

***Campbell's Biology, 9e* (Reece et al.)**
Chapter 24 The Origin of Species

The major changes to the Test Bank for Chapter 24 are two sets of scenario questions. The first of these deals with the adaptation of mosquitofish on the Bahamian Island of Andros. The second deals with reproductive isolation that occurred to marine species on either side of the Isthmus of Panama as it arose from the ocean floor.

Multiple-Choice Questions

1) What is true of macroevolution?

- A) It is the same as microevolution, but includes the origin of new species.
- B) It is evolution above the species level.
- C) It is defined as the evolution of microscopic organisms into organisms that can be seen with the naked eye.
- D) It is defined as a change in allele or gene frequency over the course of many generations.
- E) It is the conceptual link between irritability and adaptation.

Answer: B

Topic: Concept 24.1

Skill: Knowledge/Comprehension

2) What is true of the flightless cormorants of the Galápagos Islands?

- A) They are descendants of the same common ancestor that gave rise to the unique finches of these islands.
- B) They are close relatives of flightless cormorants from the Americas.
- C) If they are still able to breed successfully with flying cormorants, it would probably be with North American cormorants, rather than with South American cormorants.
- D) Flightless cormorants on one island have restricted gene flow with those on other islands, which could someday lead to a macroevolutionary event.
- E) Their DNA has low levels of sequence homology with the DNA of flying American cormorants.

Answer: D

Topic: Concept 24.1

Skill: Knowledge/Comprehension

3) Which of the following statements about species, as defined by the biological species concept, is (are) correct?

- I. Biological species are defined by reproductive isolation.
 - II. Biological species are the model used for grouping extinct forms of life.
 - III. The biological species is the largest unit of population in which successful interbreeding is possible.
- A) I and II
 - B) I and III
 - C) II and III
 - D) I, II, and III

Answer: B

Topic: Concept 24.1

Skill: Knowledge/Comprehension

4) Which of the various species concepts distinguishes two species based on the degree of genetic exchange between their gene pools?

- A) phylogenetic
- B) ecological
- C) biological
- D) morphological

Answer: C

Topic: Concept 24.1

Skill: Knowledge/Comprehension

5) There is still some controversy among biologists about whether Neanderthals should be placed within the same species as modern humans or into a separate species of their own. Most DNA sequence data analyzed so far indicate that there was probably little or no gene flow between Neanderthals and *Homo sapiens*. Which species concept is most applicable in this example?

- A) phylogenetic
- B) ecological
- C) morphological
- D) biological

Answer: D

Topic: Concept 24.1

Skill: Application/Analysis

6) You are confronted with a box of preserved grasshoppers of various species that are new to science and have not been described. Your assignment is to separate them into species. There is no accompanying information as to where or when they were collected. Which species concept will you have to use?

- A) biological
- B) phylogenetic
- C) ecological
- D) morphological

Answer: D

Topic: Concept 24.1

Skill: Application/Analysis

7) Dog breeders maintain the purity of breeds by keeping dogs of different breeds apart when they are fertile. This kind of isolation is most similar to which of the following reproductive isolating mechanisms?

- A) reduced hybrid fertility
- B) hybrid breakdown
- C) mechanical isolation
- D) habitat isolation
- E) gametic isolation

Answer: D

Topic: Concept 24.1

Skill: Application/Analysis

8) Rank the following from most general to most specific:

1. gametic isolation
2. reproductive isolating mechanism
3. pollen-stigma incompatibility
4. prezygotic isolating mechanism

A) 2, 3, 1, 4

B) 2, 4, 1, 3

C) 4, 1, 2, 3

D) 4, 2, 1, 3

E) 2, 1, 4, 3

Answer: B

Topic: Concept 24.1

Skill: Application/Analysis

9) Two species of frogs belonging to the same genus occasionally mate, but the offspring fail to develop and hatch. What is the mechanism for keeping the two frog species separate?

A) the postzygotic barrier called hybrid inviability

B) the postzygotic barrier called hybrid breakdown

C) the prezygotic barrier called hybrid sterility

D) gametic isolation

Answer: A

Topic: Concept 24.1

Skill: Knowledge/Comprehension

10) Theoretically, the production of sterile mules by interbreeding between female horses (mares) and male donkeys (jacks) should

A) result in the extinction of one of the two parental species.

B) cause convergent evolution.

C) strengthen postzygotic barriers between horses and donkeys.

D) weaken the intrinsic reproductive barriers between horses and donkeys.

E) eventually result in the formation of a single species from the two parental species.

