
- A. Its merchants specialized in the trading of prestige commodities.
 - B. It was the first place to use currency for the taxation of trade.
 - C. It contained enormous supplies of metal compared with other states in the region.
 - D. Trade remained a royally sponsored activity there long after the emergence of the commercial revolution.

【Paragraph 5】 The commercial revolution tended also to spread a particular pattern of exchange. The early commercial centers of the Mediterranean most characteristically offered manufactured goods—purple dye, metal goods, wine, olive oil, and so forth—for the raw materials or the partially processed natural products of other regions. **As the commercial revolution spread, this kind of exchange tended to spread with it, with the recently added areas of commerce providing new kinds of raw materials or new sources for familiar products of the natural world, and the longer established commercial centers—which might themselves have lain at the margins of this transformation—producing, or acting as the intermediaries in the transmission of manufactured commodities.** India, for instance, had developed by the turn of the era into a major exporter of its own cotton textiles, as well as naturally occurring materials, such as gems of various kinds, and at the same time its merchants were the intermediaries of the silk trade.

7. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. During the commercial revolution, newer centers of trade acted as intermediaries in the exchange of different types of manufactured goods.
- B. Longer-established trading centers were familiar with the unprocessed products of the natural world, but depended on other areas as sources for manufactured commodities.
- C. Eventually, the commercial revolution led to a trading system whereby newly established commercial centers provided the resources needed for the production of goods while older trading centers produced the goods or assisted in their distribution.
- D. The commercial revolution depended on a system of trade where consumers valued novelty in the manufactured goods they acquired, but, at the same time, they wanted to be familiar with the natural products they received.

8. Paragraph 5 supports which of the following statements about Indian merchants at the time of the commercial revolution?

- A. They imported cotton, silk, and other high-quality fabrics intended for the Indian market.
- B. They obtained various kinds of gems from intermediaries in the silk trade.
- C. They were simultaneously exporters of manufactured and natural products and intermediaries for goods produced elsewhere.
- D. They created a highly sophisticated textile industry at the same time that they were engaged in the processing of natural products.

【Paragraph 3】 ■The commercial revolution constructed the economic basis as well for a new kind of town or city, an urban center that above all serviced trade and was home to the crafts and occupational specializations that went along with commercial development. ■The urban locations of earlier times commonly drew trade simply because their populations had included a privileged elite of potential consumers. ■Such towns had arisen in the first place as political and religious centers of the society, they attracted population because power and influence reside there and access to position and wealth could be gained through service to the royal or priestly leadership. ■

9. Look at the four squares 【■】 that indicate where the following sentence can be added to the passage.

It was significantly different from the typical centers that existed before the commercial revolution.

Where would the sentence best fit?

10. Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

The commercial revolution of the last millennium B. C. resulted in both political and economic changes.

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Answer Choices

- A. New kinds of urban centers emerged that focused on commerce and encouraged craft and occupational specializations.
- B. Rulers in the last millennium B. C. began to promote the material prosperity of their people through support and improvement of commerce.
- C. More established commercial centers supplied final products to newer regions in exchange for raw materials.
- D. During the first millennium B. C., new political and religious centers arose that based their power on their ability to protect their lands and people.
- E. The focus on raw materials switched the balance of power from the manufacturing centers to the control of the exporters of the natural products.
- F. Military occupation of neighboring lands became a major means of expanding trade into new territories.

Passage 46 - European Context of the Scientific Revolution

The Scientific Revolution represents a turning point in world history. By 1700 European scientists had overthrown the science and worldviews of the ancient philosophers: Aristotle and Ptolemy. Europeans in 1700 lived in a vastly different intellectual world than that experienced by their predecessors in, say, 1500. The role and power of science, as a way of knowing about the world and as an agency with the potential of changing the world, likewise underwent profound restricting as part of the Scientific Revolution.

The social context for science in Europe in the sixteenth and seventeenth centuries had changed in several dramatic ways from the Middle Ages (roughly, 500 C.E. to the 1400s C.E.). Advances in military technology, the European voyages of exploration, and contact with the New World altered the context in which the Scientific Revolution unfolded. The geographical discovery of the Americas generally undermined the closed Eurocentric cosmos of the later Middle Ages, and the science of geography provided a stimulus of its own to the Scientific Revolution. With an emphasis on observational reports and practical experience, new geographical discoveries challenged accepted knowledge. Cartography (mapmaking) thus provided exemplary new ways of learning about the world in general, ways self-evidently superior to mastering established doctrines from dusty books. Many of the scientists of the Scientific Revolution seem to have been involved in one fashion or another with geography or cartography.

In the late 1430s, Johannes Gutenberg, apparently independently of the development of woodblock printing in Asia, invented printing with movable type, and the spread of this powerful new technology after 1450 likewise altered the cultural landscape of early modern Europe. The new medium created a revolution in communications that increased the amount and accuracy of information available and made copying of books by scribes obsolete. Producing some 13,000 works by 1500, printing presses spread rapidly throughout Europe and helped to break down the monopoly of learning in universities and to create a new group of nonreligious intellectuals. Indeed, the first printshops became something of intellectual centers themselves, with authors, publishers, and workers collaborating in unprecedented ways in the production of new knowledge. Renaissance humanism, that renowned philosophical and literary movement emphasizing human values and the direct study of classical Greek and Latin texts, is hardly conceivable without the technology of printing that sustained the efforts of learned humanists. Regarding science, the advent of printing and humanist scholarship brought another wave in the recovery of ancient texts. Whereas Europeans first learned of ancient Greek science largely through translations from the Arabic in the twelfth century, in the later fifteenth century scholars brought forth new editions from Greek originals and uncovered influential new sources, notably the Greek mathematician Archimedes. Similarly, printing disseminated previously obscure handbooks of technical and magical secrets that proved influential in the developing Scientific Revolution.

Particularly in Italy, the revival of cultural life and the arts in the late fourteenth and fifteenth centuries commonly known as the Renaissance must also be considered as an urban and comparatively secular phenomenon, aligned with courts and courtly patronage but not with the universities, which were religiously base. One associates the great flourish of artistic activity of the Renaissance with such talents as Donatello, Leonardo da Vinci, Raphael, and Michelangelo. In comparison with medieval art, the use of perspective—a projection system that realistically renders the three dimensions of space onto the two dimensions of a canvas—represents a new feature typical of Renaissance painting, and through the work of Leon Battista Alberti, Albrecht Durer, and others, artists learned to practice mathematical rules governing perspective. So noteworthy was this development that historians have been inclined to place Renaissance artists at the forefront of those uncovering new knowledge about nature in the fifteenth and sixteenth centuries. Whatever one may make of that claim, early modern artists needed accurate knowledge of human muscular anatomy for lifelike renditions, and an explosion of anatomical research in the Renaissance may be attributed to this need in the artistic community.

【Paragraph 1】 The Scientific Revolution represents a turning point in world history. By 1700 European scientists had overthrown the science and worldviews of the ancient philosophers: Aristotle and Ptolemy. Europeans in 1700 lived in a vastly different intellectual world than that experienced by their predecessors in, say, 1500. The role and power of science, as a way of knowing about the world and as an agency with the potential of changing the world, likewise underwent **profound** restricting as part of the Scientific Revolution.

1. The word “**profound**” in the passage is closest in meaning to
 - A. frequent
 - B. intense
 - C. challenging
 - D. careful
2. According to paragraph 1, what was new about the intellectual world of 1700?
 - A. Scientists were aware that they were participating in a turning point in world history.
 - B. Beliefs about nature developed by ancient philosophers were no longer accepted.
 - C. People believed that science had changed the world.
 - D. The impact of the Scientific Revolution was being felt in all aspects of European life.

