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.

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
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.
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.
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
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

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.

1. The word "subtle" in the passage is closest in meaning to
   A. limited
   B. unimportant
   C. not obvious
   D. gradual
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
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.
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.
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

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.

1. The word "elaborated" in the passage is closest in meaning to
   A. corrected
   B. defended
   C. studied
   D. developed
2. According to paragraph 2, all of the following are true about the cycles that affect Earth's orbit EXCEPT:
   A. The tilt of Earth's axis varies between 22 degrees and 24.5 degrees.
   B. The cycles determining Earth's orbital characteristics occur in regular patterns.
   C. Earth's axis wobbles in a cycle lasting about 21,700 years.
   D. The total amount of solar radiation Earth receives changes significantly with the eccentricity of its orbit.
3. According to paragraph 2, changes in the tilt of Earth's axis affect
   A. the number of hours of daylight at the poles
   B. the amount of solar radiation Earth receives during a year
   C. the degree of difference between summer and winter temperatures
   D. the length of the annual cycle of seasons
4. According to paragraph 2, the Milankovitch theory maintains that glaciation occurs when the three cycles combine in such a way that
   A. winter temperatures become milder and summer temperatures become cooler
   B. more ice is formed during the winter than is melted during the summer
   C. the difference between summer and winter temperatures is at a maximum
   D. the total amount of solar radiation reaching Earth is at a minimum
5. Why does the author mention "rock samples drilled from the deep-sea floor" in paragraph 3?
   A. To present an alternative theory to Milankovitch's explanation of climatic cycles
   B. To provide evidence that the Pleistocene temperature changes were caused by Milankovitch cycles
   C. To argue that the climate fluctuations of the last 65 million years have been remarkably close to those predicted by Milankovitch
   D. To explain how scientists developed a chronology of Pleistocene temperature changes

6. According to paragraphs 3 and 4, what is the main problem with Milankovitch's explanation of glaciation?
   A. It fails to explain why glacial periods are much less frequent than the theory would predict.
   B. It does not account for the fact that the cycles that cause glaciation have not existed throughout geologic time.
   C. It does not explain why glaciation would not occur on a regular cycle.
   D. It fails to consider that Earth's orbit would have to be more eccentric for glaciation to occur.
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. Because the Milankovitch cycles have existed for billions of years, it seems logical that glaciation would have been a rare event throughout geologic time.
   B. The fact that periods of glaciation have been rare throughout geologic time suggests that glaciation is caused by factors other than the Milankovitch cycles.
   C. We might expect glaciation to have been a cyclic event because Milankovitch cycles have existed for billions of years, but glaciation has actually been rare.
   D. Since Milankovitch cycles have existed for billions of years, glaciation should have occurred more often than it actually has.
8. The author discusses "volcanic dust" and "atmospheric carbon dioxide" in paragraph 5 in order to
   A. contrast two different explanations for the initial cooling that triggers ice ages
   B. argue that volcanic dust is not a likely cause of the initial cooling that leads to ice ages
   C. support the theory that low carbon dioxide levels are the cause of ice ages
   D. explain why Milankovitch cycles are not the main cause of ice ages

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Passage 04 - Japan's Climate

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 to revitalize the Siberian air mass and usher 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 leads 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.

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 mixes with it.
   D. It is responsible for the cold, dry weather of the eastern valleys and coastal plains and cities.
2. Why does the author include the phrase "despite the island chain's northerly latitude" in paragraph 2?
   A. To emphasize that Japan is actually located farther north than most people realize
   B. To indicate that one would not expect such hot, muggy weather at Japan's latitude
   C. To contrast the former Japanese climate to the climate of more northerly latitudes
   D. To explain why Japan's climate is only suitable for rice cultivation
3. According to paragraph 3, which of the following is true about typhoons?
   A. They involve rain combined with tropical windstorms.
   B. They usually bring warm weather followed by snow.
   C. Cyclonic storms have a predictable pattern of travel.
   D. They begin as northern Siberian air masses with consistent rains following the summer heat.
4. All of the following are mentioned in paragraph 4 as contributing to the high rate of erosion in Japan EXCEPT:
   A. very steep slopes and heavy rainfall
   B. intense agricultural manipulation
   C. earthquakes and volcanic activities
   D. human activity
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. The heavy snow that falls there in winter

B. The lack of rivers suitable for transportation
C. The relative absence of good agricultural land
D. The shortage of precipitation for farming

6. According to paragraph 6, which of the following is true about farming in southern Japan?
   A. Farming is difficult because of the yamase effect.
   B. The best farming occurs in the autumn and winter months.
   C. Farming takes place throughout the year.
   D. Farming suffers from the effects of autumn typhoons.
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 agricultural 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.

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 hillside ridges—to reduce runoff. Another newer, highly effective tool in the soil conservation toolkit 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.

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 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 reduces wind erosion and allows moisture to collect on strips of land left unplanted.
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
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. Canada
   C. Brazil
   D. Europe

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.
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
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. It experienced a period of rapid economic growth after the urban growth boundary was removed.
   C. Urban growth boundaries successfully contained urban development.
   D. Communities disagreed about how to accommodate population growth.

Passage 06 - 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 his 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 the 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." Wegener 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 by 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.

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
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.
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 was 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.

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.

Passage 07 - Soil Formation

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 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.

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.
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
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.
5. Paragraph 6 supports which of the following ideas about organic material in 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.
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. According to paragraph 7, which of the following is true about the amount of time required for soil formation?
   A. So high is the rate of erosion on steep slopes that soil there never has time to develop fully.
   B. The higher the moisture content of the soil, the longer it takes for the soil to develop.
   C. The more acidic the soil, the more slowly it develops.
   D. Soils with coarse textures take much longer to develop than do soils with fine textures.

