

## Section 4.3: Review Answers

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1. For speciation to occur, two populations must be prevented from interbreeding. This means that the populations must become isolated from one another through geographical or biological barriers. If the populations remain isolated long enough, speciation will eventually occur because of changes accumulated in the population due to natural selection. When this happens, individuals in one population are no longer able to reproduce successfully with the other population. Geographical barriers, such as mountain ranges and rivers, prevent interbreeding and result in speciation because they keep populations physically separated.
2. Student drawings should show two pathways. One should illustrate that speciation is the result of accumulated changes over a long period. A new species develops, while the old species is gradually replaced (eg., Mammoth: the ancestral mammoth → steppe mammoth → woolly mammoth).  
The second pathway should show biological diversity increasing because one or more species arise from the same parent species. For example, the *Hyracotherium* that lived about 50 million years ago is thought to be the ancestor for horses, tapirs, and rhinoceroses.
3. A geographical barrier prevents populations from interbreeding. This is quite different from habitat isolation, in which two species can occupy the same geographic range but will occupy different habitats and niches within it.

4. The species that are found within an area such as Hawaii are a result of the available ecological niches, selective pressures, and adaptations that this unique environment has created, as well as the island's isolation.
5. Criteria include physiological and anatomical analysis differences, a molecular biology analysis to look at the amino acid sequence, and an examination of the gametes and genetics of the birds. If it was proven that these birds could still interbreed and produce viable offspring, then these birds are still of the same species, though with differences.
6. The following chart summarizes the models of gradualism and punctuated equilibrium

Gradualism	Punctuated Equilibrium
<ul style="list-style-type: none"> <li>■ changes occur gradually and in a linear fashion</li> </ul>	<ul style="list-style-type: none"> <li>■ there are periods of rapid change (i.e., rapid speciation after mass extinctions)</li> </ul>
<ul style="list-style-type: none"> <li>■ big changes (such as the evolution of a new species) occur as a result of many small changes</li> </ul>	<ul style="list-style-type: none"> <li>■ long periods of equilibrium "punctuated" or interrupted by periods of speciation</li> </ul>
<ul style="list-style-type: none"> <li>■ not supported by the fossil record but should be noted that not all species leave a fossil record</li> </ul>	<ul style="list-style-type: none"> <li>■ most species undergo most of their morphological changes when they first diverge from the parent species</li> <li>■ after undergoing morphological changes, the species changes relatively little even as they evolve into a new species</li> </ul>

7. The volcanic (Red) island will support a smaller number of species and will have fewer endemic species, since it is populated with organisms that were able to colonize by dispersal, and it is a very young island. In contrast, Blue Island will have more species and more endemic species, since it already had organisms on it when it separated from the mainland and there has been 80 million years for natural selection to occur.
8. The four species in Puerto Rico have each developed traits (adapted) to suit their particular niche—be it grass, tree bases, tree branches, or the canopy. The DNA indicates that these species are closely related, which means they have diversified from a common ancestral species that arrived on the island.