【Paragraph 2】 The social context for science in Europe in the sixteenth and seventeenth centuries had changed in several dramatic ways from the Middle Ages (roughly, 500 C.E. to the 1400s C.E.). Advances in military technology, the European voyages of exploration, and contact with the New World altered the context in which the Scientific Revolution unfolded. The geographical discovery of the Americas generally undermined the closed Eurocentric cosmos of the later Middle Ages, and the science of geography provided a stimulus of its own to the Scientific Revolution. With an emphasis on observational reports and practical experience, new geographical discoveries challenged accepted knowledge. Cartography (mapmaking) thus provided exemplary new ways of learning about the world in general, ways self-evidently superior to mastering established doctrines from dusty books. Many of the scientists of the Scientific Revolution seem to have been involved in one fashion or another with geography or cartography.

3. According to paragraph 2, all of the following influenced European scientific thought during the sixteenth and seventeenth centuries EXCEPT
 - A. progress in military technology
 - B. explorative journeys made by Europeans
 - C. views expressed in the scholarship of the Middle Ages
 - D. the development of cartography

【Paragraph 3】 In the late 1430s, Johannes Gutenberg, apparently independently of the development of woodblock printing in Asia, invented printing with movable type, and the spread of this powerful new technology after 1450 likewise altered the cultural landscape of early modern Europe. The new medium created a revolution in communications that increased the amount and accuracy of information available and made copying of books by scribes obsolete. Producing some 13,000 works by 1500, printing presses spread rapidly throughout Europe and helped to break down the monopoly of learning in universities and to create a new group of nonreligious intellectuals. Indeed, the first printshops became something of intellectual centers themselves, with authors, publishers, and workers collaborating in unprecedented ways in the production of new knowledge. Renaissance humanism, that renowned philosophical and literary movement emphasizing human values and the direct study of classical Greek and Latin texts, is hardly conceivable without the technology of printing that sustained the efforts of learned humanists. Regarding science, the advent of printing and humanist scholarship brought another wave in the recovery of ancient texts. Whereas Europeans first learned of ancient Greek science largely through translations from the Arabic in the twelfth century, in the later fifteenth century scholars brought forth new editions from Greek originals and uncovered influential new sources, notably the Greek mathematician Archimedes. Similarly, printing disseminated previously obscure handbooks of technical and magical secrets that proved influential in the developing Scientific Revolution.

4. Paragraph 3 suggests that before 1500 the transmission of knowledge in Europe was

- A. stimulated by printing developments in Asia
- B. dependent on collaborations between scribes and publishers
- C. limited to religious intellectuals in academic settings
- D. influenced by philosophical rather than literary sources

5. The author discusses “Renaissance humanism” in order to

- A. demonstrate that printing presses facilitated the spread of humanistic thought
- B. discuss why print shops declined as intellectual centers
- C. compare the beliefs of classical humanists to the Renaissance humanists
- D. emphasize the importance of the direct study of Greek and Latin texts

6. According to paragraph 3, what effect did the invention of printing have on science in Europe?

- A. Scientists were able to publish books for humanists and other non-scientific intellectuals.
- B. Europeans gained access to new editions of texts as well as new sources of knowledge.
- C. Translations of Arabic texts documenting scientific discoveries became widely available.
- D. Humanistic study declined as a result of the advance of scientific study.

【Paragraph 4】 Particularly in Italy, the revival of cultural life and the arts in the late fourteenth and fifteenth centuries commonly known as the Renaissance must also be considered as an urban and comparatively secular phenomenon, aligned with courts and courtly patronage but not with the universities, which were religiously base. One associates the great flourish of artistic activity of the Renaissance with such talents as Donatello, Leonardo da Vinci, Raphael, and Michelangelo. In comparison with medieval art, the use of perspective—a projection system that realistically renders the three dimensions of space onto the two dimensions of a canvas—represents a new feature typical of Renaissance painting, and through the work of Leon Battista Alberti, Albrecht Durer, and others, artists learned to practice mathematical rules governing perspective. So noteworthy was this development that historians have been inclined to place Renaissance artists at the forefront of those uncovering new knowledge about nature in the fifteenth and sixteenth centuries. **Whatever one may make of that claim, early modern artists needed accurate knowledge of human muscular anatomy for lifelike renditions, and an explosion of anatomical research in the Renaissance may be attributed to this need in the artistic community.**

7. According to paragraph 4, Renaissance artistic contributed to the Scientific Revolution by

- A. reviving medieval mathematical and scientific sources for study
- B. establishing institutions for the study of mathematics and scientific principles in art
- C. creating paintings that contributed to the wealth of the courts and courtly patronage of science
- D. using mathematical information to realistically represent space in art

8. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Early modern artists claim to have uncovered new knowledge about nature and human muscular anatomy before the explosion of anatomical research.
- B. Artists' need for accurate knowledge in order to realistically represent the human body may have caused the sudden increase in anatomical studies in the Renaissance.
- C. Whatever other claims are made about early modern art, it is accurate to state that Renaissance artists were concerned with creating lifelike representations.
- D. The need for early modern artists to create lifelike renditions developed after the explosion of anatomical research made human anatomy clear.

【Paragraph 2】 ■The social context for science in Europe in the sixteenth and seventeenth centuries had changed in several dramatic ways from the Middle Ages (roughly, 500 C.E. to the 1400s C.E.). ■Advances in military technology, the European voyages of exploration, and contact with the New World altered the context in which the Scientific Revolution unfolded. The geographical discovery of the Americas generally undermined the closed Eurocentric cosmos of the later Middle Ages, and the science of geography provided a stimulus of its own to the Scientific Revolution. ■With an emphasis on observational reports and practical experience, new geographical discoveries challenged accepted knowledge. Cartography (mapmaking) thus provided exemplary new ways of learning about the world in general, ways self-evidently superior to mastering established doctrines from dusty books. ■Many of the scientists of the Scientific Revolution seem to have been involved in one fashion or another with geography or cartography.

9. Look at the four squares **【■】** that indicate where the following sentence can be added to the passage.

Given the advantages these new approaches offered, it is hardly surprising that sciences associated with exploration attracted great intellectual interest.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

The geographical discovery of the Americas, the technology of printing, and the revival of cultural life and the arts all contributed to the Scientific Revolution.

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Answer Choices

- A. The discovery of the Americas stimulated the science of geography and cartography which in turn emphasized observation and practical experience.
- B. The invention of movable type increased the accuracy and availability of information, and a new group of nonreligious scholars emerged.
- C. The growth of both artistic and scientific activity in Renaissance Italy was encouraged by the financial support of universities and wealthy merchants.
- D. Johannes Gutenberg's invention of printing in the late 1430s appears to have been unrelated to earlier developments in print technology in Asia.
- E. European intellectuals first discovered the existence of ancient Greek science and mathematics texts in the late fifteenth century, when translations from the Arabic finally became available.
- F. The revival of culture and art in fourteenth-century Italy encouraged the development of perspective and the adherence to mathematical rules in painting.

Passage 47 - Farming New England in Colonial Times

When in the seventeenth and eighteenth centuries European settlers arrived in New England, the northeastern part of the United States, forest was the dominant form of vegetative cover, making agriculture difficult. Initially, the Europeans went in search of areas already cleared by Native Americans (the original inhabitants of the continent) that would be suitable for planting crops, to thereby save themselves from the backbreaking labor involved in clearing forestland.

Eventually, however, population growth outstripped the supply of cleared land, forcing the European settlers to cut down more forest themselves. For most of the settlers, cleared, arable land was the landscape most familiar to them from life back across the ocean. It took time to become accustomed to the hard labor involved in cutting down the woods. In the northern colonies, trees were usually chopped down, although occasionally a technique known as girdling was used. Girdling, a practice far more common in the South, involved cutting a horizontal channel all the way around the tree, which stopped the flow of sap, the liquid that carries food to all parts of a plant. Deprived of sap, the leaves would die and the branches eventually fell off, leaving the surrounding land dry and suitable for planting.

