

## Natural Selection Misconceptions Diagnostic

1) A volcano erupted on an island. The ash released from the volcano changed the acidity (pH) of the soil from the level it had been for hundreds of years. This significant change resulted in new environmental pressures on species in the soil. Which of the following is a likely outcome of these pressures?

- a) Some species will disappear from the soil because they do not have individuals with traits that allow them to survive in more acidic soil.
- b) Only some species will generate the needed mutations to adapt to the change in pH; other species will become extinct.
- c) Most species gain additional genetically-based traits, and this increase in complexity allows them to live in the more acidic soil.
- d) Individuals in each species will evolve the traits necessary to survive under these new conditions.

2) A ship that had been used for many years in arctic exploration was sold and moved to a harbor in the warm waters of the Caribbean. Worms that had lived on the ship bottom crawled off in the warm waters and attempted to attach to other ships in this tropical area where there were no similar worms. Some of the worms were able to survive and reproduce. What would you expect to happen to this group of worms over many generations in this new environment?

- a) The worms will mate and produce offspring just as they did in their previous environment, and the group's traits will likely remain unchanged after many generations.
- b) The worms will gain new, more complex traits through natural selection that will help them better adapt to the warmer waters because natural selection leads to more complex and better adapted organisms.
- c) Worms possessing genetic variations that help them to survive and thrive in the new environment will leave more offspring than others lacking those traits. Over time, the proportion of the worm population with these adaptive traits will likely increase.
- d) The mutation rate will increase in this group of worms in order to promote evolution.

3) A scientist is studying a species of gopher found in North America. Some of the areas where these gophers live and burrow have hard packed soil. Other areas contain soil that is more lightly packed and loose, and still other areas contain both types of soil. The animals that live in the area with hard packed soil have thick short claws. Those in the areas with more loosely packed soil have long thin claws. There is wide variation in claw shape among animals living in areas where both types of soil exist. Which statement best explains this distribution of gopher types?

- a) Both the areas with hard packed soil and the areas with looser soil were colonized by animals from the mixed soil area. The hard packed soil area happened to be colonized by animals that by chance had thicker claws, and those with thinner longer claws happened to colonize the areas with less densely packed soil.
- b) Each type of environment was probably colonized by gophers with variation in claw type, but over time each individual changed its traits to ones needed to live best in each area so all the gophers in the hard packed soil had only the traits needed to live there and, similarly, because the gophers in the loosely packed soil needed particular traits, they changed their traits to suit that environment.
- c) Animals with thick short claws are better able to burrow in dense soil, so in hard packed soil areas those animals with thicker claws were better able to survive and reproduce. In areas with loose soil, animals that thin long claws better for moving larger amounts of soil were the ones most likely to survive and produce offspring.
- d) The animals in the hard packed soil areas needed to have claws adapted to hard soil, so a mutation arose to provide that trait. The animals in the less dense soil areas also needed to adapt, so they had a mutation that made their claws suitable for soil in their area.

4) *Bacillus thuringiensis* (Bt) bacteria produce a natural insecticide. Widespread use of Bt has led to Bt resistance among insects. Why is this occurring?

- a) Individual insects that have mutations providing resistance to Bt can survive in the presence of Bt. The survivors pass this Bt resistance on to their offspring.
- b) Bt-resistant insects increase in the population by chance. There are so many insects that some of them are resistant to each type of insecticide.
- c) In the presence of Bt, individual insects evolve to become Bt resistant.
- d) Natural selection causes insects to generate genes providing resistance to Bt.

5) A chef sprays antimicrobial cleaner on her counter top. At the first, the bacteria population declines significantly. However, even though she continues to spray in following weeks, the number of bacteria begins to increase again. Why did this happen?

- a) Some bacteria had traits that allowed them to survive the initial antimicrobial application. They produced offspring also carrying those traits.
- b) After the application of antimicrobial spray, the bacteria needed to adapt by developing antimicrobial spray-resistant traits.
- c) The antimicrobial compound caused a mutation for resistance to it. This trait increased in the population over time.
- d) The bacteria that tried hardest to become resistant left more offspring, who were also resistant.

