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***Biological Science*, 3e**
Chapter Quiz – 26

1. Which of the following is considered by some to be a *disadvantage* of the phylogenetic species concept?
HINT: Consider the differences between each of the species concepts.
a. The phylogenetic species concept characterizes species based on ancestry, and only monophyletic groups are recognized.
Incorrect. This is an advantage of the phylogenetic species concept.
b. The phylogenetic species concept utilizes many characteristics to establish relatedness between different species.
Incorrect. This is an advantage of the phylogenetic species concept. Phylogenetic trees can be constructed using morphological, behavioral, and genetic data.
c. The phylogenetic species concept can be used for any organism, including those that reproduce asexually.
Incorrect. This is an advantage of the phylogenetic species concept.
d. The phylogenetic species concept has yielded very few estimated phylogenetic trees, and for a small number of groups.
Correct. Although the number of phylogenies for different groups of organisms is currently increasing, there are not a large number of phylogenies for many groups on the tree of life.

2. Which of the following would *not* be a good example of prezygotic reproductive isolation?
HINT: Think about what would *not* prevent interspecific matings.
a. Two bird species live in the same area and, while similar in plumage, engage in dramatically different courtship dances.
Incorrect. Courtship dances often contain information about species identity.
b. Two beetle species are superficially similar in appearance, but the structure of the male penis and the female genitalia prevents males from one species from copulating with females of the other.
Incorrect. This is an example of mechanical isolation.
c. Two plant species have wind-dispersed pollen that lands on the styles and grows a pollen tube through the ovary of either species; however, in hybrid matings, the sperm cannot fertilize the ovum.
Incorrect. The gametes never unite, suggesting some kind of gametic incompatibility.
d. Two frog species meet and can mate with each other, but the hybrid offspring are infertile.
Correct. These frogs apparently are not completely prezygotically isolated; they mated, but the resulting zygotes are not viable.

3. Which of the following situations is a result of reproductive isolation caused by differences in timing?

HINT: What sort of timing event would maintain reproductive isolation between a pair of species?

a. Males and females within a species are active at different times of day.

Incorrect. Difference in activity patterns between the sexes within a species may have nothing to do with isolation from other species.

b. Males and females of one species form lifetime pair bonds, whereas males and females of a closely related species are polygamous.

Incorrect. Frequency of mating with different mates has nothing obvious to do with isolation from other species.

c. Males and females of one species breed in early springtime, whereas males and females of a closely related species breed in early summer.

Correct. The seasonal difference in breeding season would mean that members of one species would never have the opportunity to mate with the other species.

d. Males and females of one species breed in oak trees, while males and females of a closely related species breed in maples.

Incorrect. This is an example of spatial isolation, not temporal isolation.

4. A monophyletic group would be best described as a grouping of _____.

HINT: What species would you include in a monophyletic grouping?

a. all species descended from a common ancestor, including that ancestor

Correct. A monophyletic group includes a node and all the branches coming off that node.

b. all species descended from a common ancestor, excluding that ancestor

Incorrect. The ancestor should be included in a monophyletic grouping.

c. all species that share a similar set of traits

Incorrect. Organisms can share similar traits through convergent evolution or through descent.

d. some of the most closely related species, but not all species that are descended from a common ancestor

Incorrect. The ancestor and all species descended from a common ancestor should be included in a monophyletic grouping.

5. Paleontologists studying fossilized therapsids (a group of mammal-like reptiles that are now extinct) would probably use which of the following species concepts?
HINT: What characteristics can be used to identify a species in the fossil record?
a. biological species concept
Incorrect. How would you assess reproductive isolation in an extinct lineage?
b. morphospecies concept
Correct. Paleontologists normally have little choice but to use morphospecies concepts because they cannot test reproductive isolation or the genetic relatedness of most fossils.
c. phylogenetic species concept
Incorrect. Generally, you cannot extract DNA from a fossil, so genetic relationships cannot be assessed.
d. none of the above; fossil species cannot be classified
Incorrect. These animals are classified; think of a book about dinosaurs you may have looked at or a natural history museum you've visited.

