AP Bio Evolution Practice Test

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. Catastrophism, meaning the regular occurrence of geological or meteorological disturbances (catastrophes), was Cuvier's attempt to explain the existence of
   a. evolution.
   b. the fossil record.
   c. uniformitarianism.
   d. the origin of new species.
   e. natural selection.

2. Which of the events described below agrees with the idea of catastrophism?
   a. The gradual uplift of the Himalayas by the collision of the Australian crustal plate with the Eurasian crustal plate
   b. The formation of the Grand Canyon by the Colorado River over millions of years
   c. The gradual deposition of sediments many kilometers thick on the floors of seas and oceans
   d. The sudden demise of the dinosaurs, and various other groups, by the impact of a large extraterrestrial body with Earth
   e. The development of the Galapagos Islands from underwater seamounts over millions of years

3. What was the prevailing notion prior to the time of Lyell and Darwin?
   a. Earth is a few thousand years old, and populations are unchanging.
   b. Earth is a few thousand years old, and populations gradually change.
   c. Earth is millions of years old, and populations rapidly change.
   d. Earth is millions of years old, and populations are unchanging.
   e. Earth is millions of years old, and populations gradually change.

4. During a study session about evolution, one of your fellow students remarks, "The giraffe stretched its neck while reaching for higher leaves; its offspring inherited longer necks as a result." Which statement is most likely to be helpful in correcting this student's misconception?
   a. Characteristics acquired during an organism’s life are generally not passed on through genes.
   b. Spontaneous mutations can result in the appearance of new traits.
   c. Only favorable adaptations have survival value.
   d. Disuse of an organ may lead to its eventual disappearance.
   e. Overproduction of offspring leads to a struggle for survival.

5. Which group is composed entirely of individuals who maintained that species are fixed (i.e., unchanging)?
   a. Aristotle, Cuvier, and Lamarck
   b. Linnaeus, Cuvier, and Lamarck
   c. Lyell, Linnaeus, and Lamarck
   d. Aristotle, Linnaeus, and Cuvier
6. In the mid-1900s, the Soviet geneticist Lysenko believed that his winter wheat plants, exposed to ever-colder temperatures, would eventually give rise to ever more cold-tolerant winter wheat. Lysenko's attempts in this regard were most in agreement with the ideas of
a. Cuvier.
b. Hutton.
c. Lamarck.
d. Darwin.
e. Plato.

The following questions refer to Figure 22.1, which shows an outcrop of sedimentary rock whose strata are labeled A-D.

![Figure 22.1](image)

7. Who would have proposed that the boundaries between each stratum mark the occurrence of different localized floods?
   a. Lyell
   b. Cuvier
   c. Hutton
   d. Darwin
   e. Lamarck

8. Which pair would have been likely to agree that strata such as those depicted here were deposited gradually over long periods of time by subtle mechanisms that are still at work?
   a. Cuvier and Aristotle
   b. Cuvier and Lamarck
   c. Lyell and Linnaeus
   d. Aristotle and Hutton
   e. Hutton and Lyell

9. Darwin's mechanism of natural selection required long time spans in order to modify species. From whom did Darwin get the concept of Earth's ancient age?
   a. Georges Cuvier
   b. Charles Lyell
   c. Alfred Wallace
   d. Thomas Malthus
10. As a young biologist, Charles Darwin had expected the living plants of temperate South America would resemble those of temperate Europe, but he was surprised to find that they more closely resembled the plants of tropical South America. The biological explanation for this observation is most properly associated with the field of
   a. meteorology.
   b. embryology.
   c. vertebrate anatomy.
   d. bioengineering.
   e. biogeography.

11. Which of these naturalists synthesized a concept of natural selection independently of Darwin?
   a. Charles Lyell
   b. Gregor Mendel
   c. Alfred Wallace
   d. John Henslow
   e. Thomas Malthus

12. Charles Darwin was the first person to propose
   a. that evolution occurs.
   b. a mechanism for how evolution occurs.
   c. that the Earth is older than a few thousand years.
   d. a mechanism for evolution that was supported by evidence.
   e. a way to use artificial selection as a means of domesticating plants and animals.

13. In Darwin’s thinking, the more closely related two different organisms are, the
   a. more similar their habitats are.
   b. less similar their DNA sequences are.
   c. more recently they shared a common ancestor.
   d. less likely they are to have the same genes in common.
   e. more similar they are in size.

14. Which of these conditions should completely prevent the occurrence of natural selection in a population over time?
   a. All variation between individuals is due only to environmental factors.
   b. The environment is changing at a relatively slow rate.
   c. The population size is large.
   d. The population lives in a habitat where there are no competing species present.

15. Natural selection is based on all of the following except
   a. genetic variation exists within populations.
   b. the best-adapted individuals tend to leave the most offspring.
   c. individuals who survive longer tend to leave more offspring than those who die young.
   d. populations tend to produce more individuals than the environment can support.
   e. individuals adapt to their environments and, thereby, evolve.
16. Which of the following represents an idea that Darwin learned from the writings of Thomas Malthus?
   a. All species are fixed in the form in which they are created.
   b. Populations tend to increase at a faster rate than their food supply normally allows.
   c. Earth changed over the years through a series of catastrophic upheavals.
   d. The environment is responsible for natural selection.
   e. Earth is more than 10,000 years old.

17. Which statement about natural selection is most correct?
   a. Adaptations beneficial in one habitat should generally be beneficial in all other habitats as well.
   b. Different species that occupy the same habitat will adapt to that habitat by undergoing the same genetic changes.
   c. Adaptations beneficial at one time should generally be beneficial during all other times as well.
   d. Well-adapted individuals leave more offspring, and thus contribute more to the next generation's gene pool, than do poorly adapted individuals.
   e. Natural selection is the sole means by which populations can evolve.

18. Given a population that contains genetic variation, what is the correct sequence of the following events, under the influence of natural selection?
   1. Well-adapted individuals leave more offspring than do poorly adapted individuals.
   2. A change occurs in the environment.
   3. Genetic frequencies within the population change.
   4. Poorly adapted individuals have decreased survivorship.

   a. 2 → 4 → 1 → 3
   b. 4 → 2 → 1 → 3
   c. 4 → 1 → 2 → 3
   d. 4 → 2 → 3 → 1
   e. 2 → 4 → 3 → 1

19. A biologist studied a population of squirrels for 15 years. During that time, the population was never fewer than 30 squirrels and never more than 45. Her data showed that over half of the squirrels born did not survive to reproduce, because of competition for food and predation. In a single generation, 90% of the squirrels that were born lived to reproduce, and the population increased to 80. Which inference(s) about this population might be true?
   a. The amount of available food may have increased.
   b. The number of predators may have decreased.
   c. The squirrels of subsequent generations should show greater levels of genetic variation than previous generations, because squirrels that would not have survived in the past will now survive.
   d. A and B only
   e. A, B, and C

20. To observe natural selection's effects on a population, which of these must be true?
   a. One must observe individual organisms undergoing adaptation.
b. The population must contain genetic variation.
c. Members of the population must increase or decrease the use of some portion of their anatomy.
d. A and C only
e. A and B only

21. If the HMS *Beagle* had completely bypassed the Galapagos Islands, Darwin would have had a much poorer understanding of the
   a. relative stability of a well-adapted population's numbers over many generations.
   b. ability of populations to undergo modification as they adapt to a particular environment.
   c. tendency of organisms to produce the exact number of offspring that the environment can support.
   d. unlimited resources that support population growth in most natural environments.
   e. lack of genetic variation among all members of a population.

