**1.** Certain human genetic conditions, such as sickle cell anemia, result from single base-pair mutations in DNA.

(a) Explain how a single base pair mutant in DNA can alter the structure and in some cases the function of the protein.

(b) Explain, using a specific example, the potential consequences of the production of a mutant protein to the structure and function of the cells of an organism.

**2.** Biologists are interested in preserving the diversity of living organisms on the planet.

(a) Explain one of the following processes or phenomena, using an appropriate example of each.

* Adaptive Radiation

(b) Discuss process or phenomena above, and its impact on the diversity of life on earth.

**3.** During an investigation of a freshwater lake, an AP Biology student discovers a previously unknown microscopic organism. Further study shows that the unicellular organism is eukaryotic

(a) Identify four organelles that should be present in the eukaryotic organism and describe the function of each organelle.

(b) Prokaryotic cells lack membrane bound organelles found in eukaryotes. However, prokaryotes must perform many of the same functions as eukaryotes. For three of the organelles identified in part (a), explain how prokaryotic cells carry out the associated functions.

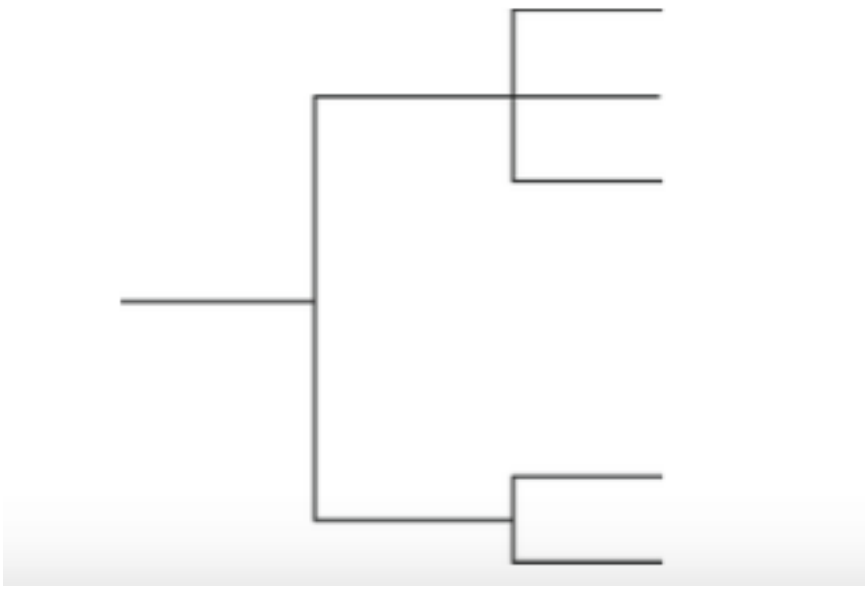
## 4.

Mammalian milk contains antibodies that are produced by the mother's immune system and passed to offspring during feeding. Mammalian milk also contains a sugar (lactose) and may contain proteins (protein A, protein B, and casein), as indicated in the table.

MILK COMPONENTS IN DIFFERENT MAMMALS

| Character | Cat | Cow | Horse | Human | Pig |
|---|---|---|---|---|---|
| Lactose | + | + | + | + | + |
| Protein A | + | + | + | + | + |
| Protein B | – | + | + | – | + |
| Casein | – | + | + | – | + |
| + indicates the presence of the character, and – indicates the absence of the character | | | | | |

(a) Using the data in the table, **construct** a cladogram on the template provided to indicate the most likely evolutionary relationships among the different mammals. **Indicate** on the cladogram where each of the characters most likely arose in the evolutionary process, and **justify** the placement of the characters on the cladogram.



