

PART I. Multiple choice questions – (4 points each, 36 points total). Single best answer.

1. Which of the following is considered a macro-mutation in DNA and can lead to the development of a cline in fruit flies across geographical areas?
 - A. Transition
 - B. Transversion
 - C. Synonymous
 - D. Non-synonymous
 - E. Inversion

2. Which of the following evolutionary forces is considered the “natural resource” of evolution?
 - A. Genetic Drift
 - B. Speciation
 - C. Mutation
 - D. Natural Selection
 - E. Migration

3. Natural Selection is the driving force behind evolution. Which of the following is **NOT** a correct concept related to natural selection?
 - A. change in the trait distribution of populations
 - B. mechanism for sorting individuals
 - C. forward looking process
 - D. operates on existing traits or phenotypes
 - E. has no ultimate goal

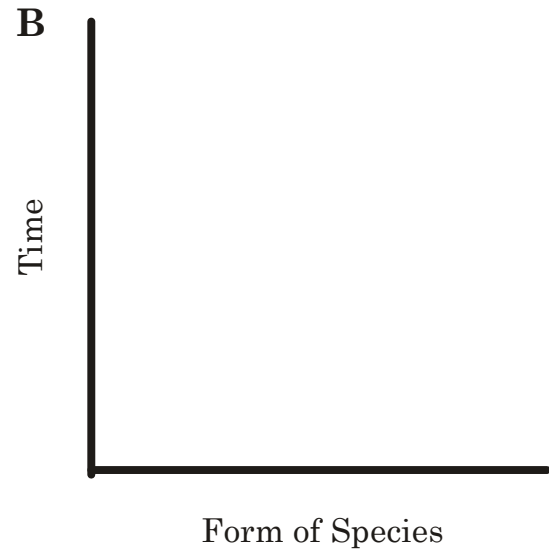
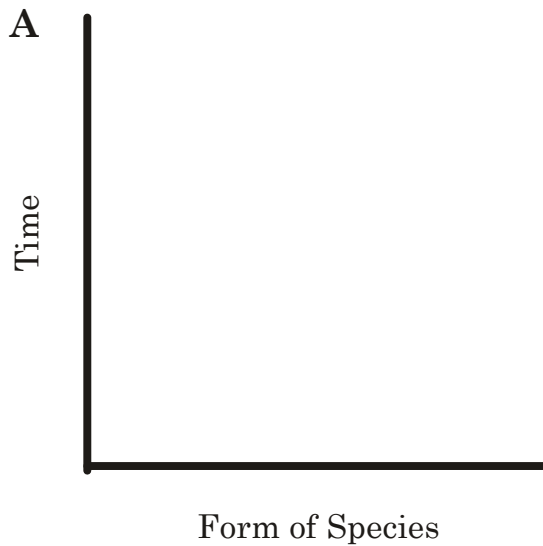
4. During his career, Charles Darwin had to go to sea to conduct field studies. During this oceanographic cruise on the vessel the HMS Beagle he visited which Islands that later played a critical role with his theory of evolution?
 - A. Canary Islands
 - B. Hawaiian Islands
 - C. Galapagos Islands
 - D. Aleutian Islands
 - E. Falkland Islands

5. Which of the following evolutionary forces occurs strictly by **chance**?
- A. genetic drift
 - B. speciation
 - C. mutation
 - D. natural selection
 - E. migration
6. When considering the neutral theory of molecular evolution, which of the following is/are correct assumptions of this model?
- A. positive selection is excluded
 - B. population size does not matter
 - C. pseudogenes are useful in measuring evolution rates
 - D. genetic drift is the dominant feature
 - E. all of the above
7. Paedomorphosis or the retention of juvenile features in the reproductive adult is considered a form of which of the following?
- A. Heterotopy
 - B. Heterometry
 - C. Heterotypy
 - D. Heterochrony
 - E. Heteromorphy
8. The fossil record is great, but it has certain biases associated with it. Which of the following is NOT one of these biases?
- A. Hard parts over soft parts (construction bias)
 - B. More rocks of recent age (temporal bias)
 - C. Simpler forms before complex forms (temporal bias)
 - D. Highland and Mountains over lowland and shallow marine (geographic bias)
 - E. Sedimentary over metamorphic rocks (construction bias)
9. The advent of wild fires after the Paleozoic atmospheric oxygen spike resulted in which time period?
- A. Precambrian B. Silurian C. Devonian D. Carboniferous E. Holocene

PART II. Short answer questions – (Number of points in parentheses, 74 points total).

- 10.** (10 points) Human eye/Molluscan eye, analogy or homology? Give a single specific reason to justify your choice.
- 11.** (15 points) Humans have approximately 3.8 billion nucleotides in their genome. **(A)** Name an organism that has a larger genome (yes, there are many). **(B)** Is this organism considered more complex than humans? **(C)** What paradoxical concept does this comparison validate?
- 12.** (14 points) Consider the Hardy-Weinburg Equilibrium Principle. **(A)** What is it that actually goes to **equilibrium** and why is this considered a "null" hypothesis? **(B)** Briefly, what are two of the assumptions that are required? **(C)** What cellular process accounts for the segregation of alleles allowing HW equilibrium to even be possible?

13. (10 points) Using line models, construct two figures describing (A) Darwin's theory of natural selection and (B) Lamarck's theory of transformation as it relates to the changes in the form of a species with time:



14. (15 points) What are three different examples that can be defined as encompassing the concept of homoplasy, and why is it necessary to minimize this in any phylogenetic analysis? Also, how does the concept of Ockham's Razor apply to minimizing homoplasy?
15. (10 points) What is the primary pattern predicted by the punctuated gradualism hypothesis in terms of the occurrence of various species in the fossil record? Why are foraminifera a good indicator of this hypothesis as opposed to bryozoans?

PART III. Short Essay – (Number of points in parentheses, 40 points total).

- 16.** (20 points) Discuss in some detail (preferably using an example from class) the idea that you cannot make something out of nothing or, more specifically, that there is no such thing as spontaneous generation of evolutionary characteristics and every adaptive trait must evolve from something else.

17. (20 points) Describe the role that **oxygen** has played regarding the evolution of multicellular organisms. **(A)** What is thought to have caused multicellularity to get “put off” for such a long time? **(B)** What were the sources and the sinks for oxygen over the history of the Earth? **(C)** Now that an excess of oxygen has occurred, what are the feedback mechanisms that control its level in terms of upper AND lower limits in the atmosphere?