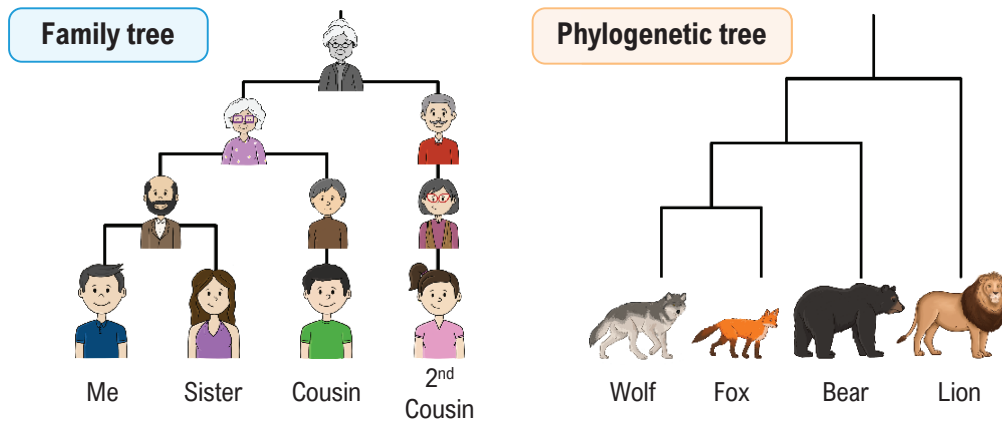


TOPIC: PHYLOGENY

Reading a Phylogenetic Tree

◆ **Phylogenetic tree:** branching diagram that shows _____ relationships.

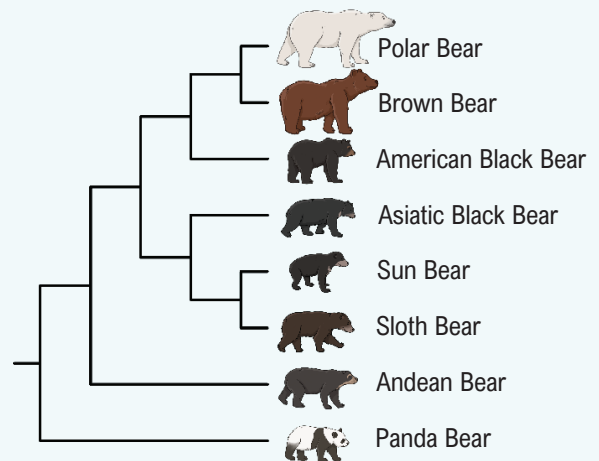
- *Phylo:* _____. *Genesis:* _____.
- Groups are made by finding a common _____; where lines _____ in the tree.
- Can be read similarly to a _____ tree.



EXAMPLE

Evaluate the following statements as true or false based on the following phylogenetic tree.

- _____ This tree shows that polar bears have undergone the most evolution.
- _____ The sun bear is most closely related to the sloth bear.
- _____ The American black bear and Asiatic black bear are most closely related to each other.
- _____ The Andean bear and the panda bear are most closely related to each other.
- _____ The brown bear is equally related to the Asiatic black bear and the sloth bear.
- _____ This tree shows that the ancestor of all bears was most similar to a panda bear.
- _____ The American black bear is more closely related to a polar bear than it is to an Asiatic black bear.

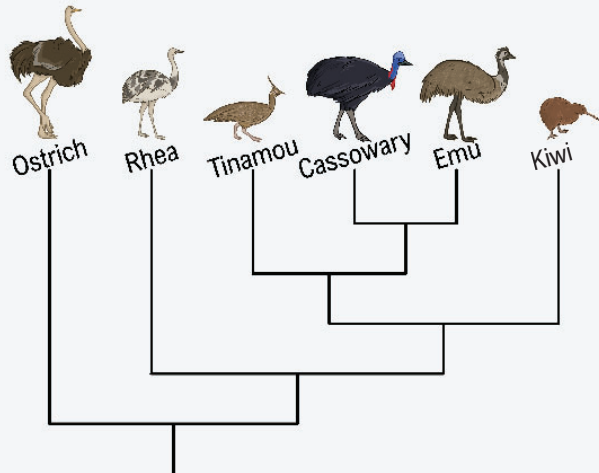


TOPIC: PHYLOGENY

PRACTICE

Based on the tree below, which of the organisms listed is most closely related to the tinamou?