22. During drought years on the Galapagos, small, easily eaten seeds become rare, leaving mostly large, hard-cased seeds that only birds with large beaks can eat. If a drought persists for several years, what should one expect to result from natural selection?
   a. Small birds gaining larger beaks by exercising their mouth parts.
   b. Small birds mutating their beak genes with the result that later-generation offspring have larger beaks.
   c. Small birds anticipating the long drought and eating more to gain weight and, consequently, growing larger beaks.
   d. More small-beaked birds dying than larger-beaked birds. The offspring produced in subsequent generations have a higher percentage of birds with large beaks.
   e. Larger birds eating less so smaller birds can survive.

23. Which of the following statements is an *inference* of natural selection?
   a. Subsequent generations of a population should have greater proportions of individuals that possess traits better suited for success.
   b. An individual organism undergoes evolution over the course of its lifetime.
   c. Habitats do not generally have unlimited resources.
   d. Natural populations tend to reproduce to their full biological potential.
   e. Some of the variation that exists among individuals in a population is genetic.

24. Which of the following must exist in a population before natural selection can act upon that population?
   a. Genetic variation among individuals
   b. Variation among individuals caused by environmental factors
   c. Sexual reproduction
   d. B and C only
   e. A, B, and C

25. Which of Darwin's ideas had the strongest connection to Darwin having read Malthus's essay on human population growth?
   a. Descent with modification
   b. Variation among individuals in a population
c. Struggle for existence
d. The ability of related species to be conceptualized in "tree thinking"
e. That the ancestors of the Galapagos finches had come from the South American mainland

The following questions refer to the evolutionary tree in Figure 22.2.

The tree's horizontal axis is a timeline that extends from 100,000 years ago to the present; the vertical axis represents nothing in particular. The labeled branch points on the tree (V—Z) represent various common ancestors. Let's say that only since 50,000 years ago has there been enough variation between the lineages depicted here to separate them into distinct species, and only the tips of the lineages on this tree represent distinct species.

![Evolutionary Tree Illustration]

**Figure 22.2**

26. How many separate species, both extant and extinct, are depicted in this tree?
   a. 2
   b. 3
   c. 4
   d. 5
   e. 6

27. According to this tree, what percent of the species seem to be extant (i.e., not extinct)?
   a. 25%
   b. 33%
   c. 50%
   d. 66%
   e. 75%

28. Which of the five common ancestors, labeled V—Z, has given rise to the greatest number of species, both extant and extinct?
   a. V
   b. W
   c. X
   d. Y
29. Which of the five common ancestors, labeled V—Z, has been least successful in terms of the percent of its derived species that are extant?
   a. V
   b. W
   c. X
   d. Y
   e. Z

30. Which of the five common ancestors, labeled V—Z, has been most successful in terms of the percent of its derived species that are extant?
   a. V
   b. W
   c. X
   d. Y
   e. Z

31. Which pair would probably have agreed with the process that is depicted by this tree?
   a. Cuvier and Lamarck
   b. Lamarck and Wallace
   c. Aristotle and Lyell
   d. Wallace and Linnaeus
   e. Linnaeus and Lamarck

32. Evolutionary trees such as this are properly understood by scientists to be
   a. theories.
   b. hypotheses.
   c. laws.
   d. dogmas.
   e. facts.

33. In a hypothetical environment, fishes called pike-cichlids are visual predators of algae-eating fish (i.e., they locate their prey by sight). If a population of algae-eaters experiences predation pressure from pike-cichlids, which of the following should least likely be observed in the algae-eater population over the course of many generations?
   a. Selection for drab coloration of the algae-eaters
   b. Selection for nocturnal algae-eaters (active only at night)
   c. Selection for larger female algae-eaters, bearing broods composed of more, and larger, young
   d. Selection for algae-eaters that become sexually mature at smaller overall body sizes
   e. Selection for algae-eaters that are faster swimmers

34. Which statement best describes the evolution of pesticide resistance in a population of insects?
   a. Individual members of the population slowly adapt to the presence of the chemical by striving to meet the new challenge.
b. All insects exposed to the insecticide begin to use a formerly silent gene to make a new enzyme that breaks down the insecticide molecules.
c. Insects observe the behavior of other insects that survive pesticide application, and adjust their own behaviors to copy those of the survivors.
d. Offspring of insects that are genetically resistant to the pesticide become more abundant as the susceptible insects die off.

35. DDT was once considered a "silver bullet" that would permanently eradicate insect pests. Today, instead, DDT is largely useless against many insects. Which of these would have been required for this pest eradication effort to be successful in the long run?
   a. Larger doses of DDT should have been applied.
   b. All habitats should have received applications of DDT at about the same time.
   c. The frequency of DDT application should have been higher.
   d. None of the individual insects should have possessed genomes that made them resistant to DDT.
   e. DDT application should have been continual.

36. Some members of a photosynthetic plant species are genetically resistant to an herbicide, while other members of the same species are not resistant to the herbicide. Which combination of events should cause the most effective replacement of the non-herbicide-resistant strain of plants by the resistant strain?
   1. The presence of the herbicide in the environment
   2. The absence of the herbicide from the environment
   3. The maintenance of the proper conditions for one generation
   4. The maintenance of the proper conditions for many generations
   a. 1 and 3
   b. 1 and 4
   c. 2 and 3
   d. 2 and 4

37. The graph in Figure 22.3 depicts four possible patterns for the abundance of 3TC-resistant HIV within an infected human over time.

![Figure 22.3](image)
If 3TC resistance is costly for HIV, then which plot (I—IV) best represents the response of a strain of 3TC-resistant HIV over time, if 3TC administration begins at the time indicated by the arrow?

a. I
b. II
c. III
d. IV

38. Of the following anatomical structures, which is homologous to the wing of a bird?

a. Dorsal fin of a shark
b. Hindlimb of a kangaroo
c. Wing of a butterfly
d. Tail fin of a flying fish
e. Flipper of a cetacean

39. If two modern organisms are *distantly* related in an evolutionary sense, then one should expect that

a. they live in very different habitats.
b. they should share fewer homologous structures than two more closely related organisms.
c. their chromosomes should be very similar.
d. they shared a common ancestor relatively recently.
e. they should be members of the same genus.

40. Structures as different as human arms, bat wings, and dolphin flippers contain many of the same bones, these bones having developed from very similar embryonic tissues. How do biologists interpret these similarities?

a. By identifying the bones as being homologous
b. By the principle of convergent evolution
c. By proposing that humans, bats, and dolphins share a common ancestor
d. A and C only
e. A, B, and C

41. Over evolutionary time, many cave-dwelling organisms have lost their eyes. Tapeworms have lost their digestive systems. Whales have lost their hind limbs. How can natural selection account for these losses?

a. Natural selection cannot account for losses, only for innovations.
b. Natural selection accounts for these losses by the principle of use and disuse.
c. Under particular circumstances that persisted for long periods, each of these structures presented greater costs than benefits.
d. The ancestors of these organisms experienced harmful mutations that forced them to find new habitats that these species had not previously used.

e. The ancestors of these organisms experienced harmful mutations that forced them to find new habitats that these species had not previously used.