New Englanders, however, generally clear-cut the forest, in part because the demand for fuel wood and lumber encouraged it. The market for potash, an alkaline substance that came from burning hardwood trees, also strongly motivated farmers to cut and burn the woods. Used to manufacture soap, glass, and gunpowder and to bleach linens and print calicoes, potash served a range of industrial uses but at the expense of farms, which lost the nutrients that the wood ashes would otherwise have released back into the soil had they not been exported to market.

With their very existence dependent on the successful production of food, farmers had little, if any, time for removing stumps and stones. Instead, they adapted to the half-cleared fields by planting corn (maize) and grass, both grew well in such an environment. A pattern of “extensive” farming began to emerge. Rather than carefully tending arable land, engaging in crop rotation, manuring, and removing all stumps and stones—all recognized as part of proper agricultural practice in Europe—New England farmers simply exploited the soil and then forged ahead with the cleaning of new land. Cutting down trees remained hard work, but it was easier to partially clear the land, plant it, and then move on to another small plot than to constantly improve the soil on one field to the high Old World (European) standards. The settlers were too busy figuring out how to produce food rapidly to worry about efficient agricultural practices.

Early on, the settlers adopted the Native American practice of planting corn along with beans and pumpkins or squash. These plants reinforced one another, resulting in high agricultural yields. The stalks of corn facilitated the growth of beans by giving them a structure to climb. The beans replenished the nitrogen that the corn drained out of the soil, bolstering fertility. And the pumpkins were a valuable source of food in the pioneer environment. After a few seasons, however, the settlers slowly began the process of transforming New England into an image of the Old World, planting European grains such as wheat and rye alongside the maize, a crop they never abandoned, in part because it proved a more reliable source of food.

New England, unlike the South, did not center its economy on an export crop like tobacco. Nor were its soils as fertile as those in the mid-Atlantic area (south of New England), which by the eighteenth century was the great grain-producing region of the colonies instead. New England’s soil had a moisture content that made it especially suited for growing grass. Grass played the pivotal role in the region’s farm ecology: the grass fed cattle that, in turn, produced manure that was spread over the fields as fertilizer for growing corn and other crops. Grass and cattle thus helped to maintain soil fertility—

the key to reproducing a sustainable form of farm life—by recycling nutrients back into the fields.

【Paragraph 1】 When in the seventeenth and eighteenth centuries European settlers arrived in New England, the northeastern part of the United States, forest was the dominant form of vegetative cover, making agriculture difficult. Initially, the Europeans went in search of areas already cleared by Native Americans (the original inhabitants of the continent) that would be suitable for planting crops, to thereby save themselves from the backbreaking labor involved in clearing forestland.

1. According to paragraph 1, European settlers were interested in areas that had already been cleared by Native Americans because

- A. they believed that the most fertile soil was to be found in those areas
- B. they wanted to locate their field where they would do as little damage to the forest as possible
- C. cleaning forestland to create fields was extremely hard work
- D. it took some time before a newly cleared area became suitable for planting crops

【Paragraph 2】 Eventually, however, population growth outstripped the supply of cleared land, forcing the European settlers to cut down more forest themselves. For most of the settlers, cleared, arable land was the landscape most familiar to them from life back across the ocean. It took time to become accustomed to the hard labor involved in cutting down the woods. In the northern colonies, trees were usually chopped down, although occasionally a technique known as girdling was used. Girdling, a practice far more common in the South, involved cutting a horizontal channel all the way around the tree, which stopped the flow of sap, the liquid that carries food to all parts of a plant. Deprived of sap, the leaves would die and the branches eventually fell off, leaving the surrounding land dry and suitable for planting.

2. According to paragraph 2, girdling worked by

- A. splitting the tree in half vertically
- B. removing all the branches from a tree
- C. keeping sap from reaching the tree's leaves and branches
- D. preventing the tree from absorbing water from the ground

【Paragraph 3】 New Englanders, however, generally clear-cut the forest, in part because the demand for fuel wood and lumber encouraged it. The market for potash, an alkaline substance that came from burning hardwood trees, also strongly motivated farmers to cut and burn the woods. **Used to manufacture soap, glass, and gunpowder and to bleach linens and print calicoes, potash served a range of industrial uses but at the expense of farms, which lost the nutrients that the wood ashes would otherwise have released back into the soil had they not been exported to market.**

3. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Potash from wood ash was used in manufacturing many industrial products, and it was also used to restore nutrients that had been lost from farm soil.
- B. The use of potash in the manufacture of a wide range of industrial products meant that farmers could make a good profit by exporting the ashes from the wood they burned.
- C. Farms suffered when wood ashes were converted into potash instead of being exported to market for profit.
- D. Potash had many industrial uses, but when wood ashes were for potash, farms suffered from the loss of the nutrients that would have restored to the soil.

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4. According to paragraph 3, one advantage of cutting down trees rather than girding them was that cutting down trees
- A. supplied marketable products
 - B. reduced the risk of fire
 - C. added alkaline substances to the soil
 - D. preserved nutrients in the soil

【Paragraph 4】 With their very existence dependent on the successful production of food, farmers had little, if any, time for removing stumps and stones. Instead, they adapted to the half-cleared fields by planting corn (maize) and grass, both grew well in such an environment. A pattern of “extensive” farming began to emerge. Rather than carefully **tending** arable land, engaging in crop rotation, manuring, and removing all stumps and stones—all recognized as part of proper agricultural practice in Europe—New England farmers simply exploited the soil and then forged ahead with the cleaning of new land. Cutting down trees remained hard work, but it was easier to partially clear the land, plant it, and then move on to another small plot than to constantly improve the soil on one field to the high Old World (European) standards. The settlers were too busy figuring out how to produce food rapidly to worry about efficient agricultural practices.

5. The word “**tending**” in the passage is closest in meaning to
- A. searching for
 - B. cleaning
 - C. selecting
 - D. taking care of
6. Why does the author discuss the settlers’ need to “produce food rapidly”?
- A. To emphasize the contrast between early and later farming practices among New England farmers
 - B. To help explain why the settlers did not follow established European farming practices
 - C. To support the idea that the settlers cut down trees to clear the land only because they had no other choice
 - D. To argue that settlers were able to survive because of their economical practices

【Paragraph 5】 Early on, the settlers adopted the Native American practice of planting corn along with beans and pumpkins or squash. These plants reinforced one another, resulting in high agricultural yields. The stalks of corn facilitated the growth of beans by giving them a structure to climb. The beans replenished the nitrogen that the corn drained out of the soil, bolstering fertility. And the pumpkins were a valuable source of food in the pioneer environment. After a few seasons, however, the settlers slowly began the process of transforming New England into an image of the Old World, planting European grains such as wheat and rye alongside the maize, a crop they never abandoned, in part because it proved a more reliable source of food.

7. According to paragraph 5, which of the following best describes an agricultural practice of the settlers?
- A. They abandoned European grains, which were not as productive as corn.
 - B. They planted certain crops close together to support and improve growth.
 - C. They created structures to protect and cover corn and bean.
 - D. They planted more corn than other crops because it supplied the nutrients.

【Paragraph 6】 New England, unlike the South, did not center its economy on an export crop like tobacco. Nor were its soils as fertile as those in the mid-Atlantic area (south of New England), which by the eighteenth century was the great grain-producing region of the colonies instead. New England’s soil had a moisture content that made it especially suited for growing grass. Grass played the pivotal role in the region’s farm ecology: the grass fed cattle that, in turn, produced manure that was spread over the fields as fertilizer for growing corn and other crops. Grass and cattle thus helped to maintain soil fertility—the key to reproducing a sustainable form of farm life—by recycling nutrients back into the fields.