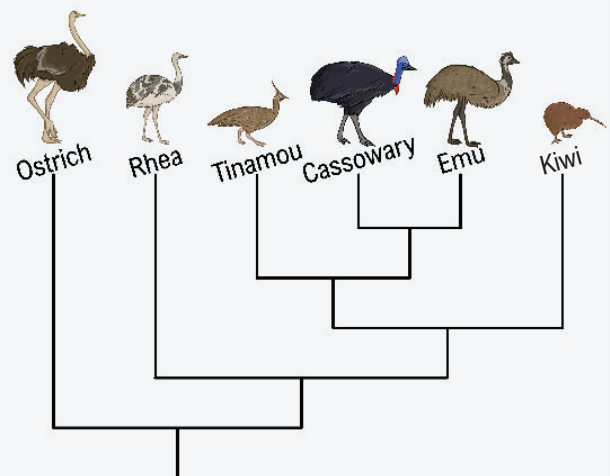
- a) Rhea.
- b) Kiwi.
- c) Emu.
- d) Ostrich.



PRACTICE

According to the phylogenetic tree below, which statement is correct?

- a) The rhea is most closely related to the tinamou.
- b) The rhea is equally related to both the cassowary and the kiwi.
- c) The ostrich and the rhea are most closely related to each other.
- d) The kiwi is more closely related to the rhea than it is to the cassowary.

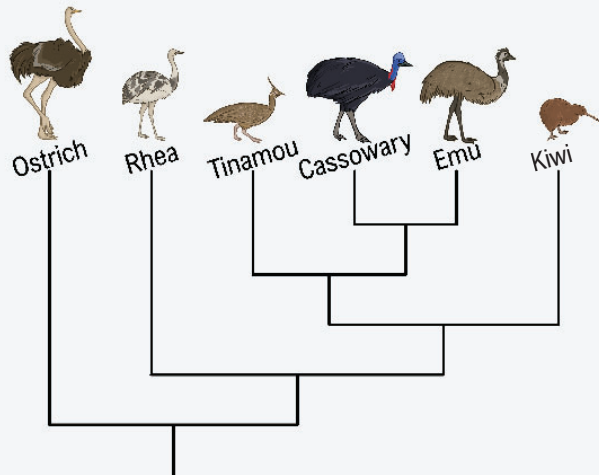


TOPIC: PHYLOGENY

PRACTICE

Based on the tree below, which of the birds listed is most distantly related to the tinamou?

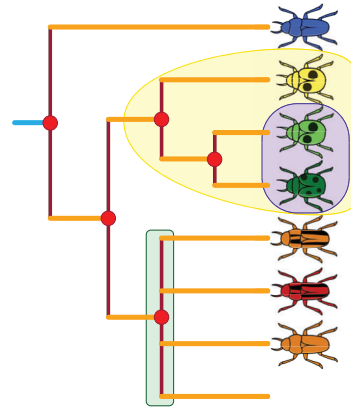
- a) Cassowary.
- b) Kiwi.
- c) Rhea.
- d) Emu.



TOPIC: PHYLOGENY

Parts of a Phylogenetic Tree

- ◆ Phylogenetic trees use a _____ set of vocabulary to describe them.
- ◆ Parts of a tree:
 - **Branch:** line that represents a _____ over time.
 - **Node (Branch Point):** last common _____ of multiple taxa.
 - **Root:** common ancestor for _____ organisms on the tree.
 - **Sister Taxa:** organisms that share an _____ common ancestor.
 - **Polytomy:** node with more than _____ branches.
 - **Clade (Monophyletic Group):** group that includes a node and all _____ descended from that node.