42. Which of the following pieces of evidence most strongly supports the common origin of all life on Earth?

a. All organisms require energy.
b. All organisms use essentially the same genetic code.
c. All organisms reproduce.
d. All organisms show heritable variation.
e. All organisms have undergone evolution.
43. Logically, which of these should cast the most doubt on the relationships depicted by an evolutionary tree?
   a. None of the organisms depicted by the tree ate the same foods.
   b. Some of the organisms depicted by the tree had lived in different habitats.
   c. The skeletal remains of the organisms depicted by the tree were incomplete (i.e., some bones were missing).
   d. Transitional fossils had not been found.
   e. Relationships between DNA sequences among the species did not match relationships between skeletal patterns.

44. Which of the following statements most detracts from the claim that the human appendix is a completely vestigial organ?
   a. The appendix can be surgically removed with no immediate ill effects.
   b. The appendix might have been larger in fossil hominids.
   c. The appendix has a substantial amount of defensive lymphatic tissue.
   d. Individuals with a larger-than-average appendix leave fewer offspring than those with a below-average-sized appendix.
   e. In a million years, the human species might completely lack an appendix.

45. Members of two different species possess a similar-looking structure that they use in a similar fashion to perform the same function. Which information would best help distinguish between an explanation based on homology versus one based on convergent evolution?
   a. The two species live at great distance from each other.
   b. The two species share many proteins in common, and the nucleotide sequences that code for these proteins are almost identical.
   c. The sizes of the structures in adult members of both species are similar in size.
   d. Both species are well adapted to their particular environments.
   e. Both species reproduce sexually.

46. Ichthyosaurs were aquatic dinosaurs. Fossils show us that they had dorsal fins and tails, as do fish, even though their closest relatives were terrestrial reptiles that had neither dorsal fins nor aquatic tails. The dorsal fins and tails of ichthyosaurs and fish are
   a. homologous.
   b. examples of convergent evolution.
   c. adaptations to a common environment.
   d. A and C only
   e. B and C only

47. It has been observed that organisms on islands are different from, but closely related to, similar forms found on the nearest continent. This is taken as evidence that
   a. island forms and mainland forms descended from common ancestors.
   b. common environments are inhabited by the same organisms.
   c. the islands were originally part of the continent.
   d. the island forms and mainland forms are converging.
   e. island forms and mainland forms have identical gene pools.
48. Monkeys of South and Central America have prehensile tails, meaning that their tails can be used to grasp objects. The tails of African and Asian monkeys are not prehensile. Which discipline is most likely to provide an evolutionary explanation for how this difference in tails came about?
   a. Aerodynamics
   b. Biogeography
   c. Physiology
   d. Biochemistry
   e. Botany

49. The theory of evolution is most accurately described as
   a. an educated guess about how species originate.
   b. one possible explanation, among several scientific alternatives, about how species have come into existence.
   c. an opinion that some scientists hold about how living things change over time.
   d. an overarching explanation, supported by much evidence, for how populations change over time.
   e. an idea about how acquired characteristics are passed on to subsequent generations.

50. Which of the following is not an observation or inference on which natural selection is based?
   a. There is heritable variation among individuals.
   b. Poorly adapted individuals never produce offspring.
   c. Species produce more offspring than the environment can support.
   d. Individuals whose characteristics are best suited to the environment generally leave more offspring than those whose characteristics are less suited.
   e. Only a fraction of the offspring produced by an individual may survive.

51. The upper forelimbs of humans and bats have fairly similar skeletal structures, whereas the corresponding bones in whales have very different shapes and proportions. However, genetic data suggest that all three kinds of organisms diverged from a common ancestor at about the same time. Which of the following is the most likely explanation for these data?
   a. Humans and bats evolved by natural selection, and whales evolved by Lamarckian mechanisms.
   b. Forelimb evolution was adaptive in people and bats, but not in whales.
   c. Natural selection in an aquatic environment resulted in significant changes to whale forelimb anatomy.
   d. Genes mutate faster in whales than in humans or bats.
   e. Whales are not properly classified as mammals.

52. Which of the following observations helped Darwin shape his concept of descent with modification?
   a. Species diversity declines farther from the equator.
   b. Fewer species live on islands than on the nearest continents.
   c. Birds can be found on islands located farther from the mainland than the birds' maximum nonstop flight distance.
   d. South American temperate plants are more similar to the tropical plants of South America than to the temperate plants of Europe.
   e. Earthquakes reshape life by causing mass extinctions.
53. Within a few weeks of treatment with the drug 3TC, a patient's HIV population consists entirely of 3TC-resistant viruses. How can this result best be explained?
   a. HIV can change its surface proteins and resist vaccines.
   b. The patient must have become reinfected with 3TC-resistant viruses.
   c. HIV began making drug-resistant versions of reverse transcriptase in response to the drug.
   d. A few drug-resistant viruses were present at the start of treatment, and natural selection increased their frequency.
   e. The drug caused the HIV RNA to change.

54. DNA sequences in many human genes are very similar to the sequences of corresponding genes in chimpanzees. The most likely explanation for this result is that
   a. humans and chimpanzees share a relatively recent common ancestor.
   b. humans evolved from chimpanzees.
   c. chimpanzees evolved from humans.
   d. convergent evolution led to the DNA similarities.
   e. humans and chimpanzees are not closely related.

55. Which of the following pairs of structures is least likely to represent homology?
   a. The wings of a bat and the arms of a human
   b. The hemoglobin of a baboon and that of a gorilla
   c. The mitochondria of a plant and those of an animal
   d. The wings of a bird and those of an insect
   e. The brain of a cat and that of a dog

56. Which of these is a statement that Darwin would have rejected?
   a. Environmental change plays a role in evolution.
   b. The smallest entity that can evolve is an individual organism.
   c. Individuals can acquire new characteristics as they respond to new environments or situations.
   d. Inherited variation in a population is a necessary precondition for natural selection to operate.
   e. Natural populations tend to produce more offspring than the environment can support.

57. Which definition of evolution would have been most foreign to Charles Darwin during his lifetime?
   a. change in gene frequency in gene pools
   b. descent with modification
   c. the gradual change of a population's heritable traits over generations
   d. populations becoming better adapted to their environments over the course of generations
   e. the appearance of new varieties and new species with the passage of time

58. About which of these did Darwin have a poor understanding?
   a. that individuals in a population exhibit a good deal of variation
   b. that much of the variation between individuals in a population is inherited
   c. the factors that cause individuals in populations to struggle for survival
   d. the sources of genetic variations among individuals
e. how a beneficial trait becomes more common in a population over the course of generations

59. If, on average, 46% of the loci in a species' gene pool are heterozygous, then the average homozygosity of the species should be
   a. 23%
   b. 46%
   c. 54%
   d. 92%
   e. There is not enough information to say.