8. According to paragraph 6, grass particularly grew well in the New England region because of

- A. the widespread practice of keeping cattle in the fields
- B. the regular recycling of nutrients back into the fields
- C. the amount of water in the soil
- D. the fertility of the soil

【Paragraph 4】 With their very existence dependent on the successful production of food, farmers had little, if any, time for removing stumps and stones. Instead, they adapted to the half-cleared fields by planting corn (maize) and grass, both grew well in such an environment. ■A pattern of “extensive” farming began to emerge. ■Rather than carefully tending arable land, engaging in crop rotation, manuring, and removing all stumps and stones—all recognized as part of proper agricultural practice in Europe—New England farmers simply exploited the soil and then forged ahead with the cleaning of new land. ■Cutting down trees remained hard work, but it was easier to partially clear the land, plant it, and then move on to another small plot than to constantly improve the soil on one field to the high Old World (European) standards. ■The settlers were too busy figuring out how to produce food rapidly to worry about efficient agricultural practices.

9. Look at the four squares **【■】** that indicate where the following sentence could be added to the passage.

This way of farming differed considerably from the European system.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage.

When European colonists settled New England, they tended to farm areas already cleared by Native Americans.

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Answer Choices

- A. Once the supply of suitable cleared land ran out, the settlers had to clear new land before they could plant, generally converting the trees they removed into lumber, fuel, or potash.
- B. Because clearing fields took time and the need for food was pressing, farmers were forced to resort to extensive farming practices rather than follow their old European farming system.
- C. The settlers developed a farm ecology that eventually made the region more productive than the South or even the mid-Atlantic area.
- D. The settlers' attempt to follow what, in Europe, was considered proper farming practices was soon abandoned as they discovered that food could be grown more efficiently in other ways.
- E. After planting corn (maize) enough times to drain the excess nitrogen out of the soil, the settlers were able to grow more familiar European crops such as wheat and rye.
- F. The soil was not particularly fertile, but grass grew well and fed cattle that produced manure, which in turn served as fertilizer for crops and recycled nutrients back into the soil.

Passage 48 - Population Revolution in Eighteenth-Century Europe

In late seventeenth-century Europe, what had been evolution in population followed by stabilization changed to population revolution. Increasing contacts with the Americas brought more sophisticated knowledge of the advantages of new foods, particularly the potato. Originally a cool-weather mountain crop in the Americas, potatoes did well in the Pyrenees, Alps, and Scottish Highlands. They also grew well in the long, damp springtime of the northwest European plain. Whatever hesitancy peasants may have felt about eating potatoes quickly passed when famine threatened; after all, people who in famines desperately consumed grass, weeds, and the bark of trees hardly would have hesitated to eat a potato. By the later eighteenth and the nineteenth century, American foods had become the principal foodstuffs of many rural folk. Various agricultural publicists promoted adoption of these foods, and peasants found that potatoes could allow subsistence on smaller plots of land. Fried potatoes soon began to be sold on the streets of Paris in the 1680s, the original French fries. Governments, eager to promote population growth as a source of military and economic strength, also backed the potato.

Along with new foods, some landowners began to introduce other innovations. The nutritional base for a population revolution combined regional changes with the use of American foods. Dutch and English farmers drained more swamps and so increased cultivable land. Agricultural reformers further promoted the use of crops such as the turnip that return valuable nitrogen to the soil. Improvements in available tools, such as growing use of the scythe instead of the sickle for harvesting, and better methods of raising livestock also spread. All this took shape from the late seventeenth century onward, building on earlier agricultural changes. At the same time, rates of epidemic disease declined, in part because of more effective government controls over the passage of people and animals along traditional plague routes from the Middle East. It was the change in foods that really counted, however.

These developments provided a framework for an unprecedented surge. In virtually every area of Europe, the population increased by 50 to 100 percent in the eighteenth century, with the greatest growth coming after 1750. The Hapsburg Empire grew from 20 million to 27 million people; Spain rose from 5 million to 10 million, and Prussia rose from 3 million to 6 million. Growth would continue throughout the nineteenth century. In Europe as a whole, population rose from 188 million in 1800 to 401 million in 1900. This was an upheaval of truly impressive proportions.

The population explosion resulted from a break in the traditional, if approximate, balance between births and deaths in European society. In England between 1700 and 1750, approximately 32.8 people were born annually for every 1,000 inhabitants, and 31.5 people died. Similarly, in Lombardy in the eighteenth century, 39 people were born and 37 people died for every 1,000 inhabitants. Clearly, a major alteration had to occur in either the birth or the mortality rate before the expansion of population could begin. In fact, both rates changed: families began to have more children, and a lower percentage of the population died each year. Lower infant death rates meant more people living to produce children of their own, though falling adult death rates also increased the number of older Europeans.

While historians continue to debate the precise balance of causes involved in these dramatic changes, basic outlines are clear. Better food and a reduction in the epidemic-disease cycle allowed more children to live to adulthood, which increased the population directly and also provided more parents for the next generation, a double impact. Rapidly increasing populations provided a new labor force for manufacturing. In the eighteenth century, this mainly involved hundreds of thousands of people, mostly rural, producing thread, cloth, and other products for market sale. This manufacturing expansion helped sustain the growing population, but it could also encourage a higher birth rate. Some people, able to earn money by their late teens, began to produce children earlier; the rate of illegitimate births went up. Others realized that having an extra child or two might help the family economy by providing additional worker-assistants. While death-rate decline was the most important source of

Europe's population explosion, various changes on the birth rate side, though quite short-lived, pushed the population up as well.

【Paragraph 1】 In late seventeenth-century Europe, what had been evolution in population followed by stabilization changed to population revolution. Increasing contacts with the Americas brought more **sophisticated** knowledge of the advantages of new foods, particularly the potato. Originally a cool-weather mountain crop in the Americas, potatoes did well in the Pyrenees, Alps, and Scottish Highlands. They also grew well in the long, damp springtime of the northwest European plain. **Whatever hesitancy peasants may have felt about eating potatoes quickly passed when famine threatened; after all, people who in famines desperately consumed grass, weeds, and the bark of trees hardly would have hesitated to eat a potato.** By the later eighteenth and the nineteenth century, American foods had become the principal foodstuffs of many rural folk. Various agricultural publicists promoted adoption of these foods, and peasants found that potatoes could allow subsistence on smaller plots of land. Fried potatoes soon began to be sold on the streets of Paris in the 1680s, the original French fries. Governments, eager to promote population growth as a source of military and economic strength, also backed the potato.

1. Paragraph 1 suggests that the European population before the late seventeenth century had been

- A. growing slowly and then not at all
- B. changing in distribution but not in the overall number of people
- C. decreasing at a small but stable rate
- D. alternating between periods of slow and fast growth

2. The word “**sophisticated**” in the passage is closest in meaning to

- A. quickly obtained
- B. highly developed
- C. widely distributed
- D. easily understood

3. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. The constant threat of famine caused peasants to become desperate and eat unusual foods like grass, weeds, and the bark of trees.
- B. Because famine forces people to eat foods they normally would not want to eat, peasants were willing to eat potatoes.
- C. Although some people ate foods like potatoes during famine, others preferred to eat easily accessible foods like grass, weeds, and the bark of trees.
- D. Famine had the greatest impact on peasants, whose regular diet of potatoes expanded to include other vegetation.

4. According to paragraph 1, all of the following contributed to the widespread adoption of the potato in Europe EXCEPT

- A. Peasants growing potatoes for their own use could support themselves on smaller plots of land.
- B. Potatoes grew well in a variety of locations in Europe.
- C. Potatoes were the preferred food of European military forces.
- D. Agricultural publicists encouraged the public to eat potatoes.

【Paragraph 2】 Along with new foods, some landowners began to introduce other innovations. The nutritional base for a population revolution combined regional changes with the use of American foods. Dutch and English farmers drained more swamps and so increased cultivable land. Agricultural reformers further promoted the use of crops such as the turnip that return valuable nitrogen to the soil. Improvements in available tools, such as growing use of the scythe instead of the sickle for harvesting, and better methods of raising livestock also spread. All this took shape from the late seventeenth century onward, building on earlier agricultural changes. At the same time, rates of epidemic disease declined, in part because of more effective government controls over the passage of people and animals along traditional plague routes from the Middle East. It was the change in foods that really counted, however.