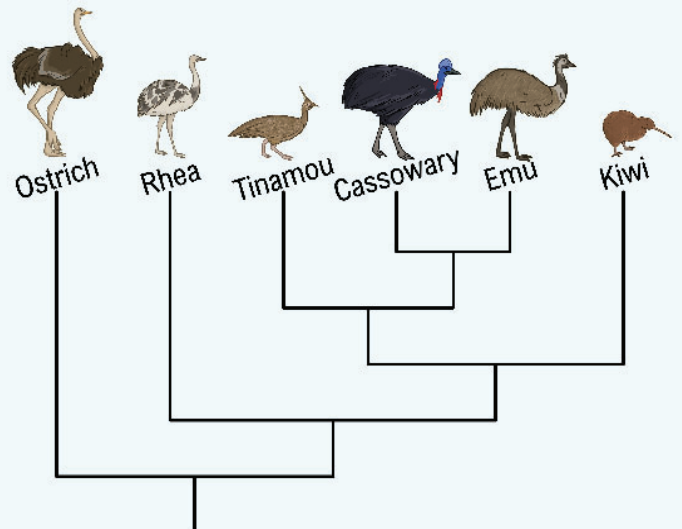
EXAMPLE

Using the tree below, answer the following.

- Put a star on the node that represents the last common ancestor of the tinamou and the emu.
- Circle the branch that leads to the ancestor of the kiwi and the cassowary.
- The cassowary is a sister taxon to which other organism?

- Put a box around the root of the tree.
- What does the root of the tree represent?

- Does this tree contain a polytomy? _____
- If it does contain a polytomy, mark the polytomy with an asterisk.



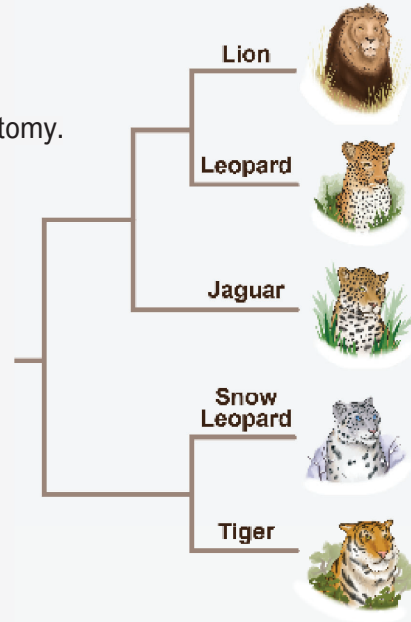
TOPIC: PHYLOGENY

PRACTICE

Based on the tree below, which statement is true?

- i. Snow leopards and tigers are sister taxa.
- ii. Lions, leopards, and jaguars represent a clade.
- iii. The node leading to lions, jaguars, and leopards is a polytomy.

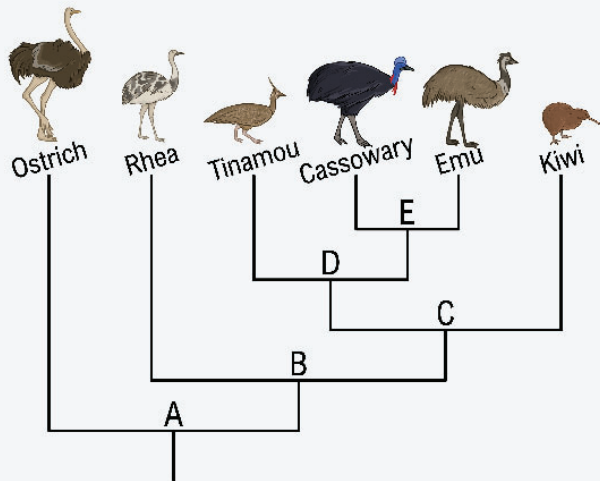
- a) I & II.
- b) I & III.
- c) II & III.
- d) I, II, & III.



PRACTICE

Which node represents the most recent common ancestor of the rhea and the kiwi?

- a) A.
- b) B.
- c) C.
- d) D.
- e) E.