Answer: C

Topic: Concept 24.1

Skill: Knowledge/Comprehension

11) When male horses (stallions) and female donkeys (jennets) mate, they produce a sterile hybrid called a hinny. Hinnies occur much less frequently than do mules, but are just as healthy and robust as mules. Logically, which of the following best accounts for the relative rarity of hinnies, and what kind of prezygotic isolating mechanism is at work here?

A) Most hinnies die during fetal development; reduced hybrid viability.

B) Most hinnies die soon after being born; hybrid breakdown.

C) Most hinnies are reproductively sterile; reduced hybrid fertility.

D) Stallions and jennets are choosier about their mating partners than are mares and jacks; behavioral isolation.

E) Stallions and jennets are choosier about their mating partners than are mares and jacks; gametic isolation.

Answer: D

Topic: Concept 24.1

Skill: Application/Analysis

12) Dogs (*Canis lupus familiaris*) and gray wolves (*Canis lupus*) can interbreed to produce viable, fertile offspring. These species shared a common ancestor recently (in geologic time) and have a high degree of genetic similarity, although their anatomies vary widely. Judging from this evidence, which *two* species concepts are most likely to place dogs and wolves together into a single species?

- A) ecological and morphological
- B) ecological and phylogenetic
- C) morphological and phylogenetic
- D) biological and morphological
- E) biological and phylogenetic

Answer: E

Topic: Concept 24.1

Skill: Application/Analysis

13) Rocky Mountain juniper (*Juniperus scopulorum*) and one-seeded juniper (*J. monosperma*) have overlapping ranges. If pollen grains (which contain sperm cells) from one species are unable to germinate and make pollen tubes on female ovules (which contain egg cells) of the other species, then which of these terms are applicable?

1. sympatric species
2. prezygotic isolation
3. postzygotic isolation
4. allopatric species
5. habitat isolation
6. reduced hybrid fertility

A) 1 and 2

B) 2 and 4

C) 1, 3, and 6

D) 2, 4, and 5

E) 1, 2, 5, and 6

Answer: A

Topic: Concept 24.1

Skill: Application/Analysis

14) Rocky Mountain juniper (*Juniperus scopulorum*) and one-seeded juniper (*J. monosperma*) have overlapping ranges. If pollen grains (which contain sperm cells) from one species are unable to germinate and make pollen tubes on female ovules (which contain egg cells) of the other species, then which of these terms is applicable?

- A) behavioral isolation
- B) mechanical isolation
- C) hybrid breakdown
- D) reduced hybrid viability

Answer: B

Topic: Concept 24.1

Skill: Application/Analysis

15) What does the biological species concept use as the primary criterion for determining species boundaries?

- A) geographic isolation
- B) niche differences
- C) gene flow
- D) morphological similarity
- E) molecular (DNA, RNA, protein) similarity

Answer: C

Topic: Concept 24.1

Skill: Knowledge/Comprehension

16) In a hypothetical situation, a certain species of flea feeds only on pronghorn antelopes. In rangelands of the western United States, pronghorns and cattle often associate with one another. If some of these fleas develop a strong preference for cattle blood and mate only with other fleas that prefer cattle blood, then over time which of these should occur, if the host mammal can be considered as the fleas' habitat?

- 1. reproductive isolation
- 2. sympatric speciation
- 3. habitat isolation
- 4. prezygotic barriers

- A) 1 only
- B) 2 and 3
- C) 1, 2, and 3
- D) 2, 3, and 4
- E) 1 through 4

Answer: E

Topic: Concepts 24.1, 24.2

Skill: Application/Analysis

17) Two closely related populations of mice have been separated for many generations by a river. Climatic change causes the river to dry up, thereby bringing the mice populations back into contact in a zone of overlap. Which of the following is not a possible outcome when they meet?

- A) They interbreed freely and produce fertile hybrid offspring.
- B) They no longer attempt to interbreed.
- C) They interbreed in the region of overlap, producing an inferior hybrid. Subsequent interbreeding between inferior hybrids produces progressively superior hybrids over several generations.
- D) They remain separate in the extremes of their ranges but develop a persistent hybrid zone in the area of overlap.
- E) They interbreed in the region of overlap, but produce sterile offspring.

Answer: C

Topic: Concept 24.2

Skill: Application/Analysis

- 18) The difference between geographic isolation and habitat differentiation is the
- A) relative locations of two populations as speciation occurs.
 - B) speed (tempo) at which two populations undergo speciation.
 - C) amount of genetic variation that occurs among two gene pools as speciation occurs.
 - D) identity of the phylogenetic kingdom or domain in which these phenomena occur.
 - E) the ploidy of the two populations as speciation occurs.

Answer: A

Topic: Concept 24.2

Skill: Knowledge/Comprehension

- 19) Among known plant species, which of these have been the *two* most commonly occurring phenomena that have led to the origin of new species?