Passage 08 - Earthquake Prediction

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.

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 fault 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 estimate the recurrence interval, or the average time between earthquakes of a particular magnitude. For example, if a 6.0 magnitude earthquake occurs every 50 to 100 years along a particular fault segment, a 6.0 magnitude earthquake could occur at any time within that time span.

1. 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
2. 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

3. According to paragraph 3, which of the following is true about the dilatancy model?
   A. It explains that volume increase is caused by the closure of microcracks.
   B. It explains how groundwater moving into stressed areas can affect the transmission of seismic waves.
   C. It proposes that changes in land-surface elevation are related to the movement of tectonic plates.
   D. It suggests that radon gas is released when rocks are fully saturated with water.
4. According to paragraph 3, which of the following is a change that may occur before an earthquake?
   A. The electrical resistance of rocks increases due to the opening of microcracks.
   B. The land surface in the area becomes flat.
   C. Groundwater becomes more acidic.
   D. Seismic waves travel more quickly through the ground.
5. The word "imminent" in the passage is closest in meaning to
   A. about to happen
   B. clearly visible
   C. destructive
   D. well understood
6. 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.
7. 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.
8. According to paragraph 5, which of the following is true about the magnitude 6.9 North American earthquake in 1989?
   A. It was successfully predicted based on foreshocks that occurred fifteen months and two months before the event.
   B. It was preceded by foreshocks that led to predictions of a stronger

earthquake, but those predictions were incorrect.
C. It demonstrated that the dilatancy model's stages have uniform duration.
D. It was preceded by foreshocks that occurred within five days of the main earthquake.

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 10,000 B.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, it is the most different from any art produced today, so much so that we have difficulty appreciating it. The art is difficult to understand partly because the system was so long-lasting. During its 8,000 years, artists would have been producing works for about 4,000 generations, each learning from the last and gradually introducing changes. However, these changes were so subtle that to us, the earliest works are almost indistinguishable from the latest. In other words, the Magdalenian art system was one of the most stable cultural systems in human history. Its stability implies that the artists were following a strict set of conventions that survived almost unchanged for millennia.

Magdalenian art is almost entirely about animals. The animals depicted are mainly horses, bison, ibex, mammoths, rhinoceroses, lions, and bears, with a few birds and fish. Human figures are very rare and are often crudely drawn or even disguised. The animals are often shown with great naturalism and skill, but they are not arranged in any kind of natural setting. They are simply placed on the rock surface, often overlapping each other, with no indication of ground line or landscape. This has led some scholars to suggest that the art was not meant to depict the real world but rather a spiritual or mythical one.

The meaning of the art is still a mystery. Some have suggested that it was part of hunting magic, designed to ensure success in the hunt. Others have argued that it was related to shamanistic rituals, in which the animals were spirit helpers. Still others have proposed that the caves were sanctuaries where initiation ceremonies took place. Whatever its meaning, the art was clearly of great importance to the Magdalenians, as they went to great trouble to create it in the deepest, most inaccessible parts of caves, often carrying lamps and torches to light their way.

The caves themselves are often difficult to access, and some of the best paintings are in the most remote chambers. At Lascaux, for example, the famous Hall of the Bulls is near the entrance, but other paintings are deep in the cave system. At Altamira, the famous ceiling paintings are in a side chamber, and visitors must crouch to see them. This inaccessibility suggests that the art was not meant for public viewing but rather for a select few, perhaps shamans or initiates. It also explains why the art has survived so well; the caves provided a stable environment with constant temperature and humidity, protecting the paintings from the elements.

Today, many of the caves are closed to the public to protect the fragile paintings from damage caused by visitors' breath, body heat, and the introduction of light. Even photography is strictly controlled, and reproductions of the paintings often give 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.

1. According to paragraph 1, which of the following is true about the Magdalenian art system?
   A. It lasted longer than any other art system in human history.
   B. It was created by peoples who flourished in Europe from 40,000 to 10,000 B.C.
   C. It consisted entirely of engraved works on open-air rocks.
   D. It was the most primitive art system in human history.
2. The word "subtle" in paragraph 2 is closest in meaning to
   A. rapid
   B. slight
   C. important
   D. predictable
3. According to paragraph 2, what does the stability of the Magdalenian art system imply?
   A. Magdalenian artists had little creativity.
   B. The artists strictly followed established conventions.
   C. The art was produced by only a few generations of artists.
   D. The art was not influenced by changes in the environment.
4. According to paragraph 3, which of the following is true about the subject matter of Magdalenian art?
   A. Human figures are shown more often than animals.
   B. Animals are shown in their natural settings.
   C. Bison and horses are among the most commonly depicted animals.
   D. Birds and fish are depicted more often than large mammals.
5. The word "sanctuaries" in paragraph 4 is closest in meaning to
   A. hunting grounds
   B. sacred places

C. living spaces
D. storage areas

6. According to paragraph 5, why have many of the caves been closed to the public?
   A. The caves are too difficult for most people to access.
   B. The paintings are too fragile to be exposed to visitors.
   C. The caves are being used for ongoing archaeological excavations.
   D. The paintings are considered too sacred for public viewing.
7. Which of the following is NOT mentioned in paragraph 5 as a reason for the inaccessibility of the caves?
   A. The need to protect the paintings from damage
   B. The remote location of some paintings within caves
   C. The difficulty of photographing the paintings accurately
   D. The high cost of maintaining the caves for visitors
8. Paragraph 5 suggests which of the following about reproductions of cave paintings?
   A. They are often of higher quality than the originals.
   B. They are useful for studying the paintings but cannot replace seeing the originals.
   C. They are not permitted by the authorities who control access to the caves.
   D. They are available only to scholars and researchers.