5. According to paragraph 2, regional farmers did all of the following to improve food production in Europe EXCEPT

- A. They improved the way they raised farm animals.
- B. They used both the sickle and the scythe to harvest crops.
- C. They grew special crops that nourished the soil.
- D. They created more farmland by draining swamps.

【Paragraph 3】 These developments provided a framework for an unprecedented surge. In virtually every area of Europe, the population increased by 50 to 100 percent in the eighteenth century, with the greatest growth coming after 1750. The Hapsburg Empire grew from 20 million to 27 million people; Spain rose from 5 million to 10 million, and Prussia rose from 3 million to 6 million. Growth would continue throughout the nineteenth century. In Europe as a whole, population rose from 188 million in 1800 to 401 million in 1900. This was an upheaval of truly impressive proportions.

6. In paragraph 3, the author mentions the Hapsburg Empire, Spain, and Prussia in order to

- A. support the claim that the population explosion covered most of the European continent
- B. give examples of population growth during the nineteenth century
- C. suggest that the population of Prussia grew more slowly than the populations of other countries
- D. demonstrate that the fastest population growth took place in Spain

【Paragraph 4】 The population explosion resulted from a break in the traditional, if approximate, balance between births and deaths in European society. In England between 1700 and 1750, approximately 32.8 people were born annually for every 1,000 inhabitants, and 31.5 people died. Similarly, in Lombardy in the eighteenth century, 39 people were born and 37 people died for every 1,000 inhabitants. Clearly, a major alteration had to occur in either the birth or the mortality rate before the expansion of population could begin. In fact, both rates changed: families began to have more children, and a lower percentage of the population died each year. Lower infant death rates meant more people living to produce children of their own, though falling adult death rates also increased the number of older Europeans.

7. According to paragraph 4, the expansion of Europe's population was made possible by

- A. a major improvement in the care of older Europeans
- B. increased variation in the ages at which people gave birth to children
- C. a change in traditional beliefs about family size
- D. increased birth rates accompanied by a decline in mortality

【Paragraph 5】 While historians continue to debate the precise balance of causes involved in these dramatic changes, basic outlines are clear. Better food and a reduction in the epidemic-disease cycle allowed more children to live to adulthood, which increased the population directly and also provided more parents for the next generation, a double impact. Rapidly increasing populations provided a new labor force for manufacturing. In the eighteenth century, this mainly involved hundreds of thousands of people, mostly rural, producing thread, cloth, and other products for market sale. This manufacturing expansion helped sustain the growing population, but it could also encourage a higher birth rate. Some people, able to earn money by their late teens, began to produce children earlier; the rate of illegitimate births went up. Others realized that having an extra child or two might help the family economy by providing additional worker-assistants. While death-rate decline was the most important source of Europe's population explosion, various changes on the birth rate side, though quite short-lived, pushed the population up as well.

8. According to paragraph 5, what effect did the epidemic-disease cycle have on population during the eighteenth century
- A. Childhood diseases kept population growth rates from rising even higher.
 - B. Periodic epidemics caused population growth rates to rise and fall in cycles.
 - C. The effect varied by area, with urban populations more affected by disease than rural areas.
 - D. Fewer childhood deaths from disease led to an increased number of children in the current and future generations.

【Paragraph 1】 In late seventeenth-century Europe, what had been evolution in population followed by stabilization changed to population revolution. ■Increasing contacts with the Americas brought more sophisticated knowledge of the advantages of new foods, particularly the potato. ■Originally a cool-weather mountain crop in the Americas, potatoes did well in the Pyrenees, Alps, and Scottish Highlands. ■They also grew well in the long, damp springtime of the northwest European plain. ■Whatever hesitancy peasants may have felt about eating potatoes quickly passed when famine threatened; after all, people who in famines desperately consumed grass, weeds, and the bark of trees hardly would have hesitated to eat a potato. By the later eighteenth and the nineteenth century, American foods had become the principal food stuffs of many rural folk. Various agricultural publicists promoted adoption of these foods, and peasants found that potatoes could allow subsistence on smaller plots of land. Fried potatoes soon began to be sold on the streets of Paris in the 1680s the original French fries. Governments, eager to promote population growth as a source of military and economic strength, also backed the potato.

9. Look at the four squares **【■】** that indicate where the following sentence could be added to the passage.

What were the factors that led to this population revolution?

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Population began to expand in the late seventeenth century Europe.

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Answer Choices

- A. Climate conditions in Europe allowed for the introduction of new crops that competed with American foods for popular consumption.
- B. An important cause of population growth was improved nutrition, due in large part to the addition of the potato and other American foods to the standard European diet.
- C. Regional landowners developed improved agricultural techniques, and mortality rates declined as governments gained control over traditional plague routes.
- D. Growth rates varied widely across the continent but were highest in France, Spain, and Britain and lowest in Prussia and the Hapsburg Empire.
- E. Birth rates went up as more people lived long enough to have their own children, had children earlier, and had larger families.
- F. Government policies promoting population growth helped to create a large labor force for the manufacturing industry.

Passage 49 - The British Economy under the Roman Empire

Following the Roman Empire conquering the area in the first century A.D., there is a great deal of archaeological evidence for the economic growth of the British Isles. Prior to this event, the economy of the British Isles, which was based on manufacturing, was centered mainly on the household and on craft skills, and the best quality and greatest range of goods were largely a monopoly of the tribal aristocracies. This was the nature of the economy which lasted in regions of Britain that were unconquered by the Roman Empire, even though some Roman products were utilized in such areas. The majority of these Roman artifacts were glass vessels, pots, as well as small metal objects that were dispersed over a vast region. They perhaps held a symbolic value and were not necessarily used for their originally designed purposes. The spread of Roman objects beyond Roman Britain does not seem to have happened on an enormous scale. In areas where artifacts are more numerous, it is likely due to gift giving during close interactions between the Roman government and the tribes.

In regions that experienced direct economic control under the Romans, however, economic growth is clearly notable. There was an enormous increase in the number and variety of goods in circulation and the range of settlements in which they were found. This is clearly true in the overwhelming majority of excavated sites in Roman Britain, with the only exceptions being some rural regions that continued the pre-Roman, Iron Age pattern. The majority of sites resulted in the discovery of an abundance of iron, glass, and pottery, and good quantities of copper alloys, lead, tin, silver, and occasionally gold. For example, the humble iron nail is found in numbers not repeated until the Industrial Revolution.

The technology levels and range of the manufacturing of these objects also developed alongside the sheer increase in their quantity. During the Iron Age, the typical household objects were usually manufactured using a low technology of craft manufacture. Later, this changed to more specialized and larger-scale production methods. During this time, specialized workers could utilize equipment manufactured through time and resource investments. In these regions, small scale workshops used by specialized craftsmen betoken full-time employment in this work. Regardless of the large increase in the scale of manufacturing, there is little evidence of major growth in the size of productive units. We are left with the impression of an economy still based on small-scale craft production.

Where we do see an important change is in the removal of any exclusive association between the best traditional craftsmen and the governing elite. The powerful could show off their status in new ways, particularly by using Roman architecture and domestic decoration, but the traditional classes of decorative metalwork manufacture no longer seem to have been under the control of the tribal leaders. Rich objects from a wide range of archaeological sites imply the deterioration of this monopoly. There are a number of contributing factors. The control of precious metals moved to the imperial government immediately after the conquest, and gold and silver were also removed from circulation when captured as booty during the invasion. Similarly, changes in taste and the fashions of wealth and status display were stimulated by the arrival of new things like Roman dress, architecture, and sculpture.

These changes in manufacture were accompanied by increased distances over which many goods were transported to their consumers. The bulk of pottery and other items originated locally, during the Iron Age; but after the Roman invasion, these objects had been produced over a far greater range of distances. In this way, vast regions of the Roman province were incorporated into a society where there was wide access to material wealth. New changes in manufacturing production were coupled with huge increase in the importation of goods from elsewhere in the empire. These commodities, which included Mediterranean foodstuffs such as olive oil as well as comparatively low-value objects such as decorated pottery, also achieved a wide distribution and are found in many different types of site.