6) A population of a particular shoreline plant has existed for a long period of time under conditions of stable temperature and sea level. Years ago, these plants were tall with very long roots and thin leaves, traits adapted for windy conditions well above the high tide line. Due to global climate change, a significant rise in sea level occurs and persists over multiple plant generations. A group of scientists measures this same population of plants, and finds that they are now on average shorter with much thicker leaves and even longer roots, traits adapted for being submerged at each high tide. Explain the change in the population.

- a) The traits in the plant population randomly changed, and would have done so regardless of an increase in rainfall.
- b) Due to the increased sea level, mutations occurred that led to some of the plants being shorter with thicker leaves, allowing them to withstand submergence at high tide.
- c) Each plant evolved to become shorter with thicker leaves in order to thrive in this wetter environment. They then passed these traits on to their offspring.
- d) Shorter plants with thicker leaves that already existed in the population were better able to thrive and generate offspring under the new conditions.

7) A given plant population is pollinated exclusively by a particular bee. A wet spring leads to a disease that wipes out all of the bees in the plant's habitat. What is the likely outcome for this plant population?

- a) A mutation will arise which will allow the plants to be pollinated by other insects.
- b) Because they need to change their pollinators, some plant individuals will adapt to be pollinated by other insects.
- c) This plant population will die off.
- d) Enough variation exists within the plant population to allow it to adapt to any environmental challenge.

8) Male deer (bucks) in a given population are reaching sexual maturity with smaller antlers than they did in the past because antler growth rate has decreased. Some biologists suggest that this change is related to hunting because bucks with larger antlers are most prized and therefore taken by hunters more often than bucks with smaller antlers. Which statement best explains the decreased antler size of the buck population?

- a) The bucks know that if they grow big antlers, they will be hunted before they can reproduce, so they grow their antlers slowly and reproduce as quickly as they can.
- b) Because bucks with large antlers are taken most often, more mutations occur to help the deer population reproduce before growing large antlers.
- c) Bucks that reproduce with smaller antlers are likely to have more chances to reproduce because they are not as likely to be taken by hunters. They then pass on their slower antler growth rate to their offspring.
- d) All bucks in the population reduce their antler growth rate so that the entire population has smaller antlers.

9) Individuals in a large insect population display wide variation in the shape of their nectar-gathering mouthparts. A new food source, with flowers of different shapes, replaces the previous one, and insects with shorter, thicker mouthparts are much more efficient at gathering nectar from the new type of flower. Over multiple generations, what will likely happen to the variation of mouth parts within the population of insects?

- a) The variation in mouth parts will remain exactly the same, because variation occurs randomly.
- b) Shorter, thicker mouth parts will become more prevalent in the insect population, although some variation will continue to exist.
- c) The change in food source will lead to the occurrence of more mutations that result in shorter, thicker mouth parts.
- d) Because natural selection favors shorter, thicker mouth parts, all individuals will have short, thick mouth parts after multiple generations.

10) In an experiment with a particular bacterial species, you plate 100 samples in separate petri dishes. Half of these, group A, have all necessary nutrients, while group B have low levels of one important nutrient. All petri dishes are placed in an incubator and are treated identically. After several weeks, you measure colony growth and find that the colonies in group B are, on average, 4 mm smaller in diameter than those in group A. What is the most reasonable explanation?

- a) You didn't keep Group B warm enough compared to Group A.
- b) Among the bacteria in Group B, the ability has evolved to grow more slowly when the important nutrient is present in lower amounts.
- c) The growth rate of bacteria in Group B is lower due to limitation of the one important nutrient.
- d) Natural selection is operating by selecting for slower-growing bacteria in Group B.

11) Researchers recently discovered that the diets of young coyotes can affect their biting ability as adults. Coyote pups from the same litter were split into two groups: one that gnawed on animal bones (bone-gnawers), and one that was fed exclusively a soft diet similar to canned dog food (non-gnawers). As adults, the bone-gnawers had significantly shorter and wider mouth bones and bigger chewing muscles. They were also able to eat rawhide treats 1.5 times faster than the non-gnawers. If bone-gnawers were only allowed to mate with bone-gnawers and non-gnawers with non-gnawers, what would you expect to find among the offspring?

