**AP Biology, Evolution Unit Objectives**

1. Explain how the principle of gradualism and Charles Lyell's theory of uniformitarianism

influenced Darwin's ideas about evolution.

1. Describe Jean Baptiste Lamarck's model for how adaptations evolve. Explain the

challenges to Lamarck's ideas with respect to current understandings of biology.

1. Describe how Darwin used his observations from the voyage of the HMS Beagle to

formulate and support his theory of evolution.

1. Describe how Lyell and Alfred Russel Wallace influenced Darwin.
2. Explain what Darwin meant by "descent with modification."
3. Explain what evidence convinced Darwin that species change over time.
4. Describe the three inferences Darwin made from his observations that led him to propose
5. natural selection as a mechanism for evolutionary change.
6. Distinguish between artificial selection and natural selection.
7. Explain why the population is the smallest unit that can evolve.
8. Using some contemporary examples, explain how natural selection results in evolutionary change.
9. Describe the research that suggested to David Reznick and John Endler that the lifehistory traits among guppy populations are correlated with the main type of predator in a stream pool.
10. Explain how homologous structures support Darwin's theory of natural selection.
11. Explain how biogeography and the fossil record support the evolutionary deductions based on homologies.
12. What Is Theoretical about the Darwinian View of Life?
13. What Is a Species? Define biological species
14. Distinguish between anagenesis and cladogenesis.
15. Distinguish between prezygotic and postzygotic isolating mechanisms.
16. Describe five prezygotic isolating mechanisms and give an example of each.
17. Explain why many hybrids are sterile.
18. Explain how hybrid breakdown maintains separate species even if gene flow occurs.
19. Describe some limitations of the biological species concept.
20. Define and distinguish among each of the following: ecological species concept, pluralistic
21. species concept, morphological species concept, and genealogical species concept.
22. Distinguish between allopatric and sympatric speciation.
23. Explain the allopatric speciation model and describe the role of intraspecific variation and geographic isolation.
24. Define a ring species and describe an example found in salamanders.
25. Describe examples of adaptive radiation in the Gal·pagos and Hawaiian archipelagoes.
26. Explain how reproductive barriers evolve. Describe an example of the evolution of a
27. prezygotic barrier and the evolution of a postzygotic barrier.
28. Define sympatric speciation and explain how polyploidy can cause reproductive isolation.
29. Distinguish between an autopolyploid and an allopolyploid species and describe examples of each.
30. Describe an example of sympatric speciation in fish.
31. List some points of agreement and disagreement between the two schools of thought about the tempo of speciation (gradualism versus punctuated equilibrium).
32. Explain why speciation is at the boundary between microevolution and macroevolution.
33. Define exaptation and illustrate this concept with an example.
34. Explain how the evolution of changes in temporal and spatial developmental dynamics can result in evolutionary novelties.
35. Define evo-devo, allometric growth, heterochrony, and paedomorphosis.
36. Explain why extracting a single evolutionary progression from a fossil record can be misleading.
37. Define and illustrate the concept of species selection. Explain why evolutionary trends are not directional.
38. Distinguish between phylogeny and systematics.
39. Describe the process of sedimentation and the formation of fossils. Explain what portions of organisms mostly fossilize and why.
40. Distinguish between relative dating and absolute dating.
41. Explain how isotopes can be used in absolute dating.
42. Explain why the fossil record is incomplete.
43. Describe two dramatic chapters in the history of continental drift. Explain how those

movements affected biological evolution.

1. Explain how mass extinctions have occurred and how they affected the evolution of surviving forms.
2. Describe the evidence related to the impact hypothesis associated with the Cretaceous extinctions. Describe the hypothesized consequences of such an impact.Systematics: Connecting Classification to Phylogeny
3. Distinguish between systematics and taxonomy.
4. Explain how species are named and categorized into a hierarchy of groups.
5. List the major taxonomic categories from the most to least inclusive.
6. Define the parts and describe the interrelationships within a cladogram. Explain how a

cladogram is constructed.

1. Distinguish between homologous and analogous structures. Explain why the similarity of

complex systems implies a more recent common ancestor.

1. Distinguish between shared primitive characters and shared derived characters. Compare the definitions of an ingroup and outgroup.
2. Compare the cladistic and phylocode classification systems.
3. Explain how nucleotide sequences and amino acid sequences can be used to help classify organisms. Explain the advantages that molecular methods have over other forms of
4. classification.
5. Explain the principle of parsimony. Explain why any phylogenetic diagram is viewed as a

hypothesis.

1. Explain how molecular clocks are used to determine the approximate time of key

evolutionary events. Explain how molecular clocks are calibrated in actual time.

1. Explain how scientists determined the approximate time when HIV first infected humans.
2. Describe an example of a conflict between molecular data and other evidence, such as the fossil record. Explain how these differences can be addressed.
3. Describe the major events in Earth's history from its origin up to about 2 billion years ago. In particular, note when Earth first formed, when life first evolved, and what forms of life existed up until about 2 billion years ago.
4. Describe the timing and significance of the evolution of photosynthesis.
5. Describe the timing of key events in the evolution of the first eukaryotes and later multicellular eukaryotes.
6. Describe the snowball-Earth hypothesis.
7. Describe the timing of key evolutionary adaptations as life colonized land.
8. Contrast the concept of spontaneous generation and the principle of biogenesis. Describe the biogenesis paradox and suggest a solution.
9. Describe the four stages of the hypothesis for the origin of life on Earth.
10. Describe the evidence that suggests that RNA was the first genetic material. Explain the

significance of the discovery of ribozymes.

1. Describe how natural selection would have worked in an early RNA world.
2. Describe the key properties of protobionts in the evolution of the first cells.
3. Describe the evidence that suggests that life first evolved on the sea floor near deep-sea
4. vents.
5. Describe the basis for R. H. Whittaker's five-kingdom system.
6. List, distinguish among, and describe examples from each of the five kingdoms.
7. Compare the three-domain system and R. H. Whittaker's five-kingdom system of

classification