## 5.

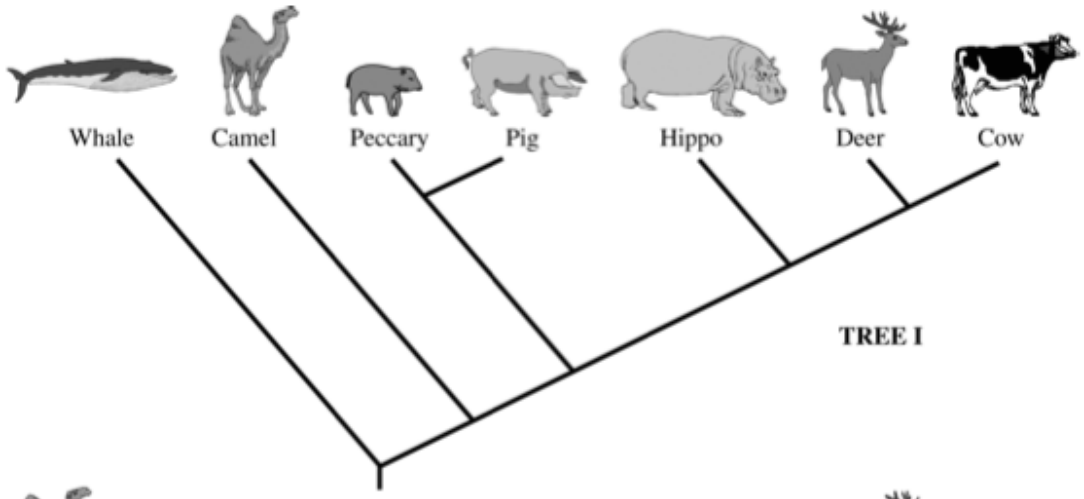
Phylogeny reflects the evolutionary history of organisms.

(a) **Discuss** TWO mechanisms of speciation that lead to the development of separate species from a common ancestor.

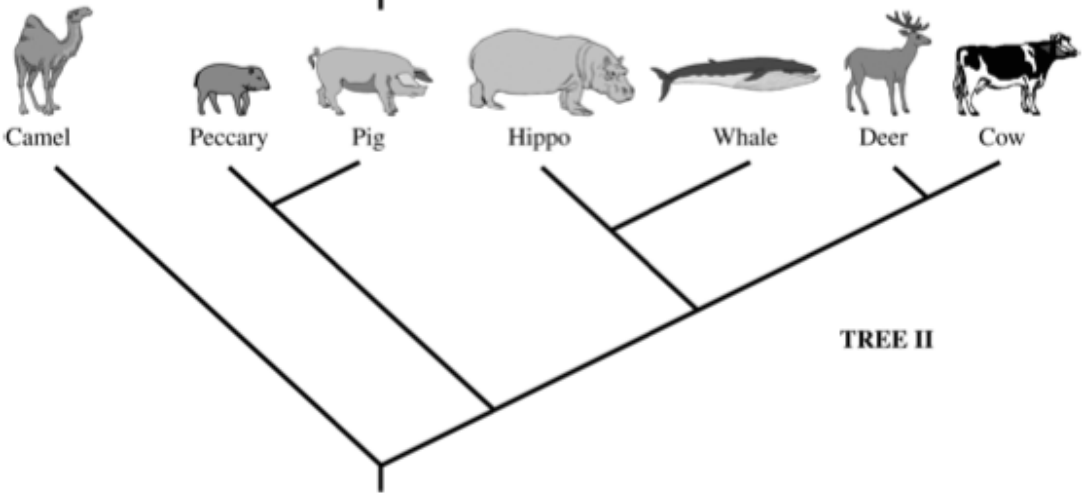
(b) **Explain** THREE methods that have been used to investigate the phylogeny of organisms. **Describe** a strength or weakness of each method.

(c) The two phylogenetic trees represent the relationship of whales to six other mammals. All of the organisms shown have a pulley-shaped astragalus bone in the ankle except for the whale.

- For each tree, **describe** a monophyletic group, the closest relative to the whale, and the point at which the pulley astragalus was lost or gained.
- Based on the principle of parsimony (the simplest explanation is the best) and the genomic information in the table shown, **identify** which tree is the best representation of the evolutionary relationship of these animals, and **justify** your answer.




**TREE I**




**TREE II**

1.B FRQ Formatives

1.B FRQ Formatives