6. A subspecies is _____.
HINT: How are subspecies classifications different from biological species classification?
a. a species that is descended from another species
Incorrect. All extant species are descended from other species.
b. each population of a biological species
Incorrect. If this were true, the words *subspecies* and *population* would mean the same thing.
c. a population that is somewhat distinctive in behavior or appearance from other similar populations, but not different enough to be considered a separate species
Correct. The problem with the designation subspecies is that it is arbitrary; many populations within a species may differ morphologically or behaviorally, but these differences do not isolate the populations.
d. a population that is in the process of diverging from another population of the same species but is not quite reproductively isolated
Incorrect. Although this may be true of a particular subspecies, it is not a general characteristic.

7. Which event would *not* result in allopatric speciation?
HINT: What is allopatric speciation?
a. an earthquake that isolates a population of rodents on a mountain
Incorrect. Allopatric speciation can occur as a result of vicariance events.
b. development of different antler sizes between male and female reindeer
Correct. Allopatric speciation occurs when populations are separated geographically, or by a barrier that inhibits gene flow.
c. migration of birds to an island
Incorrect. Allopatric speciation can occur as a result of dispersal.
d. a flood that separates a population of frogs onto opposite sides of a large lake
Incorrect. Allopatric speciation can occur as a result of vicariance events.

8. Peter and Rosemary Grant observed a small group of the large ground finch that colonized Daphne Major in the Galápagos Islands. Within a few years, the descendants of the colonists had evolved beaks that were much larger than those in the original source population. What factors did the Grants think influenced this evolution?

HINT: What evolutionary processes are driving evolution on Daphne Major?

a. The original small size of the colonist pool probably resulted in divergence due to founder effects and genetic drift.

Incorrect. A small founding population can certainly change due to genetic drift, but is this the only thing affecting the finches?

b. Natural selection occurred due to the larger seeds found on Daphne Major compared to the ancestral island.

Incorrect. Beak size in Darwin's finches is often related to changes in seed size and hardness, but is this the only factor affecting the finches?

c. Reinforcement occurred due to postzygotic isolation on secondary contact.

Incorrect. This is not a situation involving secondary contact.

d. Both the first and second choices were probably important.

Correct. Although the studies of finches on other islands strongly suggest that natural selection is driving the divergence in beak size, one cannot rule out genetic drift because of the small founding population.

9. Which of the following represents a vicariant event that may lead to speciation?

HINT: What is the definition of vicariance?

a. In a population of beetles, one leaves and moves to a new population.

Incorrect. This scenario represents a dispersal event.

b. A small subset of individuals in a population of mainland birds leaves and starts a new population on a small neighboring island.

Incorrect. This scenario is a colonization event.

c. During a strong storm, a river changes course and flows through a population of ground beetles; the river is now a barrier.

Correct. This is a vicariant event. The ground beetle population is now permanently divided. Subpopulations on either side are now separated in allopatry.

d. Some individuals of flightless insects colonize a new food plant also present in the distribution of their original population, and no longer interact with individuals from the original population.

Incorrect. This would be an example of divergence in sympatry, not allopatry.

10. Vicariance is best described as a _____.
HINT: Think about the major types of geographic speciation.
a. pattern of speciation in which a population is subdivided by a geographic barrier
Correct. An example would be the raising of the Isthmus of Panama approximately 3 million years ago (mya), which separated isolated marine populations in the Pacific Ocean and Caribbean Sea.
b. kind of speciation in which a small propagule founds a population on a habitat island
Incorrect. This is a founder event, not vicariance.
c. pattern of speciation whereby new species evolve reproductive isolation in sympatry
Incorrect. Vicariance occurs in allopatry, not sympatry.
d. technique for constricting phylogenetic trees based on vicariant traits shared by all members of a taxon
Incorrect. Vicariance refers to a pattern of speciation, not a phylogenetic method.

11. Which of the following evolutionary forces could be important for population differentiation in allopatric speciation?
HINT: Think about mechanisms of evolution that could act independently in allopatric populations.
a. genetic drift
Incorrect. Genetic drift certainly can lead to differentiation, especially if the size of one population is small, but this may not be the best answer choice.
b. natural selection
Incorrect. If the two populations experienced different selection pressures, then the populations would diverge. Still, there might be a better answer.
c. nonrandom mating
Incorrect. If individuals chose mates based on phenotype or if inbreeding was relatively common, this could cause divergence between the populations. However, there may be a better answer.
d. all of the above
Correct. All of these evolutionary forces have the potential to cause divergence in allopatric populations.

