

Evolution Concept Questions

1. What is evolution? Why is evolution referred to as a theory? (It is a change over generations in the heritable characteristics of a population. It is called a theory because it is a well-supported explanation for the observed evidence of the diversity we see on the planet.)
2. What does the fossil record tell us about evolution? (Species have become more complex over time; not all species lived at the same time; some species are no longer present.)
3. Why are fossils of many species not found in the fossil record? (Conditions must be right for fossils to form. Some organisms are soft-bodied and don't fossilize well. Also, fossils of some organisms undoubtedly exist but we have simply not found them yet.)
4. What two ideas in geology were important for Darwin's thinking? (Earth is very old and the same processes that shaped Earth millions of years ago continue today. This allowed time for species to change.)
5. How did his visit to the Galapagos Islands influence Darwin's thinking? (The distribution of species throughout the islands and compared to the mainland convinced him that new species might be arising from existing species over time.)
6. a) What is artificial selection? How does it differ from natural selection? (Artificial selection (or selective breeding) is when humans select a desirable trait when crossing two individuals. The hope is that the offspring will also have the desirable traits.)
b) How did artificial selection influence Darwin's thinking? (Huge changes in a variety of species had been achieved by selective breeding over thousands of years so Darwin reasoned the same could happen naturally over much longer periods of time.)
7. How does the concept of descent with modification explain the variety of species observed today? (Species change over time by inheriting traits from their ancestors but those traits are modified over time as natural selection favors different things.)
8. How would you summarize the main ideas in Darwin's theory? (Variations occur in populations and some are favorable. Offspring that have favorable variations have a survival advantage and, over time, favorable traits accumulate.)
9. How does natural variation affect evolution? (It provides the raw material for natural selection which, in turn, leads to evolution.)
10. How is the process of natural selection related to a population's environment? (Individuals best suited to their environment survive and reproduce most successfully.)
11. How does the process of natural selection account for the diversity of organisms that have appeared over time? What is being selected in the process? What is selecting it? (Traits that are advantageous are selected by the environment. This leads to changes in organisms over time, resulting in the diversity we see today.)
12. Distinguish between fitness and adaptation. Give an example of each. (Fitness is the ability of an organism to survive and reproduce in its environment and increases through ongoing adaptation. For example, camouflage. An adaptation is any inherited characteristic that increases an organism's chance of survival. For example, porcupine quills or lion claws.)
13. How might natural selection have produced the modern giraffe from short-necked ancestors? (A slightly longer neck would be an advantage for reaching food and give a survival advantage. Longer necks would be passed on and later changes could produce slightly longer necks, *etc.*)
14. a) How is the general understanding of survival of the fittest misleading? (We usually think of fittest as meaning "strongest" but this is not the case. It simply means best adapted to the current environment.)
b) What do we mean when we describe an organism as "more fit" than some other organism? (We mean it is better suited to survive in its current environment.)
15. What role do mutations play in evolution? (Mutations create the original differences between individuals in a population.)

16. How does sexual reproduction benefit a species? (The offspring possesses parental genes mix in a new combination, creating variety.)
17. What term describes each of the following?
- a) Two species may live in the same area but in different habitats. Since there is little if any contact the possibility of successfully mating is drastically reduced. (habitat isolation)
 - b) Since the breeding times of similar organisms are different there is no chance of reproductive contact. (temporal isolation)
 - c) Birds, mammals, and insects have pre-mating rituals that attract the proper mate. (behavioral isolation)
 - d) A physical barrier separates a species into two separate areas and does not allow any further contact. (habitat isolation)
18. How did the breakup of Pangea and then of Gondwana contribute to the variety of species? (The breakup of these land masses caused geographic isolation. As populations became isolated they began to diverge.)
19. Predict what may eventually happen to two snail populations living on either side of a road. (This geographic isolation may lead to speciation.)
20. How can a population not separated geographically, diverge into two separate species? (Other isolating mechanisms exist to explain sympatric speciation. These include, temporal isolation, behavioral isolation, mechanical isolation, gametic isolation, or hybrid sterility.)
21. a) Explain the difference between homologous and analogous. Give examples of each. (Homologous structures are similar because of shared ancestry - they were present in the last common ancestor. Analogous structures are similar because of convergent evolution, not common ancestry.)
- b) How could two analogous structures arise? (Under similar selective pressure, two structures could arise that represent similar solutions to similar problems.)
22. What can we learn about evolution from looking at the embryos of vertebrates? (The embryos of all vertebrates are similar early in development. More closely related species retain more similarities later in development. This suggests the common ancestry of vertebrates.)
23. What is meant by the term vestigial structure? How do they provide evidence of evolution? (A vestigial structure is one with reduced or no function. They are evidence of evolution because they suggest these structures were present in an ancestral species. If this is not the case, why else would they be present?)
24. a) If you looked at the DNA of two closely related species, what would you expect to find? (The DNA of two species is more similar the more closely related they are.)
- b) What can be learned through protein comparisons of two different species? Give an example. (Proteins change over time by mutation. Proteins in distantly related species would have more time since the last common ancestor to become more different from one another.)
25. How can two species that look very different from each other be more closely related than two species that look similar to each other? (This is biogeography. Regardless of appearance, two species are closely related when they share a common ancestry. Distantly related organisms can share traits because they evolved in similar habitats, while closely related species in different habitats may look quite different from one another.)
26. Currently, health officials worldwide are becoming more and more concerned that bacteria are becoming resistant to antibiotics. How can this resistance be evolving? (The few bacteria that have some resistance to the antibiotic survive low doses. Successive generations of bacteria have increasing resistance to the antibiotic.)
27. Is protecting endangered species upsetting the process of natural selection? (Species are usually endangered because of human activity. Protecting them may restore the balance.)