60. Which of these variables is likely to undergo the largest change in value as the result of a mutation that introduces a brand-new allele into a population's gene pool at a locus that had formerly been fixed?
   a. Average heterozygosity
   b. Nucleotide variability
   c. Geographic variability
   d. Average number of loci

61. Which of these is the smallest unit upon which natural selection directly acts?
   a. a species' gene frequency
   b. a population's gene frequency
   c. an individual's genome
   d. an individual's genotype
   e. an individual's phenotype

62. Which of these is the smallest unit that natural selection can change?
   a. a species' gene frequency
   b. a population's gene frequency
   c. an individual's genome
   d. an individual's genotype
   e. an individual's phenotype

63. Which of these evolutionary agents is most consistent at causing populations to become better suited to their environments over the course of generations?
   a. Mutation
   b. Non-random mating
   c. Gene flow
   d. Natural selection
   e. Genetic drift

64. Which statement about the beak size of finches on the island of Daphne Major during prolonged drought is true?
   a. Each bird evolved a deeper, stronger beak as the drought persisted.
   b. Each bird developed a deeper, stronger beak as the drought persisted.
   c. Each bird's survival was strongly influenced by the depth and strength of its beak as the drought persisted.
d. Each bird that survived the drought produced only offspring with deeper, stronger beaks than seen in the previous generation.
e. The frequency of the strong-beak alleles increased in each bird as the drought persisted.

65. Each of the following has a better chance of influencing gene frequencies in small populations than in large populations, but which one most consistently requires a small population as a precondition for its occurrence?
   a. Mutation
   b. Non-random mating
   c. Genetic drift
   d. Natural selection
   e. Gene flow

66. In modern terminology, diversity is understood to be a result of genetic variation. Sources of variation for evolution include all of the following except
   a. mistakes in translation of structural genes.
   b. mistakes in DNA replication.
   c. translocations and mistakes in meiosis.
   d. recombination at fertilization.
   e. recombination by crossing over in meiosis.

67. A trend toward the decrease in the size of plants on the slopes of mountains as altitudes increase is an example of
   a. a cline.
   b. a bottleneck.
   c. relative fitness.
   d. genetic drift.
   e. geographic variation.

68. The higher the proportion of loci that are "fixed" in a population, the lower is that population's
   a. nucleotide variability.
   b. genetic polyploidy.
   c. average heterozygosity.
   d. A, B, and C
   e. A and C only

69. Which statement about variation is true?
   a. All phenotypic variation is the result of genotypic variation.
   b. All genetic variation produces phenotypic variation.
   c. All nucleotide variability results in neutral variation.
   d. All new alleles are the result of nucleotide variability.
   e. All geographic variation results from the existence of clines.

70. In a hypothetical population's gene pool, an autosomal gene, which had previously been fixed, undergoes a mutation that introduces a new allele, one inherited according to incomplete dominance. Natural selection then causes stabilizing selection at this locus. Consequently, what should happen over the course of many generations?
a. The proportions of both types of homozygote should decrease.
b. The proportion of the population that is heterozygous at this locus should remain constant.
c. The population's average heterozygosity should increase.
d. Both (A) and (B)
e. Both (A) and (C)

71. Rank the following 1-base point mutations (from most likely to least likely) with respect to their likelihood of affecting the structure of the corresponding polypeptide:
1. insertion mutation deep within an intron
2. substitution mutation at the 3rd position of an exonic codon
3. substitution mutation at the 2nd position of an exonic codon
4. deletion mutation within the first exon of the gene

a. 1, 2, 3, 4
b. 4, 3, 2, 1
c. 2, 1, 4, 3
d. 3, 1, 4, 2
e. 2, 3, 1, 4

72. Sponges are known to contain a single Hox gene. Most invertebrates have a cluster of 10 similar Hox genes, all located on the same chromosome. Most vertebrates have four such clusters of Hox genes, located on four non-homologous chromosomes. The process responsible for the change in number of Hox genes from sponges to invertebrates was most likely ____, whereas a different process that could have potentially contributed to the cluster's presence on more than one chromosome was ____.
I. binary fission
II. translation
III. gene duplication
IV. non-disjunction
V. transcription

a. I, II
b. II, III
c. II, V
d. III, IV
e. III, V

Use the following information to answer the questions below.

HIV’s genome of RNA includes code for reverse transcriptase (RT), an enzyme that acts early in infection to synthesize a DNA genome off of an RNA template. The HIV genome also codes for protease (PR), an enzyme that acts later in infection by cutting long viral polyproteins into smaller, functional proteins. Both RT and PR represent potential targets for antiretroviral drugs. Drugs called nucleoside analogs (NA) act against RT, whereas drugs called protease inhibitors (PI) act against PR.
73. Which of these represents the treatment option that is most likely to avoid the production of drug-resistant HIV (assuming no drug interactions or side effects)?
   a. using a series of NAs, one at a time, and changed about once a week
   b. using a single PI, but slowly increasing the dosage over the course of a week
   c. using high doses of NA and a PI at the same time for a period not to exceed 1 day
   d. using moderate doses of NA and of two different PI's at the same time for several months

74. Within the body of an HIV-infected individual who is being treated with a single NA, and whose HIV particles are currently vulnerable to this NA, which of these situations can increase the virus' relative fitness?
   1. mutations resulting in RTs with decreased rates of nucleotide mismatch
   2. mutations resulting in RTs with increased rates of nucleotide mismatch
   3. mutations resulting in RTs that have proofreading capability
   a. 1 only
   b. 2 only
   c. 3 only
   d. 1 and 3
   e. 2 and 3

75. HIV has 9 genes in its RNA genome. Every HIV particle contains two RNA molecules, each molecule containing all 9 genes. If, for some reason, the two RNA molecules within a single HIV particle do not have identical sequences, then which of these terms can be applied due to the existence of the non-identical regions?
   a. homozygous
   b. gene variability
   c. nucleotide variability
   d. average heterozygosity
   e. all except A

76. If two genes from one RNA molecule become detached and then, as a unit, get attached to one end of the other RNA molecule within a single HIV particle, which of these is true?
   a. There are now fewer genes within the viral particle.
   b. There are now more genes within the viral particle.
   c. A point substitution mutation has occurred in the retroviral genome.
   d. The retroviral equivalent of crossing-over has occurred, no doubt resulting in a heightened positive effect.
   e. One of the RNA molecules has experienced gene duplication as the result of translocation.

77. The DNA polymerases of all cellular organisms have proofreading capability. This capability tends to reduce the introduction of
   a. extra genes by gene duplication events.
   b. chromosomal translocation.
   c. genetic variation by mutations.
   d. proofreading capability into prokaryotes.
78. Which of these makes determining the evolutionary relatedness of different species based on the amino acid sequence of homologous proteins generally less accurate than determinations of relatedness based on the nucleotide sequences of homologous genes?
   a. Silent mutations
   b. Gene duplications
   c. Translocation events that change gene sequences
   d. Crossing-over
   e. Independent assortment

79. Which is a true statement concerning genetic variation?
   a. It is created by the direct action of natural selection.
   b. It arises in response to changes in the environment.
   c. It must be present in a population before natural selection can act upon the population.
   d. It tends to be reduced by the processes involved when diploid organisms produce gametes.
   e. A population that has a higher average heterozygosity has less genetic variation than one with a larger average heterozygosity.

Use the following information to answer the questions below.

A large population of laboratory animals has been allowed to breed randomly for a number of generations. After several generations, 25% of the animals display a recessive trait (aa), the same percentage as at the beginning of the breeding program. The rest of the animals show the dominant phenotype, with heterozygotes indistinguishable from the homozygous dominants.

