Tree-Thinking POGIL

Model 1:

1. To whom are you more closely related, your sister or your cousin? Explain your reasoning.

2. Who is more closely related to Cousin #1, you or your sister? Explain your reasoning.

3. What individuals might be represented by each of the following letters:
   - A:
   - B:
   - C:

4. Congratulations! You have a new baby sibling! Add and label a line to Model 1 to show your sibling on Model 1. Explain why you placed your baby sibling where you did.

5. In Model 1, which tells you how closely related two individuals are: the branching pattern of the lines, or the vertical location of the tips of the branches? Justify your answer.
6. What languages are spoken in the present?

7. Why do you think there is an X at the end of the line leading to Latin?

8. Model 2 represents "relatedness" in a similar way to Model 1. Based only on Model 2, which two languages are most closely related? Explain your answer.

9. Based on Model 2, which is more closely related to French: Spanish or Italian? Explain your reasoning.

10. What can you predict about the vocabulary, grammar, and sound of Language A, compared to Spanish and Italian? Explain your reasoning.
11. Language A is a **common ancestor** of Spanish and Italian. Define **common ancestor**.

12. What is the relationship between how closely two languages are related and how recently they shared a common ancestor?

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Molecular and radioactive dating of fossils are used to determine the phylogeny of organisms. Turtles are organisms with a long evolutionary history, making them an ideal group to study. Below is a phylogeny of some turtle genera developed using both fossil and molecular dating.

![Turtle phylogeny diagram](image)

**Model 3:**

13. Look at the time scale: what is unusual about it?

14. Why do you think the author of this model would choose to represent time in this way?

15. What does one of the horizontal lines represent in a family tree (Model 1)? How is that different from what’s represented by the horizontal lines in Model 3? ¹

16. During which geological era did Emys and Trachemys last share a common ancestor?

17. According to Model 3, which two are most closely related: Carettochelys, Apalone, Lissemys? Use the term common ancestor in your answer.

18. According to Model 3, who is more closely related: Lissemys and Chelonia, or Lissemys and Heosemys? Explain how you know.

¹ Thanks much to Natalie Dutrow for this updated question to help address an important misconception.
19. Of these three, which two are more closely related: *Trachemys*, *Emys*, or *Platysternon*? Explain how you know.

20. Model 3 is called a **cladogram**. Define the term **cladogram** and explain what it is used for.

21. In Model 1, the "branches" represent couples, and the tips of the branches represented individual organisms. How does Model 3 differ from this representation? How is it similar?

22. **Challenge Question**: Imagine that a new turtle group has been discovered. The evidence suggests that this group of turtles was more closely related to *Geochelone* than any other known turtle group but went extinct during the Cenozoic period. Draw a line on the cladogram to indicate where this new group of turtles should be placed on the cladogram.