

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 103 points.

1. If two people have the same mitochondrial DNA, would they also have the same skin color? Why or why not? (8 pts)

*Not necessarily. With the same mtDNA they could have a common ancestor in the last 10,000 years, but their nuclear DNA, notably the genes regulating skin color could have diverged during this time. OR The mtDNA has nothing to do with skin color. OR mtDNA is inherited maternally while the nuclear DNA, skin color genes, are inherited from both parents, and therefore the nuclear DNA may have had a radically different origin than the mtDNA.*

*Yes. With the same mtDNA they might be siblings, and therefore share the same mtDNA and nuclear DNA, skin color genes.*

2. You are running an experiment where you show test subjects a 3x3 grid with pictures of faces. Some of the faces have a similar skin color to the test subjects, and some of the faces have a different skin color than the test subjects. Based on the experiments we looked at in class, which skin color would you predict that the test subjects could pick out more quickly, someone with similar or different skin color. Why? (10 pts)

*Different skin color. The experiment using electric shocks to induce nervousness showed that people reacted similarly to fear relevant objects like snakes/spiders and people of different skin color from themselves. Another experiment showed that people can recognize fear relevant objects faster.*

3. a. Which hypothesis about the evolution of humans would be more likely to have led to multiple human species coexisting on earth? Explain. (4 pts)

*"Out of Africa". This hypothesis proposes that humans evolved in Africa before the other regions where *H. erectus* existed.*

b. After the disruptive selection took place between *H. erectus* and *H. sapiens* what else would have been necessary for multiple human species to arise? (4 pts)

*Any one of: The two groups did not reproduce with each other because they were geographically or behaviorally separated.*

4. A bird named Jill mates with Fred several times, and then later, mates with Mark one time. All of her offspring are from Fred. Give **two** explanations for this result. (10 pts)

*Any two of: Mark is sterile. Mark and Jill have incompatible genes. Jill was no longer fertile when Mark mated with her.*

5. Both ferns and flowering plants (angiosperms) have leaves. Is this convergent or divergent evolution? Why? (8 pts)

*Divergent. Angiosperms diverged from ferns, and that is why they both have leaves.*

6. If GCTATC is the DNA sequence of a species 'O' and two other species evolved from species 'O', and they have these DNA sequences: species 'M' = GCAATT; species 'G' = GCTATT. Which species is more closely related to species O? Why? (10 pts)

*G, it has only one nucleotide difference from O. M with its 2 nucleotide changes from O is likely derived from G.*

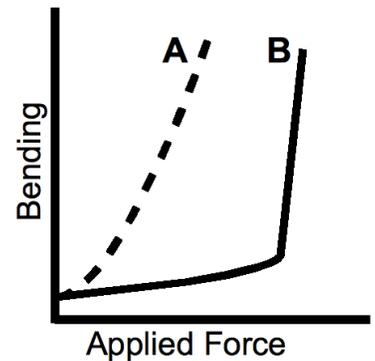
7. Crocodiles have not significantly changed in millions of years. What does this tell us about the environment where crocodiles live? (8 pts)

*This environment has not changes much so the adaptations that made a successful crocodile millions of years ago are still advantageous today.*

8. Give **three** explanations for the evolution of a species with very little genetic diversity. (6 pts)  
*Stabilizing selection reduces genetic diversity because the extremes traits are not being passed on.  
Genetic drift can cause traits to disappear if the individuals with these traits do not reproduce by random chance.*

*Bottlenecks mean that much of a population/species has been wiped out and the genetic diversity with them.*

9. Given the graph below of cells to which a bending force has been applied, which line represents what would happen to collenchyma cells and which line represents what would happen to sclerenchyma cells as the bending force is applied to them? Why? (8 pts)



*A could be parenchyma or collenchyma because it bends evenly in response to pressure. B is sclerenchyma because it rigidly resists bending, and then breaks.*

10. Is it likely that the evolution of flowering plants (angiosperms) occurred via genetic drift? Why or why not? (8 pts)

*No, the advantage that angiosperms have is better reproduction which would definitely be selected for and not random.*

11. Could a gymnosperm, like pine trees or cedar, be considered monogamous? Why or why not? (8 pts)

*No, they are wind pollinated, and the wind would take the pollen in various directions to various different other plants.*

12. Why would a plant living in 100% relative humidity have a difficult time transporting water from its roots to its leaves? (8 pts)

*Water is pulled up in xylem via transpiration. With 100% relative humidity no water would transpire and no water movement could therefore take place.*

**Bonus:** Using information about ratite birds, ostriches and related species, is the multiregional or “out of Africa” hypothesis of human evolution more likely to be correct? (3 pts)

*The ratite birds evolved into different species in different geographic locations, and so this makes it unlikely that humans in different regions, the multiregional hypothesis, would evolve into the same species.*