Passage 10 - European Urban Planning

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 art forms 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.

1. According to paragraph 1, what was the primary purpose of Renaissance urban design?
   A. To serve as an expression of the wealth and power of the ruling class
   B. To improve the classical forms of ancient Greek and Roman cities
   C. To show that the state rather than the church was the most powerful

institution in a city
D. To restore the religious and civic buildings of a city to their previous glory

2. The word "diffused" in paragraph 2 is closest in meaning to
   A. disappeared
   B. spread
   C. evolved
   D. returned
3. According to paragraph 2, which of the following was a characteristic of Renaissance urban design?
   A. A focus on the construction of defensive walls
   B. An emphasis on creating irregular, organic street patterns
   C. The use of gardens to provide food for the urban population
   D. The demolition of old fortifications to create open spaces
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
5. Paragraph 3 mentions each of the following as an accomplishment of Haussmann's redevelopment of Paris EXCEPT
   A. the creation of tree-lined avenues
   B. the construction of new monuments
   C. the improvement of traffic flow
   D. the preservation of medieval neighborhoods
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 was less expensive than other architectural styles.
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.

Passage 11 - Mexican Muralism

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.

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

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.
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.
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

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Passage 12 - The Olmecs

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 Teopanteucantilan, 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 repertoire, singly and in combination. Moreover, scenes depicted on stone carvings and on pottery probably represent events in Olmec mythology, which served as a complex symbolic code that remained in use for a thousand years.

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.
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
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.

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
7. According to paragraph 5, which of the following is true about Olmec imagery?
   A. It focused primarily on representing jaguars.
   B. It used a variety of animal images to represent mythological events.
   C. It depicted howling babies more often than any other subject.
   D. It was not understood by scholars until 1955.
8. The author discusses "the caiman, eagle, toad, jaguar, and snake" in order to
   A. support the idea that jaguar imagery was the most important in Olmec art
   B. argue that Olmec art was primarily concerned with representing tropical rainforest animals
   C. demonstrate that Olmec imagery drew on a wide range of animal forms
   D. contrast the animals depicted in Olmec art with those depicted in Maya art

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Passage 13 - Portraiture

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 Lely, 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 artists—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 in

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.

1. According to paragraph 1, which of the following gives support to 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
3. According to paragraph 2, which of the following is true about the production of portraits?
   A. The subject must be present during the entire creation of the work.
   B. The use of photographs or sketches is a recent development in portraiture.
   C. The process of creating a portrait always involves some form of reference to the subject.
   D. Portrait painters preferred to work from memory rather than from sittings.
4. The author discusses Sir Peter Lely, 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's 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
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 the 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. According to paragraph 3, which of the following is true about the status of portraiture?
   A. It has always been considered a mechanical exercise rather than a fine art.
   B. It was valued more highly in the Renaissance than in the modern era.
   C. It was viewed negatively by some artists even while they practiced it.
   D. It gained higher status with the emergence of modernism.

Passage 14 - The Origins of Motion Pictures

The principle that makes possible the motion picture we watch today has been known for centuries. It is called the persistence of vision: the tendency of the eye to briefly retain an image after it has disappeared. As early as the second century, the Greek astronomer and mathematician Ptolemy had observed that a disk with a picture on one side, when twirled rapidly, appears as a single blended image. This principle was demonstrated in the nineteenth century by a number of European toys. In 1824, Peter Roget demonstrated that the eye retains an image for about one-tenth of a second. This led to the invention of the Thaumatrope, a disk with a bird on one side and a cage on the other. When the disk was twirled, the bird appeared to be in the cage. The Phenakistoscope, invented in 1832, used a spinning disk with sequential drawings viewed through slits to create the illusion of movement. The Zoetrope, invented in 1834, and the Praxinoscope, invented in 1877, improved on this principle.

Before long, several people realized that a series of still photographs on celluloid film could be used instead of hand drawings. In 1878, a colorful Englishman, later turned American, Eadweard 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 advanced 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.

The Kinetoscope was a viewing device for individual use. A viewer looked through a peephole at the top of the cabinet to watch a short film that ran in a continuous loop. In 1893, Edison opened the first Kinetoscope parlor in New York City, where customers could view films for a penny. The Kinetoscope was a success, but it had limitations. Only one person could view the film at a time, and the films were very short. In Europe, inventors were working on projecting films onto a screen for large audiences. The Lumière brothers in France invented the Cinématographe, a combination camera and projector, in 1895. Their first public screening in Paris is often considered the birth of cinema as we know it. In the United States, Thomas Armat invented the Vitascope, a projector that Edison later manufactured and marketed. The first public screening of a motion picture in the United States using the Vitascope took place in New York City in 1896.

Early movies were simple snippets of action—acrobats tumbling, horses 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 a story. In France, Alice Guy-Blaché 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-Blaché 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.