12. Which of the following events would best be described as a case of speciation in sympatry?
HINT: Think about how sympatric populations can become reproductively isolated.
a. A population of lizards is subdivided by a natural barrier and subsequently diverges to form two species that cannot interbreed.
Incorrect. This is vicariance, not sympatric speciation.
b. A new, isolated population of fruit flies is founded by a small group of colonists, who then diverge from the ancestral source population.
Incorrect. This is allopatric speciation with a group of founding colonists, not sympatric speciation.
c. An individual hermaphroditic plant undergoes meiotic failure, producing diploid pollen and ovules; these self-fertilize, germinate, and grow into several fully fertile tetraploid plants.
Correct. The change in ploidy took place without spatial or temporal separation; the doubling of the genome immediately isolated the new tetraploid species from its parental species.
d. Speciation cannot take place in sympatry, only in allopatry where geography poses a barrier to gene flow.
Incorrect. It once was thought that sympatric speciation was less likely than allopatric speciation, but there are now many examples of speciation in sympatry.

13. Why have soapberry bugs feeding on nonnative hosts evolved shorter beaks than those feeding on their native host plant?
HINT: What is the agent of selection in this example?
a. The nonnative host species have smaller fruits; natural selection favors bugs with a shorter beak length on these hosts.
Correct. Bugs with shorter beaks are at a selective advantage on the introduced hosts, whereas bugs with longer beaks are at an advantage on the native hosts.
b. A small population of soapberry bugs with short beaks colonized the nonnative hosts; the differentiation is due to genetic drift.
Incorrect. Genetic drift may play a role in divergence here; however, other evolutionary forces, like natural selection, are probably more important.
c. This difference is due to a change in ploidy, resulting in a genetically differentiated population on nonnative hosts.
Incorrect. Speciation by polyploidy is common in plants, but almost never happens in insects.
d. Beak size is phenotypically plastic; the changes seen are not genetic and do not reflect genetic differentiation.
Incorrect. The data presented are not adequate to rule out this possibility. If one reared offspring of long- and short-beaked bugs on a common host and still observed a difference, it would suggest genetic differentiation. There is, however a better answer than this one!

14. Which of the following statements about autopolyploid individuals is correct?
HINT: What does it mean for an individual to be polyploid, and how does this result from autoploylpoidy versus allopolyploidy?

a. Autopolyploid individuals result from a mating between individuals of different species.
Incorrect. They result from a mating between individuals of the same species.

b. Autopolyploid individuals contain more than two sets of chromosomes.
Correct. All polyploid individuals contain more than two sets of chromosomes.

c. Autopolyploid individuals can be produced from nondisjunction events in mitosis.
Incorrect. They can be produced from nondisjunction events in *meiosis*.

d. Autopolyploid individuals are formed by combining gametes that have two distinct sets of chromosomes.
Incorrect. They are formed by combining gametes that have the same sets of chromosomes, because they are formed from individuals of the same species.

15. How can allopolyploid individuals result in new species?
HINT: How can polyploid individuals become reproductively isolated?

a. Polyploid individuals still produce viable offspring from matings with either parent species.
   Incorrect. This scenario would result in individuals that are not reproductively isolated, and speciation will not occur.

b. Polyploid individuals have lower fitness than either parent species, and are selected against by natural selection.
   Incorrect. If they have lowered fitness, then natural selection should remove them from the population.

c. Polyploid individuals can only reproduce with other polyploid individuals, but cannot interbreed with either parent species.
   Correct. This scenario represents reproductive isolation, and a speciation event. This also exemplifies how speciation can occur over a single generation.

d. Polyploid individuals are sterile and do not produce viable offspring.
   Incorrect. This is a postzygotic isolating mechanism and does not result in a speciation event.

16. Imagine two populations descended from a single bird species. After a period of isolation in allopatry, the populations resume inhabiting the same region. Assuming that the only differences between the populations are those listed, which of the following factors would most likely prevent interbreeding?

HINT: What factors would cause reproductive isolation between two species?

a. Population A rests in the upper branches of trees during foraging bouts; population B rests on the ground.

Incorrect. Just because the two species rest in different places does not mean they are reproductively isolated.

b. Population A forages by picking insects off leaves; population B forages by tearing open ant nests and eating the ants.

Incorrect. Eating different foods, even in different places, does not mean that the species are reproductively isolated.

c. Population A performs its mating calls in the upper branches of trees; population B performs them on the ground.