- 1. allopatric speciation
- 2. sympatric speciation
- 3. sexual selection
- 4. polyploidy

A) 1 and 3

B) 1 and 4

C) 2 and 3

D) 2 and 4

Answer: D

Topic: Concept 24.2

Skill: Knowledge/Comprehension

- 20) Beetle pollinators of a particular plant are attracted to its flowers' bright orange color. The beetles not only pollinate the flowers, but they mate while inside of the flowers. A mutant version of the plant with red flowers becomes more common with the passage of time. A particular variant of the beetle prefers the red flowers to the orange flowers. Over time, these two beetle variants diverge from each other to such an extent that interbreeding is no longer possible. What kind of speciation has occurred in this example, and what has driven it?

- A) allopatric speciation; ecological isolation
- B) sympatric speciation; habitat differentiation
- C) allopatric speciation; behavioral isolation
- D) sympatric speciation; sexual selection
- E) sympatric speciation; allopolyploidy

Answer: B

Topic: Concept 24.2

Skill: Application/Analysis

- 21) The origin of a new plant species by hybridization, coupled with accidents during nuclear division, is an example of

- A) allopatric speciation.
- B) sympatric speciation.
- C) autopolyploidy.
- D) habitat selection.

Answer: B

Topic: Concept 24.2

Skill: Knowledge/Comprehension

22) The phenomenon of fusion is likely to occur when, after a period of geographic isolation, two populations meet again and

- A) their chromosomes are no longer homologous enough to permit meiosis.
- B) a constant number of viable, fertile hybrids is produced over the course of generations.
- C) the hybrid zone is inhospitable to hybrid survival.
- D) an increasing number of viable, fertile hybrids is produced over the course of generations.
- E) a decreasing number of viable, fertile hybrids is produced over the course of generations.

Answer: D

Topic: Concept 24.3

Skill: Knowledge/Comprehension

23) A hybrid zone is properly defined as

- A) an area where two closely related species' ranges overlap.
- B) an area where mating occurs between members of two closely related species, producing viable offspring.
- C) a zone that features a gradual change in species composition where two neighboring ecosystems border each other.
- D) a zone that includes the intermediate portion of a cline.
- E) an area where members of two closely related species intermingle, but experience no gene flow.

Answer: B

Topic: Concept 24.3

Skill: Knowledge/Comprehension

24) Which of these should decline in hybrid zones where reinforcement is occurring?

- A) gene flow between distinct gene pools
- B) speciation
- C) the genetic distinctness of two gene pools
- D) mutation rate
- E) hybrid sterility

Answer: A

Topic: Concept 24.3

Skill: Knowledge/Comprehension

25) The most likely explanation for the high rate of sympatric speciation that apparently existed among the cichlids of Lake Victoria in the past is

- A) sexual selection.
- B) habitat differentiation.
- C) polyploidy.
- D) pollution.
- E) introduction of a new predator.

Answer: A

Topic: Concept 24.3

Skill: Knowledge/Comprehension

26) The most likely explanation for the recent decline in cichlid species diversity in Lake Victoria is

- A) reinforcement.
- B) fusion.
- C) stability.
- D) geographic isolation.
- E) polyploidy.

Answer: B

Topic: Concept 24.3

Skill: Knowledge/Comprehension

27) A narrow hybrid zone separates the toad species *Bombina bombina* and *Bombina variegata*. What is true of those alleles that are unique to the parental species?

- A) Such alleles should be absent.
- B) Their allele frequency should be nearly the same as the allele frequencies in toad populations distant from the hybrid zone.
- C) The alleles' heterozygosity should be higher among the hybrid toads there.
- D) Their allele frequency on one edge of the hybrid zone should roughly equal their frequency on the opposite edge of the hybrid zone.

Answer: C

Topic: Concepts 23.1, 24.3

Skill: Knowledge/Comprehension

28) According to the concept of punctuated equilibrium, the "sudden" appearance of a new species in the fossil record means that

- A) the species is now extinct.
- B) speciation occurred instantaneously.
- C) speciation occurred in one generation.
- D) speciation occurred rapidly in geologic time.
- E) the species will consequently have a relatively short existence, compared with other species.

Answer: D

Topic: Concept 24.4

Skill: Knowledge/Comprehension

29) According to the concept of punctuated equilibrium,

- A) natural selection is unimportant as a mechanism of evolution.
- B) given enough time, most existing species will branch gradually into new species.
- C) a new species accumulates most of its unique features as it comes into existence.
- D) evolution of new species features long periods during which changes are occurring, interspersed with short periods of equilibrium, or stasis.
- E) transitional fossils, intermediate between newer species and their parent species, should be abundant.