1. According to paragraph 1, what is the phi phenomenon?
   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.
2. The word "principle" in paragraph 1 is closest in meaning to
   A. scientific law
   B. moral standard
   C. basic truth
   D. method of operation

3. In paragraph 2, why does the author mention the bet that Eadweard 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. produce a clear image on celluloid film
   D. synchronize the camera with his phonograph
6. According to paragraph 3, which of the following was a limitation of the Kinetoscope?
   A. It could only show very short films.
   B. It was too expensive for most people to use.
   C. It could not project images onto a screen.
   D. It required the viewer to operate it manually.
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.
8. According to paragraph 4, what revived public interest in movies after the initial novelty wore off?
   A. The invention of longer films
   B. The use of movies to tell stories
   C. The introduction of color in films
   D. The development of better projection technology

Passage 15 - Bioluminescence in Marine Creatures

At night along the sea's edge, the ocean sometimes seems to glow, as if 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 an enzyme, luciferase. When the reaction is complete, a new molecule is formed that gives off light—glowing blue-green in color. Most bioluminescent creatures produce this blue-green light because it travels best in water. Some organisms, however, can produce red or yellow light, and a few can even produce multiple colors.

In many bioluminescent creatures, the light is produced in special organs called photophores. These organs can be simple or complex. In some fish, the photophores are equipped with lenses, shutters, color filters, and reflectors, much like a human-made lamp. The organism can control the light, turning it on and off, and even changing its intensity and color. Some creatures, like the flashlight fish, have a organ below each eye that contains bioluminescent bacteria. The fish can blink to cover the light, creating a flashing effect. Others, like some species of squid, can eject a cloud of bioluminescent fluid to confuse predators, much like an ink cloud.

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 comet-like 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.

Bioluminescence may also serve a variety of other functions. Some species use it to communicate with potential mates. In the deep sea, where darkness is complete, the ability to produce light can be an effective way to signal one's presence, species, and readiness to mate. Some species use bioluminescence as a form of camouflage. By producing light that matches the downwelling light from the surface, an organism can effectively eliminate its silhouette, making it nearly invisible to predators below. This strategy, known as counter-illumination, is used by many fish, shrimp, and squid. Still other species use bioluminescence to attract prey. The anglerfish, for example, has a bioluminescent lure that dangles in front of its mouth, attracting smaller fish that it then snaps up.

1. According to paragraph 1, bioluminescence differs from phosphorescence and fluorescence in that bioluminescence
   A. occurs only in marine organisms
   B. requires an external source of light
   C. is produced by internal biological processes
   D. produces a cold light rather than a warm light
2. According to paragraph 2, which of the following is true about the process by which bioluminescent organisms produce light?
   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. Most bioluminescent creatures produce only blue-green light.
   C. All bioluminescent creatures produce light using the same chemical reaction.
   D. Bioluminescent creatures can produce light only when they are in water.
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, the brief flashes of light produced by dinoflagellates when water moves may serve to
   A. attract prey
   B. communicate with other dinoflagellates
   C. frighten predators
   D. illuminate the surrounding water
6. According to paragraph 3, why might some deep-sea fish have a bioluminescent lure near their mouth?
   A. To attract a mate
   B. To disorient predators
   C. To lure prey
   D. To communicate with other fish
7. The author mentions "Sapphirina iris" in paragraph 3 in order to
   A. provide an example of a bioluminescent creature that produces multiple colors
   B. argue that copepods are the most spectacular bioluminescent creatures
   C. illustrate the variety of forms that bioluminescence can take
   D. contrast its appearance in water with its appearance under a microscope
8. According to paragraph 4, counter-illumination is a strategy used by some marine organisms to
   A. attract mates in the dark
   B. avoid being seen by predators
   C. lure prey into striking range
   D. communicate with members of their own species

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 urchin 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.

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.
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 filaments of the slower-growing corals
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 plant-eating 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
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

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 predators.
   C. Predation contributes to the sediment deposit of the reef.
   D. Small invertebrates are exposed to competitively superior organisms.

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.

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. 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 laid at night and offspring that emerge from the eggs at night are less likely to be discovered by predators.

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.
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.
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 hatchlings 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. begin using
C. move toward
D. find
8. According to paragraph 5, all of 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 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.

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 conduction 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.

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

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
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-line 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
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

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Passage 19 - Dolphin Brains and Intelligence

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 of 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).

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.
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?
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 animal 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

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.
8. The word "elusive" in paragraph 5 is closest in meaning to
   A. hard to explain
   B. widely agreed upon
   C. frequently studied
   D. recently discovered

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 an 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.

1. According to paragraph 1, which of the following is true about nests located in the centers of breeding colonies?
   A. They are more accessible to predators than nests at the edges.
   B. They are preferred over nests at the edges.

C. They are less densely packed than nests at the edges.
D. They are safer from predators than nests at the edges.

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.
4. According to paragraph 3, which of the following is true about cliff swallows?
   A. Parents in large colonies bring more food to their young than parents in small colonies do.
   B. The least successful foragers are most likely to be followed to food sources.
   C. Individuals that find food are unlikely to share it with others.
   D. Foraging efficiency decreases as colony size increases.
5. Which of the following is a probable effect of the fact mentioned in paragraph 4 that there are few available nesting locations in the environment?
   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 contain small numbers of seabirds.
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. According to paragraph 5, which of the following is a cost of colonial nesting?
   A. Increased competition for food within the colony
   B. Greater exposure to predators

C. Reduced reproductive success
D. Decreased foraging efficiency

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.

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.
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.
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.
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 preferred to attack lone individuals rather than groups.
   C. Both preferred to attack animals that were far from others.
   D. Both preferred to attack multiple animals at the same time.
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.
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's 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

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 posthatching (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 are 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.

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 posthatching 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?
3. According to paragraphs 1 and 2, the fossil record most clearly shows that dinosaurs engaged in which of the following behaviors?
   A. Incubating their eggs
   B. Building nests
   C. Feeding their young
   D. Guarding their nests from predators
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 grind 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

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

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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) may be 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.