80. What is the most reasonable conclusion that can be drawn from the fact that the frequency of the recessive trait (aa) has not changed over time?
   a. The population is undergoing genetic drift.
   b. The two phenotypes are about equally adaptive under laboratory conditions.
   c. The genotype AA is lethal.
   d. There has been a high rate of mutation of allele A to allele a.
   e. There has been sexual selection favoring allele a.

81. What is the estimated frequency of allele A in the gene pool?
   a. 0.05
   b. 0.25
   c. 0.50
   d. 0.75
   e. 1.00

82. What proportion of the population is probably heterozygous (Aa) for this trait?
   a. 0.05
   b. 0.25
   c. 0.50
   d. 0.75
   e. 1.00
83. In a Hardy-Weinberg population with two alleles, $A$ and $a$, that are in equilibrium, the frequency of the allele $a$ is 0.4. What is the percentage of the population that is homozygous for this allele?
   a. 4
   b. 16
   c. 32
   d. 36
   e. 40

84. In a Hardy-Weinberg population with two alleles, $A$ and $a$, that are in equilibrium, the frequency of allele $a$ is 0.1. What is the percentage of the population that is heterozygous for this allele?
   a. 90
   b. 81
   c. 49
   d. 18
   e. 10

85. In a Hardy-Weinberg population with two alleles, $A$ and $a$, that are in equilibrium, the frequency of allele $a$ is 0.2. What is the frequency of individuals with $Aa$ genotype?
   a. 0.20
   b. 0.32
   c. 0.42
   d. 0.80
   e. Genotype frequency cannot be determined from the information provided.

86. You sample a population of butterflies and find that 42% are heterozygous at a particular locus. What should be the frequency of the recessive allele in this population?
   a. 0.09
   b. 0.30
   c. 0.49
   d. 0.70
   e. Allele frequency cannot be determined from this information.

Use the following information to answer the questions below.

In a hypothetical population of 1,000 people, tests of blood-type genes show that 160 have the genotype $AA$, 480 have the genotype $AB$, and 360 have the genotype $BB$.

87. What is the frequency of the $B$ allele?
   a. 0.001
   b. 0.002
   c. 0.100
   d. 0.400
   e. 0.600

88. If there are 4,000 children born to this generation, how many would be expected to have AB blood under the conditions of Hardy-Weinberg equilibrium?
   a. 100
   b. 960
89. In peas, a gene controls flower color such that \( R = \) purple and \( r = \) white. In an isolated pea patch, there are 36 purple-flowering plants and 64 white-flowering plants. Assuming Hardy-Weinberg equilibrium, what is the value of \( q \) for this population?

- a. 0.36
- b. 0.60
- c. 0.64
- d. 0.75
- e. 0.80

The following questions refer to this information:

In the year 2500, five male space colonists and five female space colonists (all unrelated to each other) settle on an uninhabited Earthlike planet in the Andromeda galaxy. The colonists and their offspring randomly mate for generations. All ten of the original colonists had free earlobes, and two were heterozygous for that trait. The allele for free earlobes is dominant to the allele for attached earlobes.

90. Which of these is closest to the allele frequency in the founding population?

- a. 0.1 \( a \), 0.9 \( A \)
- b. 0.2 \( a \), 0.8 \( A \)
- c. 0.5 \( a \), 0.5 \( A \)
- d. 0.8 \( a \), 0.2 \( A \)
- e. 0.4 \( a \), 0.6 \( A \)

91. If one assumes that Hardy-Weinberg equilibrium applies to the population of colonists on this planet, about how many people will have attached earlobes when the planet's population reaches 10,000?

- a. 100
- b. 400
- c. 800
- d. 1,000
- e. 10,000

92. If four of the original colonists died before they produced offspring, the ratios of genotypes could be quite different in the subsequent generations. This would be an example of

- a. diploidy.
- b. gene flow.
- c. genetic drift.
- d. disruptive selection.
- e. stabilizing selection.

The following questions refer to this information:
You are studying three populations of birds. Population A has ten birds, of which one is brown (a recessive trait) and nine are red. Population B has 100 birds, of which ten are brown. Population C has 30 birds, and three of them are brown.

93. In which population is the frequency of the allele for brown feathers highest?
   a. Population A.
   b. Population B.
   c. Population C.
   d. They are all the same.
   e. It is impossible to tell from the information given.

94. In which population would it be least likely that an accident would significantly alter the frequency of the brown allele?
   a. Population A.
   b. Population B.
   c. Population C.
   d. They are all the same.
   e. It is impossible to tell from the information given.

95. Which population is most likely to be subject to the bottleneck effect?
   a. Population A.
   b. Population B.
   c. Population C.
   d. They are all the same.
   e. It is impossible to tell from the information given.

96. You are maintaining a small population of fruit flies in the laboratory by transferring the flies to a new culture bottle after each generation. After several generations, you notice that the viability of the flies has decreased greatly. Recognizing that small population size is likely to be linked to decreased viability, the best way to reverse this trend is to
   a. cross your flies with flies from another lab.
   b. reduce the number of flies that you transfer at each generation.
   c. transfer only the largest flies.
   d. change the temperature at which you rear the flies.
   e. shock the flies with a brief treatment of heat or cold to make them more hardy.

97. If the frequency of a particular allele that is present in a small, isolated population of alpine plants decreases due to a landslide that leaves an even smaller remnant of surviving plants bearing this allele, then what has occurred?
   a. a bottleneck
   b. genetic drift
   c. microevolution
   d. A and B only
   e. A, B, and C

98. If the original finches that had been blown over to the Galapagos from South America had already been genetically different from the parental population of South American finches, even before adapting to the Galapagos, this would have been an example of
a. genetic drift.
b. bottleneck effect.
c. founder's effect.
d. all three of these
e. both A and C

99. Over time, the movement of people on Earth has steadily increased. This has altered the course of human evolution by increasing
a. non-random mating.
b. geographic isolation.
c. genetic drift.
d. mutations.
e. gene flow.

100. Gene flow is a concept best used to describe an exchange between
a. species.
b. males and females.
c. populations.
d. individuals.
e. chromosomes.

101. Natural selection is most nearly the same as
a. diploidy.
b. gene flow.
c. genetic drift.
d. non-random mating.
e. differential reproductive success.

The following questions refer to this information:

The restriction enzymes of bacteria protect the bacteria from successful attack by bacteriophages, whose genomes can be degraded by the restriction enzymes. The bacterial genomes are not vulnerable to these restriction enzymes because bacterial DNA is methylated. This situation selects for bacteriophages whose genomes are also methylated. As new strains of resistant bacteriophages become more prevalent, this in turn selects for bacteria whose genomes are not methylated and whose restriction enzymes instead degrade methylated DNA.

102. The outcome of the conflict between bacteria and bacteriophage at any point in time results from
a. frequency-dependent selection.
b. evolutionary imbalance.
c. heterozygote advantage.
d. neutral variation.
e. genetic variation being preserved by diploidy.