Correct. Mating calls lure in mates for breeding. Calling from the treetops will attract potential mates to the treetops. Calling from the ground will attract potential mates to the ground. Thus, mating will never take place between the "wrong" partners.

d. Population A nests in oak trees; population B nests in maple trees.

Incorrect. Where a population nests may have nothing to do with whom it mates with.

17. Reinforcement of speciation refers to _____.

HINT: What kind of selection is imposed on offspring from a pair of species by strong postzygotic isolation?

a. natural selection favoring mechanisms of prezygotic isolation imposed by reduced fitness in hybrid offspring

Correct. Organisms that can identify members of the other species and avoid mating with them will not lose fitness due to hybrid inviability. Those individuals will be at a selective advantage over those that lack the prezygotic isolating mechanism.

b. natural selection to increase postzygotic isolation imposed by differences in courtship rituals or pollination strategies

Incorrect. If individuals can avoid mating with the wrong species, the fitness of hybrid offspring does not matter.

c. genetic drift that causes two subsets of a population to become more differentiated

Incorrect. Reinforcement is a type of natural selection; genetic drift is not.

d. the evolution of compatibility between hybrids that leads to the fusion of two diverging populations

Incorrect. This is not reinforcement but a weakening of speciation.

18. When two populations come into contact after a long period of divergence in allopatry, which of the following is the *least likely* possibility?
HINT: Consider the processes that result in divergence between two populations.
a. The two populations meet and form a hybrid zone where both species interbreed and form viable offspring.
Incorrect. This is a possibility. If the time since isolation has been short, the degree of divergence may not have been enough to render the populations reproductively isolated.
b. The two populations meet and hybrid offspring from the two populations have reduced fitness.
Incorrect. This would be the result of reinforcement.
c. The two populations meet and mating does not produce any offspring.
Incorrect. This is a possibility. Reinforcement is complete, and there is reproductive isolation.
d. The two populations meet and there have been no genetic changes between the populations. Each population is identical to before the separation.
Correct. It is highly unlikely that no changes have occurred. There must have been some mutation, or effects of drift while the populations were separated.

19. Why was mitochondrial DNA so useful in the study of the hybrid zone between Townsend's warbler and hermit warblers?
HINT: What could researchers say about the hybrids solely on the basis of the mtDNA marker?
a. mtDNA is maternally inherited, so the researchers were able to discover that most hybrids resulted from Townsend's males mating with hermit females.
Correct. Hybrid warblers always contained hermit mitochondria, suggesting that hermit females would mate with Townsend's males. If Townsend's females mated with hermit males, then some hybrids would contain Townsend's mitochondria.
b. mtDNA is easy to extract, so the researchers could obtain lots of genetic information about the hybrids.
Incorrect. This is true; however, the ease of extracting mtDNA does not give any information about the actual hybrid zone between these two species.
c. mtDNA shows that reinforcement has been occurring within this hybrid zone.
Incorrect. Reinforcement results in a change in prezygotic isolation for species in sympatry; changes in behavior or morphology that allow prezygotic isolation are unlikely to involve mitochondrial genes.
d. mtDNA is inherited from both parents, like most of the nuclear genetic material. Any gene could have been used in this study.
Incorrect. mtDNA is maternally inherited.

20. Which of the following findings would *not* support the hypothesis that the sunflower *Helianthus anomalus* originated as a hybrid between *H. annuus* and *H. petiolaris*?

HINT: What characteristics would hybrids share?

a. *H. anomalus* phenotypically resembles hybrids between *H. annuus* and *H. petiolaris*.

Incorrect. Hybrids usually exhibit a mixture of the parental species traits.

b. Most of the gene sequences in *H. anomalus* are different from either *H. annuus* or *H. petiolaris*.

Correct. Hybrids would be expected to have gene sequences in common with one or the other of the parental species.

c. Experimental crosses between *H. annuus* and *H. petiolaris* produced hybrids with similar species-specific patterns of DNA sequences as found in *H. anomalus*.

Incorrect. This finding suggests that there is selection within the hybrid genome; specific combinations of genes yield higher fitness than a random mixture of genes from the parent species.

d. *H. annuus* and *H. petiolaris* hybridize in the geographic region where *H. annuus* is found.

Incorrect. One would expect hybrids to occur in a region where both parent species are present.