Answer: C

Topic: Concept 24.4

Skill: Knowledge/Comprehension

30) Speciation

- A) occurs at such a slow pace that no one has ever observed the emergence of new species.
- B) occurs only by the accumulation of genetic change over vast expanses of time.
- C) must begin with the geographic isolation of a small, frontier population.
- D) and microevolution are synonymous.
- E) can involve changes to a single gene.

Answer: E

Topic: Concept 24.4

Skill: Knowledge/Comprehension

31) Which of the following statements about speciation is correct?

- A) The goal of natural selection is speciation.
- B) When reunited, two allopatric populations will interbreed freely if speciation has occurred.
- C) Natural selection chooses the reproductive barriers for populations.
- D) Prezygotic reproductive barriers usually evolve before postzygotic barriers.
- E) Speciation is a basis for understanding macroevolution.

Answer: E

Topic: Concept 24.4

Skill: Knowledge/Comprehension

32) In order for speciation to occur, what must be true?

- A) The number of chromosomes in the gene pool must change.
- B) Changes to centromere location or chromosome size must occur within the gene pool.
- C) Large numbers of genes that affect a single phenotypic trait must change.
- D) Large numbers of genes that affect numerous phenotypic traits must change.
- E) At least one gene, affecting at least one phenotypic trait, must change.

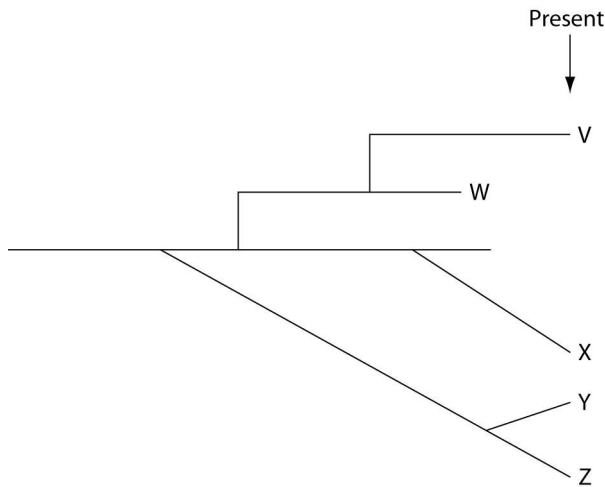
Answer: E

Topic: Concept 24.4

Skill: Knowledge/Comprehension

Art Questions

The next few questions refer to the following evolutionary tree, whose horizontal axis represents time (present time is on the far right) and whose vertical axis represents morphological change.



33) Which species is most closely related to species W?

- A) V is most closely related to species W.
- B) X is most closely related to species W.
- C) Y and Z are equally closely related to W.
- D) It is not possible to say from this tree.

Answer: A

Topic: Concepts 22.4, 23.4

Skill: Application/Analysis

34) Which species is *least* expected to have a good record of transitional fossils; in other words, which species' fossils, if present at all, are expected only in relatively superficial (i.e., shallow) strata?

- A) V
- B) W
- C) X
- D) Y
- E) Z

Answer: A

Topic: Concepts 22.4, 23.4

Skill: Synthesis/Evaluation

35) Which of these five species originated earliest and appeared suddenly in the fossil record?

- A) V
- B) W
- C) X
- D) Y
- E) Z

Answer: B

Topic: Concept 24.4

Skill: Application/Analysis

36) Which conclusion can be drawn from this evolutionary tree?

- A) Gradualistic speciation and speciation involving punctuated equilibrium are mutually exclusive concepts; only one of them can occur.
- B) Eldredge and Gould would deny that the lineages labeled X, Y, and Z could represent true species.
- C) Assuming that the tip of each line represents a species, there are five extant (i.e., not extinct) species resulting from the earliest common ancestor.
- D) A single clade (i.e., a group of species that share a common ancestor) can exhibit both gradualism and punctuated equilibrium.
- E) V and W shared a common ancestor more recently than any of the other species.

Answer: D

Topic: Concept 24.4

Skill: Synthesis/Evaluation

37) Which of these five species is the extant (i.e., not extinct) species that is most closely related to species X, and why is this so?