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
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
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.

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 statements 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.
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

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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.

1. According to paragraph 2, biologists classify animals into phyla based on
   A. their genetic makeup
   B. their evolutionary history
   C. their basic body plans
   D. their ecological roles
2. According to paragraph 2, which of the following is true about arthropods?
   A. They include mammals and reptiles.
   B. They have internal skeletons.
   C. They have jointed legs and segmented bodies.
   D. They are the most numerous animal phylum.
3. The word "flowering" in paragraph 3 is closest in meaning to
   A. sudden disappearance
   B. gradual decline
   C. rapid emergence
   D. continuous evolution
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
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.
7. According to paragraph 7, how might climate change have contributed to the Cambrian explosion?
   A. By creating extreme conditions that forced animals to evolve rapidly
   B. By eliminating many species and leaving open ecological niches
   C. By causing the Earth to warm gradually over millions of years
   D. By creating new habitats in previously frozen areas
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

Passage 25 - The Extinction of the Dinosaurs

Geologists define the boundary between sediment layers of the Cretaceous period (144-65 million 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. This change indicates that something happened in the oceans to drastically reduce the abundance of these algae. At the same time, many species that lived in the oceans disappeared forever. On land, the most dramatic extinction was that of the dinosaurs,

but many other animals and plants also became extinct. In all, about half of all living things disappeared in what is called the K-T extinction event.

For a long time, scientists have argued that the extinction of the dinosaurs was related to climate change. But what caused the climate to change? In 1980, a team of scientists led by Luis Alvarez proposed a startling hypothesis: the dinosaurs and many other organisms were killed by the effects of a giant asteroid striking Earth. The evidence for this hypothesis came from a thin layer of clay found in rocks around the world at the exact level of the K-T boundary. This clay layer is enriched in the element iridium, which is rare on Earth's surface but common in asteroids and comets. The Alvarez team argued that the iridium came from the asteroid itself, which vaporized on impact and spread its dust around the globe.

The asteroid impact hypothesis gained support when scientists discovered a huge impact crater of the right age at Chicxulub on Mexico's Yucatán Peninsula. The Chicxulub crater is about 180 kilometers in diameter, which is the size expected from an asteroid about 10 kilometers across. The impact would have released energy equivalent to millions of nuclear bombs, throwing huge amounts of dust and debris into the atmosphere. This dust would have blocked sunlight for months or even years, stopping photosynthesis and causing a dramatic drop in temperature. The resulting darkness and cold would have killed many plants and the animals that depended on them, leading to the mass extinction.

However, not all scientists accept the asteroid impact hypothesis. Some point out that the fossil record shows that many dinosaur species were already in decline long before the end of the Cretaceous. They argue that volcanic activity may have been the primary cause of the extinction. At the end of the Cretaceous, there was massive volcanic activity in what is now India, creating the Deccan Traps—a vast region of lava flows thousands of meters thick. This volcanic activity would have released huge amounts of sulfur dioxide and carbon dioxide into the atmosphere, causing rapid climate change. The sulfur dioxide would have caused cooling, while the carbon dioxide would have caused warming. Such dramatic climate swings could have stressed ecosystems and led to extinctions.

The volcanic eruptions that formed the Deccan Traps were unlike most volcanic eruptions today, which occur as relatively small, localized events. The Deccan volcanism was a flood basalt eruption, in which huge volumes of lava poured out of long fissures in the Earth's crust, covering vast areas. These eruptions were not single events but occurred in pulses over hundreds of thousands of years. Each pulse would have injected enormous amounts of volcanic gases into the atmosphere, causing rapid climate changes. Supporters of the volcanic hypothesis argue that these repeated climate shocks could have gradually weakened dinosaur populations, making them vulnerable to eventual extinction.

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 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.

1. The word "strata" in paragraph 1 is closest in meaning to
   A. fossils
   B. layers
   C. sediments
   D. boundaries
2. According to paragraph 1, which of the following is true about the K-T extinction event?
   A. It affected life only in the oceans.
   B. It caused the extinction of all life on Earth.
   C. It resulted in the disappearance of about half of all living things.
   D. It occurred gradually over millions of years.
3. The word "startling" in paragraph 2 is closest in meaning to
   A. surprising
   B. complex
   C. controversial
   D. well-known
4. According to paragraph 2, what evidence led the Alvarez team to propose the asteroid impact hypothesis?
   A. A large impact crater in Mexico
   B. High levels of iridium in rocks at the K-T boundary
   C. The disappearance of microscopic algae from the fossil record
   D. Climate change at the end of the Cretaceous period
5. In paragraph 3, why does the author include the quotation by Carl Sagan comparing the impact to an explosion of a thousand hydrogen bombs?
   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 emphasize how catastrophic the effects of the impact would have been
   D. To show that scientists have revised their ideas greatly in the last thirty years

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
8. According to paragraph 5, which of the following was an effect of the volcanic activity that formed the Deccan Traps?
   A. A long period of global warming followed by sudden cooling
   B. The extinction of all tropical species unable to adapt to cold
   C. The formation of sulfate aerosols that blocked sunlight
   D. An increase in volcanic activity around the world

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.

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. Light-detecting abilities have existed for a very long time.
   C. Animals arose from unicellular creatures that already had eyes.
   D. The first eyes were probably located near the organisms' flagella.
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.
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.
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. Its fossils include animals with and without hard parts.
   D. Its fossils are approximately 600 million years old.
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 point out a similarity between the eyes of some Burgess animals and the eyes of some living crustaceans

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

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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.