【Paragraph 1】 Following the Roman Empire conquering the area in the first century A.D., there is a great deal of archaeological evidence for the economic growth of the British Isles. **Prior to this event, the economy of the British Isles, which was based on manufacturing, was centered mainly on the household and on craft skills, and the best quality and greatest range of goods were largely a monopoly of the tribal aristocracies.** This was the nature of the economy which lasted in regions of Britain that were unconquered by the Roman Empire, even though some Roman products were utilized in such areas. The majority of these Roman artifacts were glass vessels, pots, as well as small metal objects that were dispersed over a vast region. They perhaps held a symbolic value and were not necessarily used for their originally designed purposes. The spread of Roman objects beyond Roman Britain does not seem to have happened on an enormous scale. In areas where artifacts are more numerous, it is likely due to gift giving during close interactions between the Roman government and the tribes.

1. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. Prior to the Roman conquest, the majority of manufacturing was focused on supplying the aristocratic tribal households.
- B. Before the first century A.D., the manufacturing economy was not as developed as it would become under the Roman Empire, but there was a vast range of articles available to the aristocracy.
- C. Before the Roman conquest, the majority of manufacturing in the British Isles was mostly devoted to household product with the highest quality products monopolized by the tribal aristocracies.
- D. The pre-Roman British society was ruled by tribal aristocracies and evolved with a focus on high-quality craftsmanship of household goods.

2. According to paragraph 1, the presence of a multitude of Roman products in the regions of Britain that were not under Roman was caused by

- A. the trade of goods between traveling Roman craftspeople through Britain and local inhabitants
- B. gifts Roman government officials provided to local tribes due to close relationships with the tribes and their officials
- C. trade between centers of manufacturing in Roman Britain and in centers in other regions of the Roman Empire
- D. the settlement of a high number of Roman people in regions around the Roman Britain province

【Paragraph 2】 In regions that experienced direct economic control under the Romans, however, economic growth is clearly notable. There was an enormous increase in the number and variety of goods in circulation and the range of settlements in which they were found. This is clearly true in the overwhelming majority of excavated sites in Roman Britain, with the only exceptions being some rural regions that continued the pre-Roman, Iron Age pattern. The majority of sites resulted in the discovery of an abundance of iron, glass, and pottery, and good quantities of copper alloys, lead, tin, silver, and occasionally gold. For example, the humble iron nail is found in numbers not repeated until the Industrial Revolution.

3. Paragraph 2 mentions all of the following as evidence of Roman Britain's economic development EXCEPT

- A. a rise in the variety of products available
- B. a growth in the quantity of settlements where products became available
- C. an increase in the diversity of materials uncovered at archaeological sites
- D. a rise in the rural population

4. In paragraph 2, the author talks about the iron nail in order to

- A. imply that most products manufactured were considered to be practical or useful
- B. illustrate that iron was a key player in Britain's economy before the Roman invasion
- C. give support for the statement that there was much economic activity in Britain following the Roman conquest
- D. prove that archaeologists have underestimated the degree of the Roman conquest on the British economy

【Paragraph 3】 The technology levels and range of the manufacturing of these objects also developed alongside the sheer increase in their quantity. During the Iron Age, the typical household objects were usually manufactured using a low technology of craft manufacture. Later, this changed to more specialized and larger-scale production methods. During this time, specialized workers could utilize equipment manufactured through time and resource investments. In these regions, small scale workshops used by specialized craftsmen betoken full-time employment in this work. Regardless of the large increase in the scale of manufacturing, there is little evidence of major growth in the size of productive units. We are left with the impression of an economy still based on small-scale craft production.

5. According to paragraph 3, manufacturing in the period of Roman economic control over the British was characterized by

- A. specialized production techniques
- B. a growth in the productive units' size
- C. the creation of workshops that hired a large number of staff
- D. the utilization of simple equipment for the making of household items

6. Paragraph 3 suggests which of the following statements about craft manufacture in Roman Britain?

- A. Workers did not have to invest much resources and time in the production of crafts.
- B. A number of domestic products was increasingly being made using iron.
- C. Workshops remained small despite the rise in production.
- D. Production thrived although craftspeople continued to use old-fashion production techniques.

【Paragraph 4】 Where we do see an important change is in the removal of any exclusive association between the best traditional craftsmen and the governing elite. The powerful could show off their status in new ways, particularly by using Roman architecture and domestic decoration, but the traditional classes of decorative metalwork manufacture no longer seem to have been under the control of the tribal leaders. Rich objects from a wide range of archaeological sites imply the deterioration of this monopoly. There are a number of contributing factors. The control of precious metals moved to the imperial government immediately after the conquest, and gold and silver were also removed from circulation when captured as booty during the invasion. Similarly, changes in taste and the fashions of wealth and status display were stimulated by the arrival of new things like Roman dress, architecture, and sculpture.

7. Paragraph 4 discusses all of the following as reasons for the breakdown of the tribal leaders' monopoly in decorative metalwork manufacture EXCEPT

- A. the tribal leaders' reduced influence within their communities
- B. the effect of Roman culture on the elite's display of wealth and status
- C. the removal of gold and silver from circulation
- D. the Roman government's control of precious metals

【Paragraph 5】 These changes in manufacture were accompanied by increased distances over which many goods were transported to their consumers. The bulk of pottery and other items originated locally, during the Iron Age; but after the Roman invasion, these objects had been produced over a far greater range of distances. In this way, vast regions of the Roman province were incorporated into a society where there was wide access to material wealth. New changes in manufacturing production were coupled with huge increase in the importation of goods from elsewhere in the empire. These commodities, which included Mediterranean foodstuffs such as olive oil as well as comparatively low-value objects such as decorated pottery, also achieved a wide distribution and are found in many different types of site.

8. The author mentions olive oil and decorated pottery to support the claim that

- A. the inhabitants of Roman Britain had access to daily and specialty products
- B. the rise in product manufacture caused a notable increase in waste material
- C. a number of commodities were manufactured in Britain prior to the Roman conquest
- D. imported goods had become a common feature of Roman Britain's economy

【Paragraph 5】 These changes in manufacture were accompanied by increased distances over which many goods were transported to their consumers. ■The bulk of pottery and other items originated locally, during the Iron Age; but after the Roman invasion, these objects had been produced over a far greater range of distances. ■In this way, vast regions of the Roman province were incorporated into a society where there was wide access to material wealth. ■New changes in manufacturing production were coupled with huge increase in the importation of goods from elsewhere in the empire. ■These commodities, which included Mediterranean foodstuffs such as olive oil as well as comparatively low-value objects such as decorated pottery, also achieved a wide distribution and are found in many different types of site.

9. Look at the four squares 【■】 that indicate where the following sentence could be added to the passage.

Furthermore, this provincial society was itself economically integrated with markets beyond its borders.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

The British Isles' economy experienced significant changes after the Roman conquest.

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Answer Choice

- A. British craftspeople slowly stopped producing items that generally were of little practical value in favor of the manufacturing of household products.
- B. Manufacturers invested an increased amount of resources and time towards developing specialty equipment.
- C. The production of goods still remained small scale, but the exclusive relationship between the governing elite and the best craftsmen broke down.
- D. Trade goods manufactured in Roman Britain were spread throughout the Roman Empire.
- E. The number and variety of goods found at sites in Roman Britain as well as the development of sophisticated manufacturing processes are evidence of economic development under the Romans.
- F. Roman Britain experienced a rise in product imports from elsewhere in the empire.

