Appendix B. Content pre-test.

1. Biologists assert that present-day reptile diversity can be explained by the theory of descent with modification. What does descent with modification mean? Place an '**X**' next to the single option below that best matches your definition.

_____ **A.** An organism's environment causes changes in its traits, making the organism better suited for that environment.

_____ **B.** Species share a common ancestor, and their traits reflect both that ancestry and changes over time.

_____ **C.** Species gradually become better adapted to their local environment over evolutionary time scales.

_____ **D.** An organism keeps its beneficial traits, and modifies or discards other traits.

Questions 2 - 5. Patterns in the fossil record are one kind of evidence scientists use to test their ideas about the relationship among Earth's organisms. Which of the following patterns in the fossil record of whales, if found, would tend to provide **evidence against** the hypothesis of common ancestry between whales and camels?

Indicate your answer by writing '**X'** next to each pattern you think would show **evidence against** the hypothesis of a recent common ancestor between whales and camels. You can select more than one pattern.

_____ **2. The discovery of fossils of modern whales that are much older than the earliest fossils of the hypothesized common ancestor.**

_____ **3. Some traits never changed between modern whales and the hypothesized common ancestor.**

_____ **4. Some traits in modern whales are not found in the fossils of the hypothesized common ancestor.**

_____ **5. Fossils for some of the intermediate forms between modern whales and the fossils of the hypothesized common ancestor were not found.**

Questions 6 - 9. Recently, scientists found fossil remains of several transitional species between modern whales and their last common ancestor with artiodactyls.

Read the following statements about transitional species. Please indicate whether you agree with each statement by writing '**X**' on the line next to the statement (X = agree with the statement). You can select more than one option.

The transitional species:

_____ 6. Must be the ancestors of modern whales.

_____ 7. Must have had fewer traits than modern whales.

_____ 8. Must be descended from the whales' last common ancestor with artiodactyls.

_____ 9. Could have co-occurred with modern whales.

The diagram below shows five extant (present-day) species of birds. Use this diagram when answering **Questions 10 - 11**.

10. Assume that the modern bird species above all share a single recent common ancestor that looked like the bird below.

Please list the likely order in which the following five newly derived bird traits should appear in the fossil record, listed from oldest (appearing first) to youngest (appearing last): **Black Wing Tips, Gray Bodies, Gray Face, Long Beaks, Long Tails.** Write the traits on the blank lines below.

1 (Oldest): _____

2: _____

3: _____

4: _____

5 (Youngest): _____

11. Someone claims to have discovered a fossil that **undermines** the hypothesis that the above five modern bird species share a common ancestor. This fossil appears **AFTER** the fossil of the last common ancestor in the fossil record shown in Question 11.

Of the options below, please select the letter corresponding to the fossil that would be the MOST DIFFICULT to explain under the hypothesis of common ancestry.

12. The order Primates includes lemurs, lorids, galagos, tarsiers, monkeys, apes, and humans. Apes and humans split from other primates as long as **35 million years ago**. Many primates feed on hard food. Among the features of the chimpanzee's skull are:

- **Trait A:** A postorbital plate that ventrally separates the orbit and temporal fossa (**performs no known survival function, but does not cause any harm**)
- **Trait B:** Enamel caps on the molars (**help protect the teeth from damage while eating hard foods)**

Trait A is found in fossils as old as 60 million years, whereas **Trait B** first appears in fossils just 5 million years old.

Which of these traits do you think is more widespread among other present-day primate species?

A: Trait A

B: Trait B

13. Humans carry a variety of neutral, non-functional genetic sequences, called processed pseudogenes, in their DNA. We can estimate how old these processed pseudogenes are (that is, how long ago they first appeared in the genomes of our ancestors). Human processed pseudogenes include **alpha-enolase psi$_1$ (11 million years old), AS psi$_7$ (16 million years old),** and **CALM II psi$_3$ (36 million years old).**

Which of these three neutral pseudogenes do you predict will be most widespread among other primate species?

A: Alpha-enolase psi$_1$

B: AS psi$_7$

C: CALM II psi$_3$