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
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. Gliding animals are found in areas where trees are not especially tall.

B. Tall trees are not found throughout Southeast Asia.
C. Many gliding animals do not begin their glides from treetops.
D. Dipterocarp trees are not tall enough for long glides.

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
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.
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

Passage 28 - Vocalization in Frogs

The túngara frog is a small terrestrial vertebrate that is found in Central America. Túngara 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 túngara 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 túngara 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 túngara 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 túngara 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 túngara 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. Túngara frogs in breeding choruses are preyed upon by a species of frog-eating bats, Trachops cirrhosus, 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 túngara 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 túngara 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 túngara 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.

1. According to paragraph 1, male túngara 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
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.
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.

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. Túngara frogs use both whines and whine-chucks in their vocalizations.
B. Female túngara frogs are attracted to both whine and whine-chuck vocalizations.
C. Female túngara frogs and predators of túngara frogs are attracted to different types of vocalizations.
D. Frog-eating bats are attracted to whine-chuck calls more than to whine alone.
7. According to paragraph 5, all of the following are true about túngara 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 a frog using the whine-chuck vocalization will be attacked by a predator.
8. Which of the following can be inferred from paragraph 5 about the behavior of male túngara 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.

Passage 29 - How Trees Shed Their 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 overgrown 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 horticulturists) 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.

1. All of the following situations are mentioned in paragraph 1 as reasons for a tree to shed its branches EXCEPT
   A. branches endangering other branches
   B. branches building up on a tree
   C. branches wasting a tree's resources
   D. the tree 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.
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 self-prunes in response to extreme heat or drought.

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
7. According to paragraph 4, what information can be learned from the deliberate shedding of branches by 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
8. The word "congestion" in the passage is closest in meaning to
   A. growth
   B. weight
   C. overcrowding
   D. stress

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 for agriculture. The sea provided a variety of fish, shellfish, and marine mammals. The land provided deer, bears, mountain goats, and moose, as well as roots and berries. Most importantly, the forests provided western red cedar, a wood that could be split into planks for building houses, carved into monumental sculptures, and made into huge dugout canoes capable of carrying forty or more people on long voyages. With such abundance, the people of this region developed a complex society with a rich artistic tradition.

The peoples of the Northwest Coast spoke many different languages belonging to a number of distinct language families. These languages were mutually unintelligible, meaning that speakers of one language could not understand speakers of another. Nevertheless, the various groups shared many cultural traits. They had similar social

structures, with ranked societies consisting of nobles, commoners, and slaves. They had similar religious beliefs and ceremonies, including the potlatch, a grand ceremonial feast at which the host gave away or destroyed vast amounts of property to demonstrate his wealth and status. They also shared a distinctive artistic style, characterized by the use of bold, flowing forms and the representation of animals and supernatural beings.

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. Art proclaimed the status of its owner and illustrated the myths and legends that validated his right to that status. The artist's task was not to innovate but to represent the traditional forms accurately, for any deviation might weaken the power of the object and the claim of the owner to his hereditary privileges.

Totem poles, 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 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 from simple face coverings to elaborate headdresses with movable parts. Some, like the Tlingit war helmets, were actually used in battle. Others, like the transformation masks of the Kwakiutl, could be opened and closed to reveal different faces, representing the transformation between human and animal spirits. The masks were worn in dances that reenacted the myths of the tribe, and they were considered living entities, imbued with the power of the spirits they represented. The masks were often made by specialist carvers who inherited the right to carve particular designs. The best masks are masterpieces of design and craftsmanship, combining power and beauty in a way that is immediately recognizable as Northwest Coast art.

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.

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
3. The word "diffusion" in the passage is closest in meaning to
   A. development
   B. variety
   C. similarity
   D. spread
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. They were generally not as tall as other types of Northwest Coast carvings.
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.

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 valued family possessions representing chiefs and their ancestors.
8. According to paragraph 6, what was the function of masks worn in dance-dramas?
   A. To display the wealth and status of the chief
   B. To preserve and pass on cultural myths
   C. To serve as portraits of important ancestors
   D. To protect the wearer in battle

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. The potlatch (traditional celebrations in which groups gather and give gifts) of the indigenous peoples of the northwest coast of North America provides a possible analogy. 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. As a result, the intensity of resource use increased, though it did not lead to domestication.

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 combine local sequences of environmental change, population pressure, and social change. These theories do not try to explain domestication everywhere by the same factors but instead look for the specific combination of factors that operated in each region where domestication independently arose. The evidence from southwestern Asia, for example, suggests

that domestication there resulted from a combination of climate change, population increase, and social factors that created a need for more reliable food sources. In Mesoamerica, a different combination of factors may have been at work.

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
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
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.

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 statements 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.
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

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Passage 32 - Hunting and the Settlement 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.

Settling 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.

Before 120,000 years ago, human communities seem to have been relatively isolated from one another. There is little evidence of long-distance exchange of goods or information. Stone tools were made from local materials, and there is little variation in tool types over large areas. This suggests that groups were small and widely scattered, with little contact between them. Such isolation would have made it difficult to maintain the kind of information networks that hunters need to track prey over large areas. It would also have made it hard to coordinate hunting strategies or to share knowledge about animal behavior. The colonization of Inner Eurasia may have had to wait until humans developed the social structures necessary for long-distance cooperation and communication.

