

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. If you add incorrect extraneous information, points will be deducted. The points for each question are noted in parentheses totaling 60 points.

1. Molly wants to know what is the favorite color of U.T. professors. Her hypotheses are: blue, red, green, and yellow. She asks each of her professors from her current classes. The replies are green, blue, blue, purple, blue, and magenta. She concludes that the favorite color of U.T. professors is blue. Has she done Strong Inference properly? Why or why not? (10 pts)

No. Many reasons, only need one of: Not enough hypotheses; did not include all colors. Not reliable data; only polled a few professors that may not be representative of all UT profs.

2. In the coding region of a gene, there is a substitution (a changed nucleotide). Another gene's coding region has a deletion of one nucleotide. Would the probability of these mutations causing a disease be the same or different? Why? (8 pts)

No. Due to redundancy, substitutions may not change the amino acid sequence of the protein. Because of changes in the reading frame, which 3 nucleotides will be read for each amino acid, a deletion will always cause changes to the protein.

3. Life can be defined as having the following properties: organization, metabolism, responsiveness, and replication. Proteins, by themselves, have some of these properties of life. Which properties of life do proteins have, and why? Which, if any, do proteins not have, and why? (8 pts)

Organized as strings of amino acids with a specific 3-D shape. Act as enzymes carrying out metabolism (chemical reactions). Respond via action as signal molecules. Cannot replicate.

4. Researchers are studying some cells that die in both cold and hot temperatures. In other words, these cells can only survive at moderate temperatures. What problem do these cells have that would explain their sensitivity to both cold and hot temperatures? (8 pts)

They lack cholesterol, or lack sufficient cholesterol. Cholesterol helps inhibit both membrane solidification from cold as well as gaps caused by too much phospholipid movement from hot temperatures.

5. You are studying the evolution of mitochondrial DNA (mtDNA) in people. Of the samples you have looked at, there are differences in the non-gene mtDNA, but **no** differences in the mtDNA genes. Can human mtDNA be evolving via natural selection? Why or why not? (8 pts)

No. The non-gene DNA does not code for traits, so there is no genetic diversity of traits to be selected for or against. In other words no one will have any reproductive advantage or disadvantage because of changes in non-gene DNA.

6. a) 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. Which skin color would the test subjects pick out more quickly, someone with similar or different skin color. Why? (4 pts)

Different skin color. Experiments have shown, that due to environmental factors, we see people of different skin colors from our own as threatening.

b) Some of your test subjects take the same time to find faces regardless of skin color. Why? (4 pts)

Because we group people based on what we learn, from the environment, some people may have not been exposed to an environment where skin color was a defining characteristic.

7. The figure below shows index to ring finger ratios of males. The white bars are men with no older brothers, the diagonally-hatched bars are men with one older brother, and the cross-hatched bars are men with more than one older brother. What does this data say about how older brothers affect the environment in the womb for younger brothers? (10 pts)

Males with 2 or more older brothers have a smaller ratio, indicating increased exposure to androgens (testosterone) in the womb.