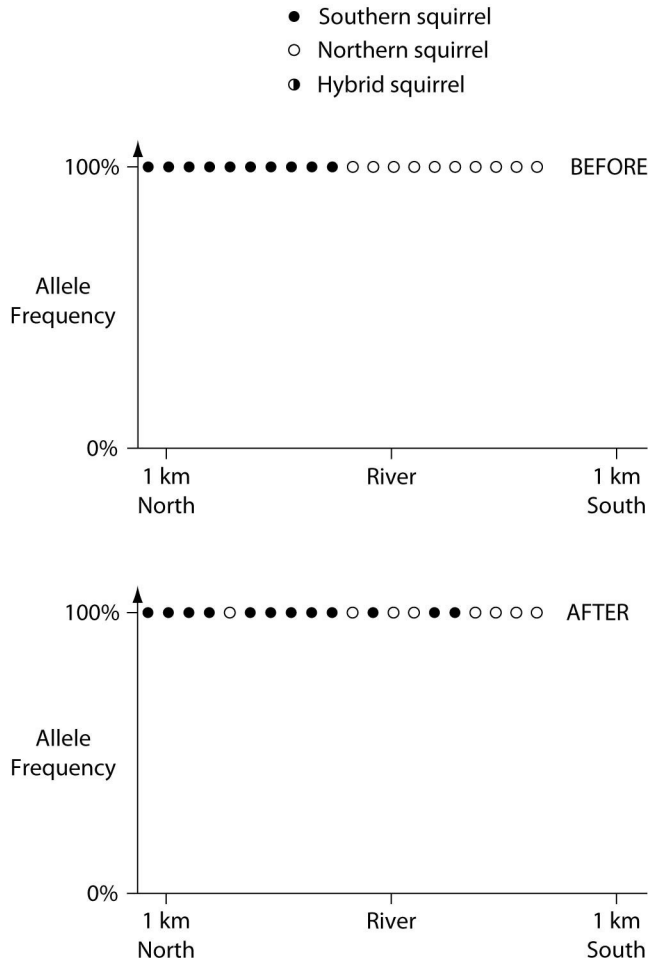
- A) V; shared a common ancestor with X most recently
- B) W; shared a common ancestor with X most recently
- C) Y; arose in the same fashion (i.e., at the same tempo) as X
- D) Z; shared a common ancestor with X most recently, and arose in the same fashion as X
- E) This tree does not provide enough information to answer this question.

Answer: A

Topic: Concept 24.4

Skill: Application/Analysis

In a hypothetical situation, the National Park Service, which administers Grand Canyon National Park in Arizona, builds a footbridge over the Colorado River at the bottom of the canyon. The footbridge permits interspersal of two closely related antelope squirrels. Previously, one type of squirrel had been restricted to the terrain south of the river, and the other type had been restricted to terrain on the north side of the river. Immediately before and ten years after the bridge's completion, researchers collected ten antelope squirrels from both sides of the river, took blood samples, and collected frequencies of alleles unique to the two types of antelope squirrels (see the following graphs).



38) The data in the previous graphs indicate that

- A) a hybrid zone was established after the completion of the bridge.
- B) no interspersal of the two types of squirrel occurred after the completion of the bridge.
- C) gene flow occurred from one type of squirrel into the gene pool of the other type of squirrel.
- D) two-way migration of squirrels occurred across the bridge, but without hybridization.
- E) some northern squirrels migrated south, but no southern squirrels migrated north across the bridge.

Answer: D

Topic: Concept 24.3

Skill: Application/Analysis

Scenario Questions

The next few questions refer to the following description.

On the volcanic, equatorial West African island of Sao Tomé, two species of fruit fly exist. *Drosophila yakuba* inhabits the island's lowlands, and is also found on the African mainland, located about 200 miles away. At higher elevations, and only on Sao Tomé, is found the very closely related *Drosophila santomea*. The two species can hybridize, though male hybrids are sterile. A hybrid zone exists at middle elevations, though hybrids there are greatly outnumbered by *D. santomea*. Studies of the two species' nuclear genomes reveal that *D. yakuba* on the island is more closely related to mainland *D. yakuba* than to *D. santomea* ($2n = 4$ in both species). Sao Tomé rose from the Atlantic Ocean about 14 million years ago.

39) Which of the following reduces gene flow between the gene pools of the two species on Sao Tomé, despite the existence of hybrids?

- A) hybrid breakdown
- B) hybrid inviability
- C) hybrid sterility
- D) temporal isolation
- E) a geographic barrier

Answer: C

Topic: Concept 24.1

Skill: Application/Analysis

40) The observation that island *D. yakuba* are more closely related to mainland *D. yakuba* than island *D. yakuba* are to *D. santomea* is best explained by proposing that *D. santomea*

- A) descended from a now-extinct, non-African fruit fly.
- B) arrived on the island before *D. yakuba*.
- C) descended from a single colony of *D. yakuba*, which had been introduced from elsewhere, with no subsequent colonization events.
- D) descended from an original colony of *D. yakuba*, of which there are no surviving members. The current island *D. yakuba* represent a second colonization event from elsewhere.

