

Read each question carefully and don't hesitate to ask if a question seems unclear. If possible, answer each question in the space provided, but if needed, continue on the back. If you use a drawing as part of your answer, be sure to also include a written explanation. These questions have specific answers, although for some, more than one answer is possible. To receive full credit you must clearly and fully answer the question being asked. The points for each question are noted in parentheses totaling 100 points.

1. You find some skeletons of human-looking individuals from an isolated island, would they be considered *H. sapiens*? Why or why not? (10 pts)

*If they were isolated from other humans, than they would be a separate species. They would not be sharing DNA with other humans.*

2. Even though evolution by natural selection, is considered **not** random, there is some randomness during natural selection. Give **one** example of a random aspect of natural selection. Describe why this aspect of natural selection is random, and how it affects evolution by natural selection. (10 pts)

*Any one of these answers: Mutations are random, and they introduce new alleles/genes/traits into a species. The changes that occur in the environment are random. Which traits get into gametes are random due to independent assortment and crossing-over.*

3. If you are using artificial selection to create more docile cows, what type of selection is this? Explain. (10 pts)

*Either directional or disruptive selection. Directional if all of the cows are becoming more docile. Disruptive if some are becoming more docile while others are staying the same.*

4. These are all sequences from five people's non-gene portion of their mitochondrial DNA. You know that GCGT is the original sequence. Draw the evolutionary relationship between these individuals (with the sequences of: GAGT; TCGT; TCGA; GAGG) and estimate how long ago they all shared a common ancestor. Describe how you derived your answer? (10 pts)

*GCGT*

*GAGT            TCGT =1 change*

*GAGG            TCGA =2 changes, 1 from before and a new one.*

*They all had the GCGT sequence around 20,000 years ago. Each single nucleotide change equals about 10,000 years since a common ancestor.*

5. Was the evolution of land plants more similar to gradualism or punctuated evolution? Why? (10 pts)

*Punctuated. Big changes, like vascular system, leaves, wind pollination, etc followed by long periods of small changes.*

6. Ferns can open and close their stomata, but mosses cannot. How can mosses survive without the ability to close their stomata? (10 pts)

*They live in wet environments, they need water to reproduce, so they do not need to conserve water.*

7. A species of birds get separated and isolated into several individual groups. The original group had tail feathers between 10-20 cm long. After several years you notice that some groups have tail lengths of around 10 cm, other groups have tail lengths of around 15 cm, while other groups have tail lengths of 20 cm. Is this trait evolving via natural selection or genetic drift? How do you know? (10 pts)

*Either: Genetic drift because the trait is changing randomly with no reproductive success gained by any specific tail length. OR Natural selection because they live in different environments where different tail lengths give a reproductive advantage.*

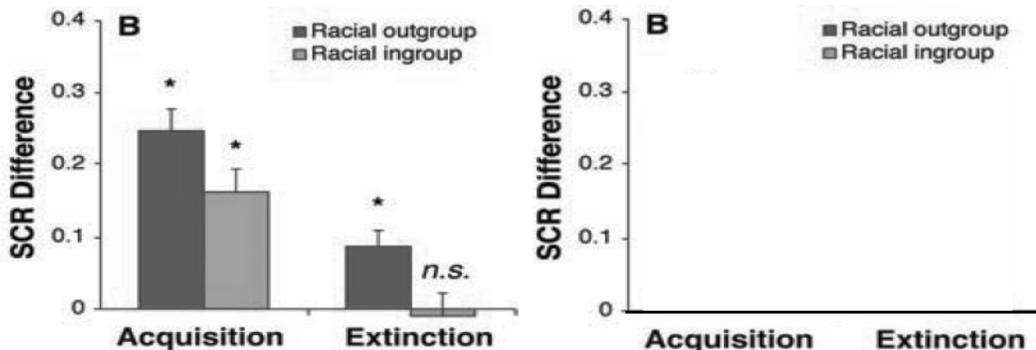
8. In a single day a leaf can be both a sugar source and a sugar sink. How is this possible? (10 pts)

*During the day the leaf is a source because it produces sugar via photosynthesis. At night it would be a sink, using stored sugar from another source because it cannot do photosynthesis in the dark.*

9. If you have two plants of the same size and mass, one with a lot of xylem and the other with very little xylem. Which plant would provide more biofuel? Why? (10 pts)

*Xylem has a lot of cellulose and so the plant with more xylem will have more cellulose, more sugar, and can therefore be used to produce more ethanol.*

10. You perform the experiment shown below on some space aliens from another planet. The space aliens have black skin color. Draw their results on the empty chart and explain why the experiment gave these results. (10 pts)



*The space aliens have not learned, via the environment, to group anyone in a particular group. They will be equally nervous when being shocked, acquisition, but will then equally lose that nervousness when the shocks stopped, extinction.*