Passage 50 - Written Records

For those ancient civilizations that used writing—for instance, all the great civilizations in Mesoamerica, China, Egypt, and the Near East—written historical records can answer many social questions. A prime goal of the archaeologist studying these societies is therefore to find appropriate texts. Many of the early excavations of the great sites of the Near East had the recovery of clay writing tablets as the main goal. Major finds of this kind are still being made—for example, at the ancient city of Ebla (Tell Mardikh) in Syria, where an archive of 5,000 clay tablets written in an early dialect of Akkadian (Babylonian) was discovered in the 1970s.

In each early literate society, writing had its own function and purpose. For instance, the clay tablets of Mycenaean Greece, dating from around 1200 B.C., were all, without exception, primarily records of commercial transactions (goods coming in or going out) at the Mycenaean palaces. This discovery gives us an impression of many aspects of the Mycenaean economy and a glimpse into craft organization (through the names for the different kinds of craftspeople), as well as an introduction of the names of the offices of state. But here, as in other cases, accidents of preservation may be important. It could be that the Mycenaeans wrote on clay only for their commercial records and used other perishable materials for literary or historical texts now lost to us. It is certainly true that for the Classical Greek and Roman civilizations, it is mainly official decrees inscribed on marble that have survived. Fragile rolls of papyrus—the predecessor of modern paper—with literary texts on them, have usually remained intact only when retained in the dry air of Egypt, or when buried beneath the volcanic ash covering Pompeii.

Coins also provide a valuable source of written records: they can reveal information about the location where they are found, which can provide evidence about trade practices there, and their inscriptions can be informative about the issuing authority, whether they were city-states (as in ancient Greece) or sole rulers (as in Imperial Rome or in the kingdoms of medieval Europe).

In recent years, one of the most significant advances in Mesoamerican archaeology has come from deciphering many of the inscribed symbols (glyphs) on the stone stelae (pillars or columns) at the largest centers. It had been widely assumed that the inscriptions were exclusively of a calendrical nature or that they dealt with purely religious matters, notably the deeds of the gods. But the inscriptions can now in many cases be interpreted as relating to real historical events, mainly the deeds of the Maya kings. We can now also begin to deduce the likely territories belonging to individual Maya centers. Maya history has thus taken on a new dimension.

Written records undoubtedly contribute greatly to our knowledge of the society in question. But one should not accept them uncritically at face value. Nor should one forget the bias introduced by the accidents of preservation and the particular uses of literacy in a society. The great risk with historical records is that they can impose their own perspective so that they begin not only to supply the answers to our questions but subtly to determine the nature of those questions and even our concepts and terminology. A good example is the question of kingship in Anglo-Saxon England. Most anthropologists and historians tend to think of a king as the leader of a state society. Therefore, when the earliest records for Anglo-Saxon England, found in the Anglo-Saxon Chronicle, which took final shape in about AD. 1155, refer to kings around AD. 500, it is easy for the historian to think of kings and states at that period. But the archaeology strongly suggests that a full state society did not emerge until the time of King Otta of Mercia in around AD. 780, or perhaps King Alfred of Wessex in AD. 871. It is fairly clear that the earlier so-called kings were generally less significant figures than some of the rulers in either Africa or Polynesia in recent times, whom anthropologists would term "chiefs."

【Paragraph 1】 For those ancient civilizations that used writing-for instance, all the great civilizations in Mesoamerica, China, Egypt, and the Near East-written historical records can answer many social questions. A prime goal of the archaeologist studying these societies is therefore to find appropriate texts. Many of the early excavations of the great sites of the Near East had the recovery of clay writing tablets as the main goal. Major finds of this kind are still being made-for example, at the ancient city of Ebla (Tell Mardikh) in Syria, where an archive of 5,000 clay tablets written in an early dialect of Akkadian (Babylonian) was discovered in the 1970s.

1. According to paragraph 1, why did many early excavations of sites of the great civilizations of the Near East have the recovery of clay writing tablets as the main goal?

- A. Archaeologists wanted to determine the writing systems used by the ancient societies that once inhabited those sites.
- B. Archaeologists wanted to show that early literate civilizations used clay tablets for their historical records.
- C. Archaeologists hoped that the clay tablets would answer many of their questions about the ancient societies that once inhabited those sites.
- D. Archaeologists hoped to find evidence that languages other than early Akkadian had been used by the ancient societies that once inhabited those sites.

【Paragraph 2】 In each early literate society, writing had its own function and purpose. For instance, the clay tablets of Mycenaean Greece, dating from around 1200 B.C., were all, without exception, primarily records of commercial transactions (goods coming in or going out) at the Mycenaean palaces. This discovery gives us an impression of many aspects of the Mycenaean economy and a glimpse into craft organization (through the names for the different kinds of craftspeople), as well as an introduction of the names of the offices of state. But here, as in other cases, accidents of preservation may be important. It could be that the Mycenaeans wrote on clay only for their commercial records and used other perishable materials for literary or historical texts now lost to us. It is certainly true that for the Classical Greek and Roman civilizations, it is mainly official decrees inscribed on marble that have survived. Fragile rolls of papyrus-the predecessor of modern paper-with literary texts on them, have usually remained intact only when retained in the dry air of Egypt, or when buried beneath the volcanic ash covering Pompeii.

2. According to paragraph 2, the writing on Mycenaean clay tablets helped to reveal all of the following about Mycenaean society EXCEPT

- A. the flow of goods entering and leaving palaces
- B. the names for various types of craftspeople
- C. the names of government offices
- D. the kinds of materials used to build Mycenaean palaces

3. In paragraph 2, why does the author discuss writing from the Classical Greek and Roman civilizations?

- A. To help explain why early civilizations wrote mainly on stone and clay tablets
- B. To explain how the role of physical material in the preservation of texts can affect our understanding of ancient societies
- C. To compare the function of writing in Classical Greek and Roman civilizations
- D. To show that some texts on papyrus survived as long as texts inscribed on marble

【Paragraph 3】Coins also provide a valuable source of written records: they can reveal information about the location where they are found, which can provide evidence about trade practices there, and their inscriptions can be informative about the issuing authority, whether they were city-states (as in ancient Greece) or sole rulers (as in Imperial Rome or in the kingdoms of medieval Europe).

4. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

- A. The locations where coins are found can provide information about local trade practices, and the writing on the coins can indicate what kind of government issued them.
- B. Coins issued in ancient Greece and Rome and in medieval Europe are important sources of information about the role of writing at those locations.
- C. Kings and other rulers often used coins to record information about trade with other governments and about their personal lives.
- D. Coins became important in conducting trade transactions, and their inscriptions often indicate the locations where they were issued.

【Paragraph 4】In recent years, one of the most significant advances in Mesoamerican archaeology has come from deciphering many of the inscribed symbols (glyphs) on the stone stelae (pillars or columns) at the largest centers. It had been widely assumed that the inscriptions were exclusively of a calendrical nature or that they dealt with purely religious matters, notably the deeds of the gods. But the inscriptions can now in many cases be interpreted as relating to real historical events, mainly the deeds of the Maya kings. We can now also begin to deduce the likely territories belonging to individual Maya centers. Maya history has thus taken on a new dimension.

5. According to paragraph 4, one result of understanding the symbols on stone stelae in Mesoamerica was that archaeologists could start to determine

- A. what types of calendars had been developed in Mesoamerica
- B. what the Mayans believed about the actions of the gods
- C. when texts on stone stelae were used for the first time
- D. what territories likely belonged to individual Mayan centers

【Paragraph 5】Written records undoubtedly contribute greatly to our knowledge of the society in question. But one should not accept them uncritically at face value. Nor should one forget the bias introduced by the accidents of preservation and the particular uses of literacy in a society. The great risk with historical records is that they can impose their own perspective so that they begin not only to supply the answers to our questions but subtly to determine the nature of those questions and even our concepts and terminology. A good example is the question of kingship in Anglo-Saxon England. Most anthropologists and historians tend to think of a king as the leader of a state society. Therefore, when the earliest records for Anglo-Saxon England, found in the Anglo-Saxon Chronicle, which took final shape in about AD. 1155, refer to kings around AD. 500, it is easy for the historian to think of kings and states at that period. But the archaeology strongly suggests that a full state society did not emerge until the time of King Otta of Mercia in around AD. 780, or perhaps King Alfred of Wessex in AD. 871. It is fairly clear that the earlier so-called kings were generally less significant figures than some of the rulers in either Africa or Polynesia in recent times, whom anthropologists would term “chiefs”.