TOPIC: PHYLOGENY

PRACTICE

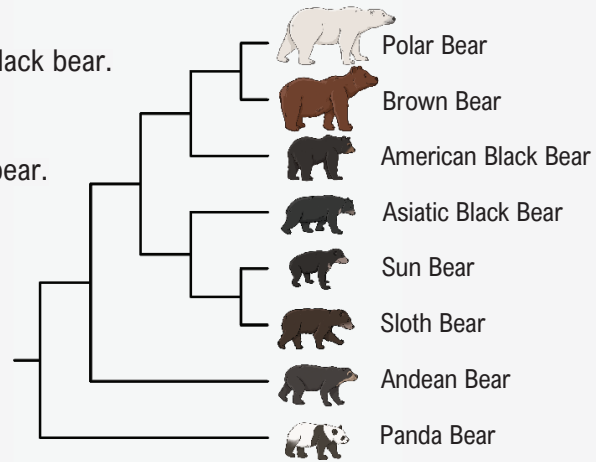
Which group represents a clade according to the tree below?

a) Asiatic black bear & sun bear.

b) Asiatic black bear & American black bear.

c) Panda bear & Andean bear.

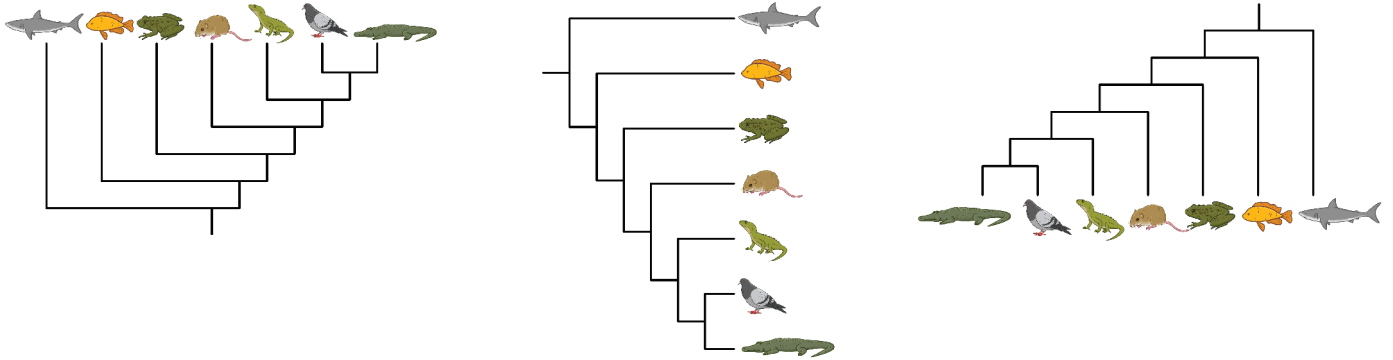
d) All the bears except the panda bear.