1. According to paragraph 1, the colonization of Inner Eurasia occurred relatively late because
   A. the region was covered by ice until about 80,000 years ago
   B. early humans lacked the technology to survive the harsh winters
   C. the region was uninhabitable until the climate warmed
   D. early humans preferred to settle in Africa, Europe, and southern Asia
2. The word "arid" in paragraph 2 is closest in meaning to
   A. cold
   B. dry
   C. windy
   D. dark
3. According to paragraph 3, what was the main problem with obtaining food in Inner Eurasia during winter?
   A. There were no animals to hunt.
   B. The available plant foods were poisonous.
   C. The main food sources were animals that were difficult to hunt.
   D. The edible plants died off and humans had to rely on meat.
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

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
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.

Passage 33 - Origins of the Megaliths

Since the days of the earliest antiquarians, scholars have been puzzled by the many Neolithic (4000 B.C. ~ 2000 B.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 (3000 B.C. ~ 1000 B.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 (8500 B.C. ~ 4000 B.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.

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
2. Why does the author mention radiocarbon dates in paragraph 3?
   A. To show that the megaliths in Brittany are older than those in Spain
   B. To argue that the megaliths were built by Aegean people
   C. To support the idea that megaliths originated in western and northern Europe
   D. To argue that the megaliths in Brittany are older than the megaliths in Los Millares
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.
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
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

6. The phrase "this hypothesis" in the passage refers to the idea that
   A. there was competition for territory between Mesolithic hunter-gatherers 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.
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.

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.

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.
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
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
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
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

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Passage 35 - Costs of Quitting a Job

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.

1. According to paragraph 1, the costs of changing jobs include all of the following EXCEPT
   A. costs related to the age of workers
   B. costs related to where workers live

C. costs related to how well workers adapt to new situations
D. costs related to the number of separations a worker has had

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.
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
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. Renters who move often have to pay much higher rents.
5. The word "sparsely" in paragraph 5 is closest in meaning to
   A. thinly
   B. heavily
   C. recently
   D. quickly
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 resettling 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
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

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 is 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 a 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 at roughly the same time as 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: 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 to label it as a 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 1990s, 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 response 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 be brief.

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

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 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
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.
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 the Schachter-Singer theory?
   A. It should occur just before a person is 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.
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 an 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.

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 during the sensorimotor stage, the first

two years of life. Piaget believed that infants initially lack an understanding of object permanence—the idea that objects continue to exist even when they are out of sight. The development of reaching and grasping allows infants to act upon objects and to discover that objects have an independent existence. By around eight months, infants will search for a hidden object, indicating that they have developed some understanding of object permanence. However, they will often make the "A-not-B error," continuing to search for an object where they last found it (location A) even after watching it being hidden in a new location (location B). By around twelve months, this error disappears, indicating a more complete understanding of object permanence.

The development of grasping follows a predictable sequence. Newborns have a grasping reflex; if you place a finger in their palm, they will grasp it tightly. This reflex disappears around two months. By around three to four months, infants begin to make swiping movements toward objects, but they rarely succeed in grasping them. By around five to six months, they can successfully grasp objects, but they use a clumsy "ulnar grasp," in which they close their fingers against the palm. By around nine months, they develop the ability to use a "pincer grasp," in which they use the thumb and index finger to pick up small objects. This fine motor skill allows them to explore objects in more detail and to manipulate their environment in new ways. By the end of the first year, infants can use this grasp to pick up very small objects, such as crumbs or small pieces of food, and to manipulate objects with increasing precision.

The development of reaching begins early on in life. Newborn infants seated in an upright position will swipe and reach toward 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.

1. The word "acquisition" in paragraph 1 is closest in meaning to
   A. practice
   B. study
   C. development
   D. understanding
2. According to paragraph 2, why do infants with locomotor experience have less trouble locating hidden objects?

A. They have developed the ability to understand spatial concepts such as here and there.
B. They have learned that objects continue to exist even when hidden.
C. They can move around and search for the objects more effectively.
D. They are less dependent on contextual similarity for memory recall.

3. The author mentions the "A-not-B error" in paragraph 3 in order to
   A. demonstrate that infants lack object permanence until about twelve months
   B. show that even at eight months, infants have only a partial understanding of object permanence
   C. argue that reaching and grasping are not essential for developing object permanence
   D. contrast Piaget's theory with more recent research on infant development
4. According to paragraph 3, at what age do infants typically begin to search for hidden objects?
   A. Two months
   B. Five to six months
   C. Eight months
   D. Twelve months
5. The word "clumsy" in paragraph 4 is closest in meaning to
   A. awkward
   B. effective
   C. rapid
   D. gentle
6. According to paragraph 4, which of the following is true about the pincer grasp?
   A. It is present at birth.
   B. It develops at around five to six months.
   C. It involves the use of the thumb and index finger.
   D. It is less precise than the ulnar grasp.
7. The word "proprioception" in paragraph 5 is closest in meaning to
   A. visual guidance
   B. muscle contraction
   C. bodily awareness
   D. reaching accuracy
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).

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 the Incas is available to researchers because early Spaniards wrote documents about them. However, there are drawbacks to using 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 Inca 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 the 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 Incas' 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 reveal some important information about the Incas.

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 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 multiple rulers share a particular title at the same time.
   C. It may have involved more than one individual holding the same title simultaneously.
   D. It was misunderstood by the Incas themselves.

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
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
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 Incas' 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.
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 the 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.
8. Which of the following is mentioned in paragraph 6 as a method for verifying the 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 the event as described

D. Determining whether the author of an account was able to cross-check information with multiple informants

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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 B.C.) 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.

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.
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
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
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.
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
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 water supplies
D. could easily be protected from invaders

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 techniques including large-scale irrigation and hill-slope terracing (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 environmental degradation and disaster have figured prominently in discussions 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 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 raised-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 levels 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.