Answer: D

Topic: Concept 24.3

Skill: Synthesis/Evaluation

41) If a speciation event occurred on Sao Tomé, producing *D. santomea* from a parent colony of *D. yakuba*, then which terms apply?

- I. macroevolution
 - II. allopatric speciation
 - III. sympatric speciation
- A) I only
 - B) II only
 - C) I and II
 - D) I and III

Answer: D

Topic: Concepts 24.1, 24.2

Skill: Application/Analysis

42) Using only the information provided in the paragraph, which of the following is the best initial hypothesis for how *D. santomea* descended from *D. yakuba*?

- A) geographic isolation
- B) autopolyploidy
- C) habitat differentiation
- D) sexual selection
- E) allopolyploidy

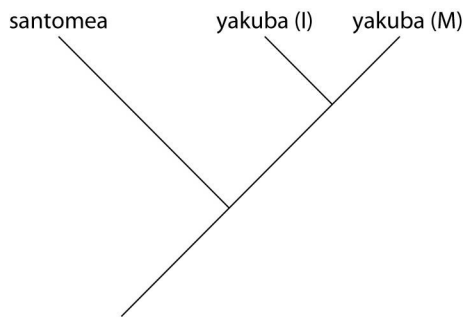
Answer: C

Topic: Concept 24.2

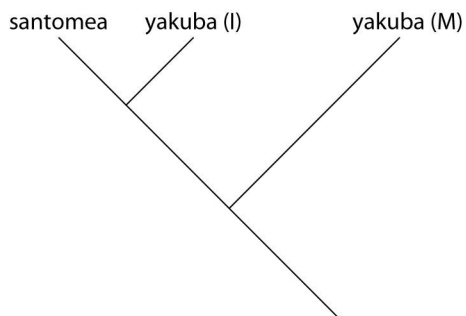
Skill: Synthesis/Evaluation

43) Which of these evolutionary trees represents the situation described in the previous paragraph (*Note: Yakuba (I)* represents the island population, and *yakuba (M)* represents the mainland population)?

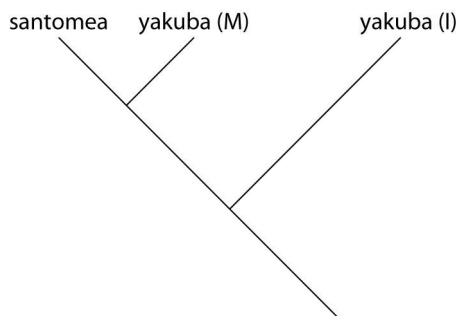
A)



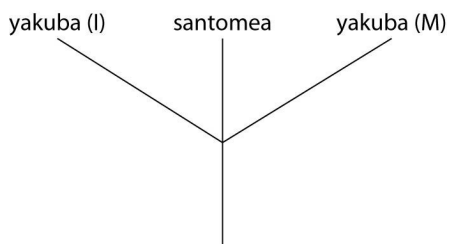
B)



C)



D)



Answer: A

Topic: Concepts 22.3, 24.1

Skill: Application/Analysis

44) If the low number of hybrid flies in the hybrid zone, relative to the number of *D. santomea* flies there, is due to the fact that hybrids are poorly adapted to conditions in the hybrid zone, and if fewer hybrid flies are produced with the passage of time, these conditions will most likely lead to

A) fusion.

B) reinforcement.

C) stability.

D) further speciation events.

Answer: B

Topic: Concept 24.3

Skill: Synthesis/Evaluation

The next few questions refer to the following description.

On the Bahamian island of Andros, mosquitofish populations live in various, now-isolated, freshwater ponds that were once united. Currently, some predator-rich ponds have mosquitofish that can swim in short, fast bursts; other predator-poor ponds have mosquitofish that can swim continuously for a long time. When placed together in the same body of water, the two kinds of female mosquitofish exhibit exclusive breeding preferences.

45) Which *two* of the following have operated to increase divergence between mosquitofish populations on Andros?

1. improved gene flow

2. bottleneck effect

3. sexual selection

4. founder effect

5. natural selection

A) 1 and 3

B) 2 and 3

C) 2 and 4

D) 3 and 4

E) 3 and 5

Answer: E

Topic: Concepts 23.3, 24.2

Skill: Application/Analysis

46) Which type of reproductive isolation operates to keep the mosquitofish isolated, even when fish from different ponds are reunited in the same body of water?

A) behavioral isolation

B) habitat isolation

C) temporal isolation

D) mechanical isolation

E) gametic isolation

Answer: A

Topic: Concept 24.2

Skill: Application/Analysis

- 47) What is the best way to promote fusion between two related populations of mosquitofish, one of which lives in a predator-rich pond, and the other of which lives in a predator-poor pond?
- A) Build a canal linking the two ponds that permits free movement of mosquitofish, but not of predators.
 - B) Transfer only female mosquitofish from a predator-rich pond to a predator-poor pond.
 - C) Perform a reciprocal transfer of females between predator-rich and predator-poor ponds.
 - D) Remove predators from a predator-rich pond and transfer them to a predator-poor pond.