6. In paragraph 5, why does the author discuss The Anglo-Saxon Chronicle?

- A. To explain why there are only a few written records from Anglo-Saxon England
- B. To explain the uses of literacy in Anglo-Saxon England

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- C. To demonstrate how archaeologists and anthropologists differ in their understanding of kingship
 - D. To illustrate the risk associated with written records

7. According to paragraph 5, all of the following are true about written records EXCEPT

- A. They help us understand a lot about the society that produced them.
- B. They can influence the kinds of questions we ask about the society that produced them.
- C. They provide archaeologists with reliable evidence about the uses of literacy in most ancient societies.
- D. They can lead to inaccurate interpretations about the organization of ancient societies.

8. Paragraph 5 suggests which of the following about written records from ancient societies?

- A. They are of far more interest to historians of ancient societies than to the archaeologists studying those societies.
- B. They should be interpreted in light of other archaeological evidence about the society in question.
- C. They provide the only reliable sources of evidence about the society that produced them.
- D. They have been interpreted differently by archaeologists and anthropologists.

【Paragraph 4】 ■In recent years, one of the most significant advances in Mesoamerican archaeology has come from deciphering many of the inscribed symbols (glyphs) on the stone stelae (pillars or columns) at the largest centers. ■It had been widely assumed that the inscriptions were exclusively of a calendrical nature or that they dealt with purely religious matters, notably the deeds of the gods. ■But the inscriptions can now in many cases be interpreted as relating to real historical events, mainly the deeds of the Maya kings. ■We can now also begin to deduce the likely territories belonging to individual Maya centers. Maya history has thus taken on a new dimension.

9. Look at the four squares 【■】 that indicate where the following sentence can be added to the passage.

Being able to accurately interpret an ancient language has in many cases transformed our knowledge about the society that used it.

Where would the sentence best fit?

10. **【Directions】** An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some answer choices do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

Written records of ancient civilizations preserved in several forms have added to our knowledge of early literate societies.

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Answer Choices

- A. Clay tablets from Mycenaean Greece provide insights into its economy and state structures, and interpreting Mayan symbols on stone stelae has led to a new understanding of Mayan history.
- B. Accidents of preservation of ancient texts can lead to a misunderstanding of the functions and purposes of writing in early literate societies.
- C. The earliest Anglo-Saxon written record of England, The Anglo-Saxon Chronicle, describes the early kings of England and provides valuable insights into its emergence as a full state society.
- D. Literary texts written on marble by the Classical Greek and Roman civilizations have survived, while Egyptian literary texts that were written on papyrus are now very rare.
- E. As a result of reading ancient historical texts, historians have come to understand that many early European kings were as powerful as the chiefs of Africa and Polynesia in recent times.
- F. Ancient historical and literary texts present their societies from particular points of view that can lead researcher to develop mistaken assumptions about these societies.

附录：Keys

		1	2	3	4	5	6	7	8	9	10
1	Determining the Ages of the Planets and the Universe	B	D	A	A	B	B	A	C	A	ABC
2	Alaska and Bark Beetles	C	A	B	A	B	AC	B	A	C	ABC
3	Milankovitch Cycles and Glaciation	D	D	D	A	B	B	A	C	C	ABC
4	The Climate of Japan	C	A	D	B	D	C	B	B	B	AEF
5	Saving Soil and Cropland	B	D	A	D	B	B	C	AB	C	BDF
6	Early Theories of Continental Drift	B	B	D	D	B	A	C	B	A	BCE
7	How soil is Formed	C	B	B	D	B	B	C	C	A	BCD
8	Earthquake Prediction	D	B	B	B	A	B	C	A	C	BCE
9	Cave and Rock Art	B	C	A	C	D	D	B	A	A	BDE
10	Historical Trends in European Urban Design	B	C	A	B	C	B	A	B	A	ADF
11	Mexican Mural Art	C	B	D	C	D	A	B	D	B	BDE
12	Olmec Art	A	D	B	D	C	B	A	B	B	AEF
13	Portraits as Art	D	D	C	A	A	B	D	D	C	BDF
14	The Early History of Motion Pictures	A	C	A	B	B	A	D	C	B	CDE
15	Bioluminescence in Marine Creatures	A	D	B	A	C	D	A	D	C	ABC
16	Coral Reef Communities	A	A	A	B	C	B	C	D	B	ACE
17	Sea Turtle Hatchling Strategies for Navigation	C	C	B	C	B	C	D	C	A	DEF
18	Temperature Regulation in Marine Organisms	B	C	C	D	A	B	A	B	C	ACE
19	The Brain Size of Bottlenose Dolphins	B	C	B	D	D	D	C	B	B	ABE
20	Bird Colonies	B	A	D	C	B	B	A	C	B	CDE
21	Bison and Humans	B	B	D	C	A	C	A	A	D	CDF
22	Dinosaurs and Parental Care	B	D	A	A	C	B	B	D	C	BCF
23	Human Impacts on Biogeography	C	A	D	B	B	C	B	A	C	BEF
24	The Cambrian Explosion	C	B	D	B	D	D	B	C	B	CDF
25	The Extinction of the Dinosaurs	C	B	B	D	B	B	C	B	D	ABE
26	The First Eyes	A	B	C	D	B	C	D	C	B	ADF
27	The Geographical Distribution of Girding Animals	D	C	CD	B	A	D	C	D	C	ADF
28	Vocalization in Frogs	D	C	D	C	C	D	B	A	A	BEF
29	Preventing Overgrowth among Tree Branches	B	A	C	C	D	B	D	C	B	ABF
30	Art and Culture of Pacific Northwest Communities	D	B	D	C	B	C	A	B	D	ABE
31	Domestication	C	D	D	B	A	C	B	C	A	BCF
32	Hunting and the Setting of Inner Eurasia	D	B	D	B	C	B	B	A	D	CEF
33	Origins of the Megaliths	B	C	B	A	A	C	A	B	D	BEF
34	Consolidated Industry in the United States	D	B	A	C	C	B	A	D	B	ACD
35	Costs of Quitting a Job	AC	B	B	A	B	C	D	C	D	BCF
36	Controversy about Causing Emotion	D	A	B	A	D	C	D	B	A	CEF
37	Motor Development in Children	C	A	D	D	C	D	C	A	D	ACF
38	Documenting the Incas	B	B	D	D	B	C	B	A	B	CDE
39	Mesopotamian and Egyptian Settlement Patterns	D	A	C	C	C	B	D	B	B	ACF
40	The Collapse of the Mayas	C	B	B	D	D	C	C	D	A	CDF
41	The Emergence of Civilization	A	B	A	B	D	C	A	C	B	BCD
42	The Multiplier Effect	C	B	D	A	B	D	A	D	C	AEF
43	The Western Roman Empire in the Fifth Century	C	A	A	D	C	C	B	B	A	BDE
44	Newspaper in Western Europe	C	D	D	C	B	B	C	B	A	ADE
45	Effects of the Commercial Revolution	D	B	D	B	A	B	C	C	B	ABC
46	Europe Context of the Scientific Revolution	B	B	C	C	A	B	D	B	D	ABF
47	Farming New England in Colonial Times	C	C	D	A	D	B	B	C	B	ABF
48	Population Revolution in Eighteenth-Century Europe	A	B	C	B	A	D	D	C	A	BCE
49	The British Economy Under the Roman Empire	C	B	D	C	A	C	A	A	C	CEF
50	Written Records	C	D	B	A	D	D	C	D	A	ABF