103. Over the course of evolutionary time, what should occur?
 a. Methylated DNA should become fixed in the gene pools of bacterial species.
b. Nonmethylated DNA should become fixed in the gene pools of bacteriophages.
c. Methylated DNA should become fixed in the gene pools of bacteriophages.
d. Methylated and nonmethylated strains should be maintained among both bacteria and bacteriophages, with ratios that vary over time.
e. Both A and B are correct.

104. Arrange the following from most general (i.e., most inclusive) to most specific (i.e., least inclusive):
   1. Natural selection
   2. Microevolution
   3. Intrasesexual selection
   4. Evolution
   5. Sexual selection
   a. 4, 1, 2, 3, 5
   b. 4, 2, 1, 3, 5
   c. 4, 2, 1, 5, 3
   d. 1, 4, 2, 5, 3
   e. 1, 2, 4, 5, 3

105. Sexual dimorphism is most often a result of
   a. pansexual selection.
   b. stabilizing selection.
   c. intrasexual selection.
   d. intersexual selection.
   e. artificial selection.

The following questions refer to this information:

In the wild, male house finches (Carpodus mexicanus) vary considerably in the amount of red pigmentation in their head and throat feathers, with colors ranging from pale yellow to bright red. These colors come from carotenoid pigments that are found in the birds' diets; no vertebrates are known to synthesize carotenoid pigments. Thus, the brighter red the male's feathers are, the more successful he has been at acquiring the red carotenoid pigment by his food-gathering efforts (all other factors being equal).

106. During breeding season, one should expect female house finches to prefer to mate with males with the brightest red feathers. Which of the following is true of this situation?
   a. Alleles that promote more efficient acquisition of carotenoid-containing foods by males should increase over the course of generations.
   b. Alleles that promote more effective deposition of carotenoid pigments in the feathers of males should increase over the course of generations.
   c. There should be directional selection for bright red feathers in males.
   d. All three of these.
   e. Only B and C.

107. Which of the following terms are appropriately applied to the situation described in the previous question?
   a. Sexual selection
   b. Mate choice
   c. Intersexual selection
   d. All three of these
108. The situation as described in the paragraph above should select most directly against males that
   a. are unable to distinguish food items that are red from those of other colors.
   b. are older, but still healthy.
   c. are capable of defending only moderately sized territories.
   d. have slightly lower levels of testosterone during breeding season than have other males.
   e. have no prior experience courting female house finches.

The following questions refer to this information:

Adult male humans generally have deeper voices than do adult female humans, as the direct result of higher levels of testosterone causing growth of the larynx.

109. If the fossil records of apes and humans alike show a trend toward decreasing larynx size in adult females, and increasing larynx size in adult males, then
   a. sexual dimorphism was developing over time in these species.
   b. intrasexual selection seems to have occurred.
   c. the "good genes" hypothesis was refuted by these data.
   d. stabilizing selection was occurring in these species concerning larynx size.
   e. selection was acting more directly upon genotype than upon phenotype.

110. Which addition to the information in the paragraph above would make more than one of the answers listed in the previous question correct?
   a. If larynx size was also affected by the amount the larynx was used (i.e., the amount of vocalization).
   b. If males prefer to mate with females possessing higher voices.
   c. If females killed female offspring whose voices were too deep.
   d. If the trend described above was seen in the fossil record of only one species of ape.

111. If one excludes the involvement of gender in the situation described in the paragraph above, then the pattern that is apparent in the fossil record is most similar to one that should be expected from
   a. pansexual selection.
   b. directional selection.
   c. disruptive selection.
   d. stabilizing selection.
   e. asexual selection.

112. The Darwinian fitness of an individual is measured most directly by
   a. the number of its offspring that survive to reproduce.
   b. the number of "good genes" it possesses.
   c. the number of mates it attracts.
   d. its physical strength.
   e. how long it lives.
113. When we say that an individual organism has a greater fitness than another individual, we specifically mean that the organism
   a. lives longer than others of its species.
   b. competes for resources more successfully than others of its species.
   c. mates more frequently than others of its species.
   d. utilizes resources more efficiently than other species occupying similar niches.
   e. leaves more viable offspring than others of its species.

114. Which of the following statements best summarizes evolution as it is viewed today?
   a. It is goal-directed.
   b. It represents the result of selection for acquired characteristics.
   c. It is synonymous with the process of gene flow.
   d. It is the descent of humans from the present-day great apes.
   e. It is the differential survival and reproduction of the most-fit phenotypes.

115. If neutral variation is truly "neutral," then it should have no effect on
   a. nucleotide diversity.
   b. average heterozygosity.
   c. our ability to measure the rate of evolution.
   d. relative fitness.
   e. gene diversity.

116. Which describes an African butterfly species that exists in two strikingly different color patterns?
   a. artificial selection
   b. directional selection
   c. stabilizing selection
   d. disruptive selection
   e. sexual selection

117. Which describes brightly colored peacocks mating more frequently than drab peacocks?
   a. artificial selection
   b. directional selection
   c. stabilizing selection
   d. disruptive selection
   e. sexual selection

118. Most Swiss starlings produce four to five eggs in each clutch. Those producing fewer or more than this have reduced fitness. Which of the following terms best describes this?
   a. artificial selection
   b. directional selection
   c. stabilizing selection
   d. disruptive selection
   e. sexual selection

119. Fossil evidence indicates that horses have gradually increased in size over geologic time. Which of the following terms best describes this?
   a. artificial selection
   b. directional selection
c. stabilizing selection
d. disruptive selection
e. sexual selection

120. The average birth weight for human babies is about 3 kg. Which of the following terms best describes this?
   a. artificial selection
   b. directional selection
   c. stabilizing selection
   d. disruptive selection
   e. sexual selection

121. A certain species of land snail exists as either a cream color or a solid brown color. Intermediate individuals are relatively rare. Which of the following terms best describes this?
   a. artificial selection
   b. directional selection
   c. stabilizing selection
   d. disruptive selection
   e. sexual selection

122. Cattle breeders have improved the quality of meat over the years by which process?
   a. artificial selection
   b. directional selection
   c. stabilizing selection
   d. A and B
   e. A and C

123. The recessive allele that causes phenylketonuria (PKU) is harmful, except when an infant's diet lacks the amino acid, phenylalanine. What maintains the presence of this harmful allele in a population's gene pool?
   a. heterozygote advantage
   b. stabilizing selection
   c. diploidy
   d. balancing selection

124. Mules are relatively long-lived and hardy organisms that cannot, generally speaking, perform successful meiosis. Consequently, which statement about mules is true?
   a. They have a relative evolutionary fitness of zero.
   b. Their offspring have less genetic variation than the parents.
   c. Mutations cannot occur in their genomes.
   d. If crossing-over happens in mules, then it must be limited to prophase of mitosis.
   e. When two mules interbreed, genetic recombination cannot occur by meiotic crossing over, but only by the act of fertilization.

125. Heterozygote advantage should be most closely linked to which of the following?
   a. sexual selection
   b. stabilizing selection
   c. random selection
126. In seedcracker finches from Cameroon, small- and large-billed birds specialize in cracking soft and hard seeds, respectively. If long-term climatic change resulted in all seeds becoming hard, what type of selection would then operate on the finch population?

a. disruptive selection
b. directional selection
c. stabilizing selection
d. sexual selection
e. No selection would operate because the population is in Hardy-Weinberg equilibrium.