- a) All of the offspring of the bone-gnawers will inherit their parents' bone-gnawing anatomical changes.
- b) The non-gnawers will develop anatomical features similar to the bone-gnawers.
- c) The parents' anatomical traits for bone-gnawing and non-gnawing will not be passed on to the offspring.
- d) The non-gnawers will inherit other features that allow them to gnaw bones more efficiently.

12) Why do some adaptive traits, such as thicker fur or flowers of different colors, evolve over time within a population of organisms?

- a) Organisms with these traits survived longer and had more offspring than other organisms in the population, so their traits were passed on to more offspring.
- b) Such traits are necessary to ensure survival of the species.
- c) These traits evolved randomly, and just happened to persist over time.
- d) These traits evolve in response to environmental challenges, ensuring that the population will survive any changes in its habitat.

### Evolution Misconceptions Diagnostic: Correct Answers

- 1) a) correct  
 b) misconception: Evolution/natural selection gives organisms/species what they need.  
 Evolution/natural selection involves a will, effort, or intent on the part of the organism/species.  
 c) misconception: Evolution results in progress; organisms are always getting “better” or more complex through evolution.  
 d) misconception: Evolution/natural selection gives organisms/species what they need.  
 Individual organisms can evolve during a single lifespan.
  
- 2) a) no specific misconception  
 b) misconception: Evolution results in progress; organisms are always getting “better” or more complex through evolution.  
 c) correct  
 d) misconception: Evolution occurs for the good of the species.
  
- 3) a) no specific misconception  
 b) misconception: Evolution/natural selection gives organisms/species what they need.  
 Evolution/natural selection involves a will, effort, or intent on the part of the organism/species.  
 Individual organisms can evolve during a single lifespan.  
 c) correct  
 d) misconception: Evolution/natural selection gives organisms/species what they need.  
 Environmental challenges cause advantageous mutations.
  
- 4) a) correct  
 b) misconception: Evolutionary theory implies that life evolved (and continues to evolve) randomly, or by chance.  
 c) misconception: Individual organisms can evolve during a single lifespan.  
 d) misconception: Environmental challenges cause advantageous mutations.
  
- 5) a) correct  
 b) misconception: Evolution/natural selection gives organisms/species what they need.  
 c) misconception: Environmental challenges cause advantageous mutations.  
 d) misconception: Evolution/natural selection involves a will, effort, or intent on the part of the organism/species.

- 6) a) misconception: Evolutionary theory implies that life evolved (and continues to evolve) randomly, or by chance.  
 b) misconception: Environmental challenges cause advantageous mutations.  
 c) misconception: Individual organisms can evolve during a single lifespan.  
 Evolution/natural selection involves a will, effort, or intent on the part of the organism/species.  
 Acquired characteristics can be inherited.  
 d) correct
- 7) a) misconception: Environmental challenges cause advantageous mutations.  
 b) misconception: Evolution/natural selection gives organisms/species what they need.  
 Individual organisms can evolve during a single lifespan.  
 c) correct  
 d) misconception: Species can evolve the traits necessary for survival and reproduction no matter what.
- 8) a) misconception: Evolution/natural selection involves a will, effort, or intent on the part of the organism/species.  
 b) misconception: Environmental challenges cause advantageous mutations.  
 c) correct  
 d) misconception: Evolution/natural selection involves a will, effort, or intent on the part of the organism/species.  
 Individual organisms can evolve during a single lifespan.
- 9) a) misconception: Evolutionary theory implies that life evolved (and continues to evolve) randomly, or by chance.  
 b) correct  
 c) misconception: Environmental challenges cause advantageous mutations.  
 d) misconception: Natural selection means that only the fittest individuals in the population will survive.
- 10) a) no specific misconception  
 b) misconception: All traits of organisms are adaptations.  
 c) correct  
 d) misconception: All traits of organisms are adaptations.
- 11) a) misconception: Acquired characteristics can be inherited.  
 b) misconception: Evolution results in progress; organisms are always getting “better” or more complex through evolution.  
 c) correct  
 d) misconception: Evolution results in progress; organisms are always getting “better” or more complex through evolution.

- 12) a) correct
- b) misconception: Evolution occurs for the good of the species.
  - c) misconception: Evolutionary theory implies that life evolved (and continues to evolve) randomly, or by chance.
  - d) misconception: Species can evolve the traits necessary for survival and reproduction no matter what.