Answer: A

Topic: Concept 24.3

Skill: Synthesis/Evaluation

- 48) If one builds a canal linking a predator-rich pond to a predator-poor pond, then what type(s) of selection should subsequently be most expected among the mosquitofish in the original predator-rich pond, and what type(s) should be most expected among the mosquitofish in the formerly predator-poor pond?

- A) stabilizing selection; directional selection
- B) stabilizing selection; stabilizing selection
- C) less-intense directional selection; more-intense directional selection
- D) less-intense disruptive selection; more-intense disruptive selection

Answer: C

Topic: Concepts 23.4, 24.3

Skill: Synthesis/Evaluation

- 49) The predatory fish rely on visual cues and speed to capture mosquitofish. Mosquitofish rely on speed and visual cues to avoid the predatory fish. Which adaptation(s) might help the predators survive in ponds that are home to faster mosquitofish?

- 1. directional selection for increased speed
- 2. stabilizing selection for speed that matches that of the mosquitofish
- 3. change in hunting behavior that replaces reliance on visual cues with reliance on tactile cues, which can be used to hunt at night
- 4. change in hunting behavior that eliminates speed in favor of better camouflage, which permits an ambush strategy

- A) 1 only
- B) 2 only
- C) either 1 or 3
- D) either 2 or 3
- E) 1, 3, or 4

Answer: E

Topic: Concept 24.3

Skill: Synthesis/Evaluation

The next few questions refer to the following description.

In the ocean, on either side of the Isthmus of Panama, are 30 species of snapping shrimp; some are shallow-water species, others are adapted to deep water. There are 15 species on the Pacific side and 15 different species on the Atlantic side. The Isthmus of Panama started rising about 10 million years ago. The oceans were completely separated by the isthmus about 3 million years ago.

50) Why should deepwater shrimp on different sides of the isthmus have diverged from each other earlier than shallow-water shrimp?

- A) They have been geographically isolated from each other for a longer time.
- B) Cold temperatures, associated with deep water, have accelerated the mutation rate, resulting in faster divergence in deepwater shrimp.
- C) The rise of the land bridge was accompanied by much volcanic activity. Volcanic ash contains heavy metals, which are known mutagens. Ash fall caused high levels of heavy metals in the ocean sediments underlying the deep water, resulting in accelerated mutation rates and faster divergence in deepwater shrimp.
- D) Fresh water entering the ocean from the canal is both less dense and cloudier than seawater. The cloudy fresh water interferes with the ability of shallow-water shrimp to locate mating partners, which reduces the frequency of mating, thereby slowing the introduction of genetic variation.

Answer: A

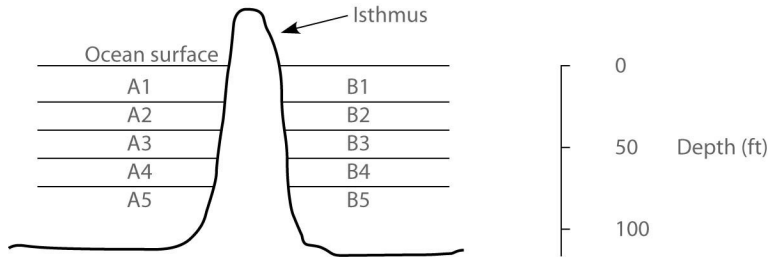
Topic: Concept 24.2

Skill: Knowledge/Comprehension

The next few questions refer to the following description.

In the ocean, on either side of the Isthmus of Panama, are 30 species of snapping shrimp; some are shallow-water species, others are adapted to deep water. There are 15 species on the Pacific side and 15 different species on the Atlantic side. The Isthmus of Panama started rising about 10 million years ago.

In the following figure, the isthmus separates the Pacific Ocean on the left (side A) from the Atlantic Ocean on the right (side B). The seawater on either side of the isthmus is separated into five depth habitats (1—5), with 1 being the shallowest.



51) In which habitat should one find snapping shrimp most closely related to shrimp that live in habitat A4?

- A) A3
- B) A5
- C) B4
- D) either A3 or A5
- E) any species from any one of the side A habitats

Answer: C

Topic: Concept 24.2

Skill: Application/Analysis

52) Which of these habitats is likely to harbor the youngest species?

- A) A5
- B) B4
- C) A3
- D) B2
- E) A1

Answer: E

Topic: Concept 24.2

Skill: Application/Analysis

53) Which habitats should harbor snapping shrimp species with the greatest degree of genetic divergence from each other?