In a very large population, a quantitative trait has the following distribution pattern:

Figure 23.1

127. What is true of the trait whose frequency distribution in a large population appears above? It has probably undergone

a. directional selection.
b. stabilizing selection.
c. disruptive selection.
d. sexual selection.
e. random selection.

128. If the curve shifts to the left or to the right, there is no gene flow, and the population size consequently increases over successive generations, then which of these is (are) probably occurring?

1. immigration or emigration
2. directional selection
3. adaptation
4. genetic drift
5. disruptive selection

a. 1 only
b. 4 only
c. 2 and 3
d. 4 and 5
e. 1, 2, and 3
129. Male satin bowerbirds adorn structures that they build, called "bowers," with parrot feathers, flowers, and other bizarre ornaments in order to attract females. Females inspect the bowers and, if suitably impressed, allow males to mate with them. The evolution of this male behavior is due to
a. frequency-dependent selection.
b. artificial selection.
c. sexual selection.
d. natural selection.
e. disruptive selection.

130. When imbalances occur in the sex ratio of sexual species that have two sexes (i.e., other than a 50:50 ratio), the members of the minority sex often receive a greater proportion of care and resources from parents than do the offspring of the majority sex. This is most clearly an example of
a. sexual selection.
b. disruptive selection.
c. balancing selection.
d. stabilizing selection.
e. frequency-dependent selection.

131. The same gene that causes various coat patterns in wild and domesticated cats also causes the cross-eyed condition in these cats, the cross-eyed condition being slightly maladaptive. In a hypothetical environment, the coat pattern that is associated with crossed eyes is highly adaptive, with the result that both the coat pattern and the cross-eyed condition increase in a feline population over time. Which statement is supported by these observations?
a. Evolution is progressive and tends toward a more perfect population.
b. Phenotype is often the result of compromise.
c. Natural selection reduces the frequency of maladaptive genes in populations over the course of time.
d. Polygenic inheritance is generally maladaptive, and should become less common in future generations.
e. In all environments, coat pattern is a more important survival factor than is eye-muscle tone.

132. A proficient engineer can easily design skeletal structures that are more functional than those currently found in the forelimbs of such diverse mammals as horses, whales, and bats. That the actual forelimbs of these mammals do not seem to be optimally arranged is because
a. natural selection has not had sufficient time to create the optimal design in each case, but will do so given enough time.
b. natural selection operates in ways that are beyond the capability of the human mind to comprehend.
c. in many cases, phenotype is not merely determined by genotype, but by the environment as well.
d. though we may not consider the fit between the current skeletal arrangements and their functions excellent, we should not doubt that natural selection ultimately produces the best design.
e. natural selection is generally limited to modifying structures that were present in previous generations and in previous species.
133. There are those who claim that the theory of evolution cannot be true because the apes, which are supposed to be closely related to humans, do not likewise share the same large brains, capacity for complicated speech, and tool-making capability. They reason that if these features are generally beneficial, then the apes should have evolved them as well. Which of these provides the best argument against this misconception?
   a. Advantageous alleles do not arise on demand.
   b. A population's evolution is limited by historical constraints.
   c. Adaptations are often compromises.
   d. Evolution can be influenced by environmental change.

134. A fruit fly population has a gene with two alleles, $A_1$ and $A_2$. Tests show that 70% of the gametes produced in the population contain the $A_1$ allele. If the population is in Hardy-Weinberg equilibrium, what proportion of the flies carry both $A_1$ and $A_2$?
   a. 0.7
   b. 0.49
   c. 0.21
   d. 0.42
   e. 0.09

135. There are 40 individuals in population 1, all of which have genotype $A_1A_1$, and there are 25 individuals in population 2, all of genotype $A_2A_2$. Assume that these populations are located far from one another and that their environmental conditions are very similar. Based on the information given here, the observed genetic variation is mostly likely an example of
   a. genetic drift.
   b. gene flow.
   c. disruptive selection.
   d. discrete variation.
   e. directional selection.

136. Natural selection changes allele frequencies in populations because some ____ survive and reproduce more successfully than others.
   a. alleles
   b. loci
   c. gene pools
   d. species
   e. individuals

137. No two people are genetically identical, except for identical twins. The chief cause of genetic variation among human individuals is
   a. new mutations that occurred in the preceding generation.
   b. the reshuffling of alleles in sexual reproduction.
   c. genetic drift due to the small size of the population.
   d. geographic variation within the population.
   e. environmental effects.

138. Sparrows with average-sized wings survive severe storms better than those with longer or shorter wings, illustrating
   a. the bottleneck effect.
b. stabilizing selection.
c. frequency-dependent selection.
d. neutral variation.
e. disruptive selection.

Short Answer

The following questions refer to Figure 22.1, which shows an outcrop of sedimentary rock whose strata are labeled A-D.

![Figure 22.1](image)

139. Which stratum should contain the greatest proportion of extinct organisms?

140. If "x" indicates the location of fossils of two closely related species, then fossils of their most-recent common ancestor are most likely to occur in which stratum?

141. Blue light is that portion of the visible spectrum that penetrates the deepest into bodies of water. Ultraviolet (UV) light, though, can penetrate even deeper. A gene within a population of marine fish that inhabits depths from 500 m to 1,000 m has an allele for a photopigment that is sensitive to UV light, and another allele for a photopigment that is sensitive to blue light. Which graph below best depicts the predicted distribution of these alleles if the fish that carry these alleles prefer to locate themselves where they can see best?
AP Bio Evolution Practice Test
Answer Section

MULTIPLE CHOICE

1. ANS: B  PTS: 1  TOP: Concept 22.1  SKL: Knowledge/Comprehension
2. ANS: D  PTS: 1  TOP: Concept 22.1  SKL: Application/Analysis
3. ANS: A  PTS: 1  TOP: Concept 22.1  SKL: Knowledge/Comprehension
4. ANS: A  PTS: 1  TOP: Concept 22.1  SKL: Synthesis/Evaluation
5. ANS: D  PTS: 1  TOP: Concept 22.1  SKL: Knowledge/Comprehension
6. ANS: C  PTS: 1  TOP: Concept 22.1  SKL: Application/Analysis
7. ANS: B  PTS: 1  TOP: Concept 22.1  SKL: Knowledge/Comprehension
8. ANS: E  PTS: 1  TOP: Concept 22.1  SKL: Knowledge/Comprehension
9. ANS: B  PTS: 1  TOP: Concept 22.2  SKL: Knowledge/Comprehension
10. ANS: E  PTS: 1  TOP: Concept 22.2  SKL: Knowledge/Comprehension
11. ANS: C  PTS: 1  TOP: Concept 22.2  SKL: Knowledge/Comprehension
12. ANS: D  PTS: 1  TOP: Concept 22.2  SKL: Knowledge/Comprehension
14. ANS: A  PTS: 1  TOP: Concept 22.2  SKL: Application/Analysis
15. ANS: E  PTS: 1  TOP: Concept 22.2  SKL: Knowledge/Comprehension
16. ANS: B  PTS: 1  TOP: Concept 22.2  SKL: Knowledge/Comprehension
17. ANS: D  PTS: 1  TOP: Concept 22.2  SKL: Synthesis/Evaluation
18. ANS: A  PTS: 1  TOP: Concept 22.2  SKL: Synthesis/Evaluation
19. ANS: E  PTS: 1  TOP: Concept 22.2  SKL: Synthesis/Evaluation
21. ANS: B  PTS: 1  TOP: Concept 22.2  SKL: Application/Analysis
22. ANS: D  PTS: 1  TOP: Concept 22.2
23. SKL: Application/Analysis
   ANS: A  PTS: 1
   TOP: Concept 22.2