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.
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.

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, what have recent studies concluded about the Mayan collapse?
   A. It was caused primarily by warfare and social unrest.
   B. It was a gradual process that began in the South and moved north.
   C. It was caused by the arrival of explorers in the 1830s.
   D. It began in southern city-states and spread to others.
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 soil erosion
   D. introduction of new crops
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, which of the following is true about the drought between A.D. 800 and A.D. 1000?
   A. It was the most severe drought in the region's history.
   B. It would not have been catastrophic if population levels had been lower.
   C. It caused the Mayan elites to abandon their social and political agendas.
   D. It had little effect on cities that depended on raised-field cultivation.

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 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 Temple 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.

1. According to paragraph 1, what made the river valleys particularly suitable for the extensive exploitation of agriculture?
   A. The presence of rich soil and a reliable water supply
   B. The absence of flooding in the delta regions
   C. The availability of large pools of labor for farming
   D. The mild climate that allowed year-round farming
2. The word "mobilize" in paragraph 1 is closest in meaning to
   A. train
   B. assemble
   C. pay
   D. control
3. According to paragraph 2, what evidence suggests that priests initially provided the centralized administration for large cities?
   A. The temples were the only large public buildings in the cities.
   B. The priests were the only people who could read and write.
   C. The temples were built before the cities were established.
   D. The priests controlled all the wealth in the cities.
4. According to paragraph 2, the priests in ancient Mesopotamian cities were responsible for all of the following EXCEPT
   A. governing the city
   B. organizing workers in the fields
   C. maintaining irrigation systems
   D. leading military campaigns
5. Paragraph 3 indicates that technological advances affected all of the following EXCEPT
   A. transportation
   B. clothing manufacture
   C. pottery making
   D. food preservation

6. The word "defining" in paragraph 5 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.
8. According to paragraph 6, why was bronze not used for farming tools in Mesopotamia and Egypt?
   A. Bronze was too soft to be effective for farming.
   B. The necessary metals for making bronze had to be imported and were expensive.
   C. Wooden plows were more effective in the soils of river valleys.
   D. Farmers preferred to use tools made from pottery and stone.

Passage 42 - The Multiplier Effect

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 metallurgy.

In the early Bronze Age, Renfrew argued, the Greek economy was transformed by two important innovations: the cultivation of the vine for wine and the olive for oil. Unlike grain, which can be grown almost anywhere, vines and olives require specific conditions and take several years to become productive. Their cultivation encourages long-term investment in land and the development of trade networks to distribute their products. Olive oil, in particular, became a valuable commodity, used for cooking, lighting, cosmetics, and religious rituals. The need to produce and distribute these new products stimulated economic growth and social change.

At the same time, the introduction of metallurgy, specifically the production of bronze, had far-reaching effects. The raw materials—copper and tin—were scarce and had to be obtained through trade. This stimulated long-distance exchange networks and created new opportunities for wealth and status. The new metal tools and weapons were more efficient than their stone predecessors, increasing agricultural productivity and military power. 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.

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.

1. According to paragraph 1, Professor Renfrew believed that the transformation of society in early Bronze Age Greece
   A. was caused by invasions from Anatolia
   B. resulted from increased trade with neighboring regions

C. was due to internal developments within the local social system
D. cannot be explained by the available evidence

2. The word "scanty" in paragraph 1 is closest in meaning to
   A. limited
   B. reliable
   C. confusing
   D. exciting
3. According to paragraph 2, the cultivation of vines and olives encouraged all of the following EXCEPT
   A. long-term investment in land
   B. the development of trade networks
   C. the immediate increase in food production
   D. economic growth
4. According to paragraph 3, the introduction of metallurgy stimulated long-distance exchange networks because
   A. metal tools were more efficient than stone tools
   B. the raw materials for bronze were scarce and had to be obtained through trade
   C. metal weapons increased military power
   D. metal tools increased agricultural productivity
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.
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 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

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.

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.

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
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.
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.

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. The 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 increasingly 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.

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.
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.
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.
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
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.
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.
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.

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 royally sponsored activity, 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.

1. The word "pioneered" in the passage is closest in meaning to
   A. adopted
   B. described
   C. demonstrated
   D. introduced
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.

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
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.
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.

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 restructuring 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 based. 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 Dürer, 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.

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.
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

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.
7. According to paragraph 4, Renaissance artists 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.

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 of which 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 clearing 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.

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 fields where they would do as little damage to the forest as possible
   C. clearing forestland to create fields was extremely hard work
   D. it took some time before a newly cleared area became suitable for planting crops
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
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 used for potash, farms suffered from the loss of the nutrients that would have been restored to the soil.

4. According to paragraph 3, one advantage of cutting down trees rather than girdling 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
5. The word "tending" in paragraph 4 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" in paragraph 4?
   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
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 beans.
   D. They planted more corn than other crops because it supplied the nutrients.
8. According to paragraph 6, grass grew particularly 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

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.

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.

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.
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
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
8. According to paragraph 5, what effect did the reduction in 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.

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 a 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.

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 products, 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 control 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
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
5. According to paragraph 3, manufacturing in the period of Roman economic control over Britain 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 were increasingly being made using iron.
   C. Workshops remained small despite the rise in production.
   D. Production thrived although craftspeople continued to use old-fashioned production techniques.
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
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

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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 to 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 A.D. 1155, refer to kings around A.D. 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 Offa of Mercia in around A.D. 780, or perhaps King Alfred of Wessex in A.D. 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."

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.

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

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.

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

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
   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.