- A) A1 and A5
- B) A1 and B5
- C) B5 and B1
- D) A5 and B5
- E) Both A1/A5 and B1/B5 should have the greatest, but equal amounts of, genetic divergence.

Answer: D

Topic: Concept 24.2

Skill: Application/Analysis

54) Which factor is most important for explaining why there are equal numbers of snapping shrimp species on either side of the isthmus?

- A) the relative shortness of time they have been separated
- B) the depth of the ocean
- C) the number of actual depth habitats between the surface and the sea floor
- D) the elevation of the isthmus above sea level
- E) the depth of the canal

Answer: A

Topic: Concept 24.2

Skill: Application/Analysis

55) The Panama Canal was completed in 1914, and its depth is about 50 feet. After 1914, snapping shrimp species from which habitats should be most likely to form hybrids as the result of the canal?

- A) A5 and B5
- B) A3 and B3
- C) A1 and B1
- D) either A1 and A2, or B1 and B2
- E) A1—A3 and B1—B3 have equal likelihoods of harboring snapping shrimp species that can hybridize.

Answer: C

Topic: Concept 24.2

Skill: Application/Analysis

56) There are currently two, large, permanent bridges that span the Panama Canal. The bridges are about 8 miles apart. If snapping shrimp avoid swimming at night and avoid swimming under shadows, then what do these bridges represent for the snapping shrimp?

- A) sources of refuge
- B) geographic barriers
- C) sources of a hybrid zone between the two bridges
- D) sources for increased gene flow

Answer: B

Topic: Concept 24.2

Skill: Knowledge/Comprehension

End-of-Chapter Questions

The following questions are from the end-of-chapter “Test Your Understanding” section in Chapter 24 of the textbook.

57) The *largest* unit within which gene flow can readily occur is a

- A) population.
- B) species.
- C) genus.
- D) hybrid.
- E) phylum.

Answer: B

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

58) Males of different species of the fruit fly *Drosophila* that live in the same parts of the Hawaiian Islands have different elaborate courtship rituals. These rituals involve fighting other males and making stylized movements that attract females. What type of reproductive isolation does this represent?

- A) habitat isolation
- B) temporal isolation
- C) behavioral isolation
- D) gametic isolation
- E) postzygotic barriers

Answer: C

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

59) According to the punctuated equilibria model,

- A) natural selection is unimportant as a mechanism of evolution.
- B) given enough time, most existing species will branch gradually into new species.
- C) most new species accumulate their unique features relatively rapidly as they come into existence, then change little for the rest of their duration as a species.
- D) most evolution occurs in sympatric populations.
- E) speciation is usually due to a single mutation.

Answer: C

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

60) Bird guides once listed the myrtle warbler and Audubon's warbler as distinct species. Recently, these birds have been classified as eastern and western forms of a single species, the yellow-rumped warbler. Which of the following pieces of evidence, if true, would be cause for this reclassification?

- A) The two forms interbreed often in nature, and their offspring have good survival and reproduction.
- B) The two forms live in similar habitats.
- C) The two forms have many genes in common.
- D) The two forms have similar food requirements.
- E) The two forms are very similar in coloration.

Answer: A

Topic: End-of-Chapter Questions

Skill: Application/Analysis

61) Which of the following factors would *not* contribute to allopatric speciation?

- A) A population becomes geographically isolated from the parent population.
- B) The separated population is small, and genetic drift occurs.
- C) The isolated population is exposed to different selection pressures than the ancestral population.
- D) Different mutations begin to distinguish the gene pools of the separated populations.
- E) Gene flow between the two populations is extensive.

Answer: E

Topic: End-of-Chapter Questions

Skill: Application/Analysis

- 62) Plant species A has a diploid number of 12. Plant species B has a diploid number of 16. A new species, C, arises as an allopolyploid from A and B. The diploid number for species C would probably be
- A) 12.
 - B) 14.
 - C) 16.
 - D) 28.
 - E) 56.

Answer: D

Topic: End-of-Chapter Questions

Skill: Application/Analysis

- 63) Suppose that a group of male pied flycatchers migrated from a region where there were no collared flycatchers to a region where both species were present. Assuming events like this are very rare, which of the following scenarios is *least* likely?

- A) The frequency of hybrid offspring would increase.
- B) Migrant pied males would produce fewer offspring than would resident pied males.
- C) Pied females would rarely mate with collared males.
- D) Migrant males would mate with collared females more often than with pied females.
- E) The frequency of hybrid offspring would decrease.

Answer: E

Topic: End-of-Chapter Questions

Skill: Synthesis/Evaluation