24. SKL: Knowledge/Comprehension
   ANS: A  PTS: 1
   TOP: Concept 22.2

25. SKL: Knowledge/Comprehension
   ANS: C  PTS: 1
   TOP: Concept 22.2

26. SKL: Knowledge/Comprehension
   ANS: E  PTS: 1
   TOP: Concepts 22.2-22.3

27. SKL: Knowledge/Comprehension
   ANS: D  PTS: 1
   TOP: Concepts 22.2-22.3

28. SKL: Knowledge/Comprehension
   ANS: C  PTS: 1
   TOP: Concepts 22.2-22.3

29. SKL: Knowledge/Comprehension
   ANS: B  PTS: 1
   TOP: Concepts 22.2-22.3

30. SKL: Knowledge/Comprehension
    ANS: E  PTS: 1
    TOP: Concepts 22.2-22.3

31. SKL: Knowledge/Comprehension
    ANS: B  PTS: 1
    TOP: Concepts 22.1-22.2

32. SKL: Knowledge/Comprehension
    ANS: B  PTS: 1
    TOP: Concepts 22.2-22.3

33. SKL: Synthesis/Evaluation
    ANS: C  PTS: 1
    TOP: Concept 22.3

34. SKL: Application/Analysis
    ANS: D  PTS: 1
    TOP: Concept 22.3

35. SKL: Application/Analysis
    ANS: D  PTS: 1
    TOP: Concept 22.3

36. SKL: Application/Analysis
    ANS: B  PTS: 1
    TOP: Concept 22.3

37. SKL: Application/Analysis
    ANS: C  PTS: 1
    TOP: Concept 22.3

38. SKL: Knowledge/Comprehension
    ANS: E  PTS: 1
    TOP: Concept 22.3

39. SKL: Application/Analysis
    ANS: B  PTS: 1
    TOP: Concept 22.3

40. SKL: Application/Analysis
    ANS: D  PTS: 1
    TOP: Concept 22.3

41. SKL: Application/Analysis
    ANS: C  PTS: 1
    TOP: Concept 22.3

42. SKL: Application/Analysis
    ANS: B  PTS: 1
    TOP: Concept 22.3

43. SKL: Synthesis/Evaluation
    ANS: E  PTS: 1
    TOP: Concept 22.3

44. SKL: Synthesis/Evaluation
    ANS: C  PTS: 1
    TOP: Concept 22.3

45. SKL: Synthesis/Evaluation
    ANS: B  PTS: 1
    TOP: Concept 22.3

46. SKL: Knowledge/Comprehension
    ANS: E  PTS: 1
    TOP: Concept 22.3
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75. ANS: E  PTS: 1  TOP: Concept 23.1
   SKL: Knowledge/Comprehension
76. ANS: E  PTS: 1  TOP: Concept 23.1
   SKL: Application/Analysis
77. ANS: C  PTS: 1  TOP: Concept 23.1
   SKL: Knowledge/Comprehension
78. ANS: A  PTS: 1  TOP: Concept 23.1
   SKL: Knowledge/Comprehension
79. ANS: C  PTS: 1  TOP: Concept 23.1
   SKL: Knowledge/Comprehension
80. ANS: B  PTS: 1  TOP: Concept 23.2
   SKL: Knowledge/Comprehension
81. ANS: C  PTS: 1  TOP: Concept 23.2
   SKL: Application/Analysis
82. ANS: C  PTS: 1  TOP: Concept 23.2
   SKL: Application/Analysis
83. ANS: B  PTS: 1  TOP: Concept 23.2
   SKL: Application/Analysis
84. ANS: D  PTS: 1  TOP: Concept 23.2
   SKL: Application/Analysis
85. ANS: B  PTS: 1  TOP: Concept 23.2
   SKL: Application/Analysis
86. ANS: E  PTS: 1  TOP: Concept 23.2
   SKL: Application/Analysis
87. ANS: E  PTS: 1  TOP: Concept 23.2
   SKL: Application/Analysis
88. ANS: C  PTS: 1  TOP: Concept 23.2
   SKL: Application/Analysis
89. ANS: E  PTS: 1  TOP: Concept 23.2
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90. ANS: A  PTS: 1  TOP: Concept 23.2
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91. ANS: A  PTS: 1  TOP: Concept 23.2
   SKL: Application/Analysis
92. ANS: C  PTS: 1  TOP: Concept 23.3
   SKL: Application/Analysis
93. ANS: E  PTS: 1  TOP: Concept 23.2
   SKL: Application/Analysis
94. ANS: B  PTS: 1  TOP: Concepts 23.2-23.3
   SKL: Application/Analysis
95. ANS: A  PTS: 1  TOP: Concepts 23.2-23.3
   SKL: Knowledge/Comprehension
96. ANS: A  PTS: 1  TOP: Concept 23.3
   SKL: Application/Analysis
97. ANS: E  PTS: 1  TOP: Concept 23.3
   SKL: Knowledge/Comprehension
98. ANS: E  PTS: 1  TOP: Concept 23.3
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123. ANS: C   PTS: 1   TOP: Concept 23.4   SKL: Knowledge/Comprehension
124. ANS: A   PTS: 1   TOP: Concept 23.4   SKL: Knowledge/Comprehension
125. ANS: B   PTS: 1   TOP: Concept 23.4   SKL: Knowledge/Comprehension
126. ANS: B   PTS: 1   TOP: Concept 23.4   SKL: Knowledge/Comprehension
127. ANS: B   PTS: 1   TOP: Concept 23.4   SKL: Knowledge/Comprehension
128. ANS: C   PTS: 1   TOP: Concept 23.4   SKL: Knowledge/Comprehension
129. ANS: C   PTS: 1   TOP: Concept 23.4   SKL: Application/Analysis
130. ANS: E   PTS: 1   TOP: Concept 23.4   SKL: Application/Analysis
131. ANS: B   PTS: 1   TOP: Concept 23.4   SKL: Application/Analysis
132. ANS: E   PTS: 1   TOP: Concept 23.4   SKL: Application/Analysis
133. ANS: A   PTS: 1   TOP: Concept 23.4   SKL: Synthesis/Evaluation
134. ANS: D   PTS: 1   TOP: Self-Quiz Questions
135. ANS: A   PTS: 1   TOP: Self-Quiz Questions
136. ANS: E   PTS: 1   TOP: Self-Quiz Questions
137. ANS: B   PTS: 1   TOP: Self-Quiz Questions
138. ANS: B   PTS: 1   TOP: Self-Quiz Questions

SHORT ANSWER

139. ANS: D
   PTS: 1   TOP: Concept 22.1   SKL: Knowledge/Comprehension
140. ANS: C
   PTS: 1   TOP: Concept 22.1   SKL: Application/Analysis
141. ANS: B
   PTS: 1   TOP: Concept 23.1   SKL: Application/Analysis