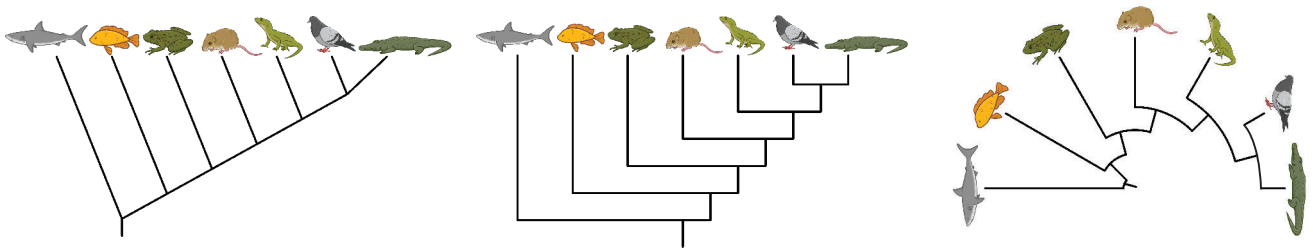
TOPIC: PHYLOGENY

Different Ways to Draw a Phylogenetic Tree

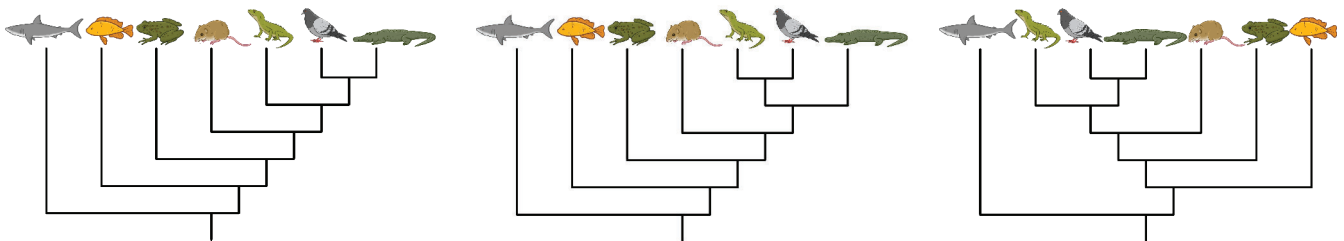
Identical trees with different _____.



Identical trees with different _____.



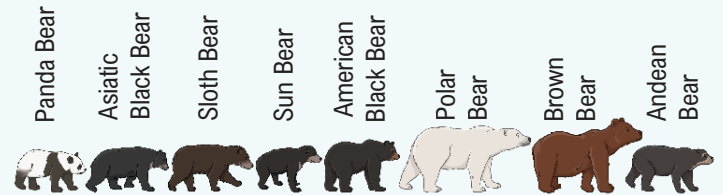
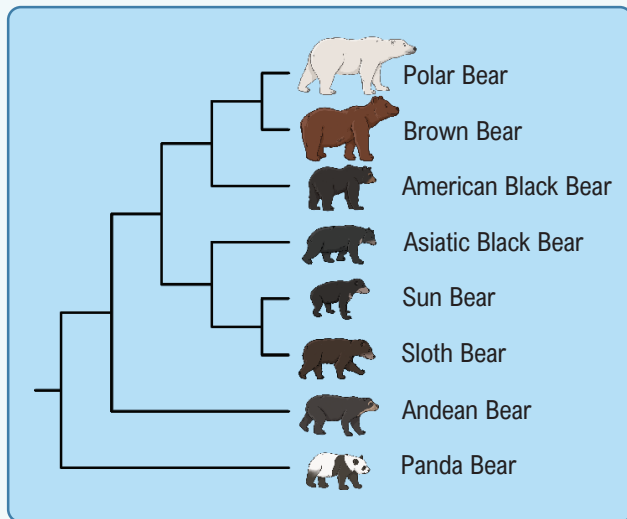
Identical trees with _____ on nodes.



TOPIC: PHYLOGENY

EXAMPLE

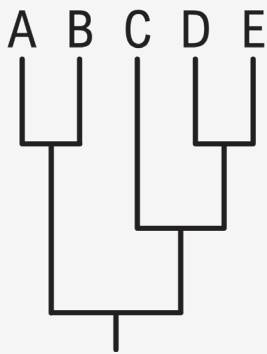
The phylogenetic tree for living bear species is shown below. To the right, the same bears are listed in a different order. Draw a phylogenetic tree connecting the bears on the right so that the relationships are the same as the original tree.



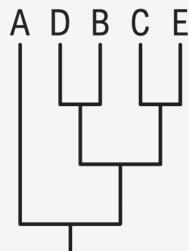
Wiley, C., Korstanje, R., (2022). Sequencing and assembling bear genomes: the bare necessities. *Frontiers in Zoology*, 19(30), <https://doi.org/10.1186/s12983-022-00475-8>

PRACTICE

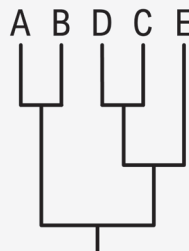
Based on the tree below, which tree shows the same evolutionary relationships?



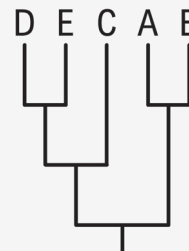
a)



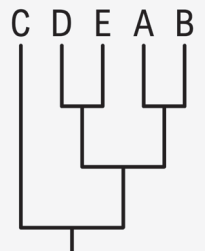
b)



c)



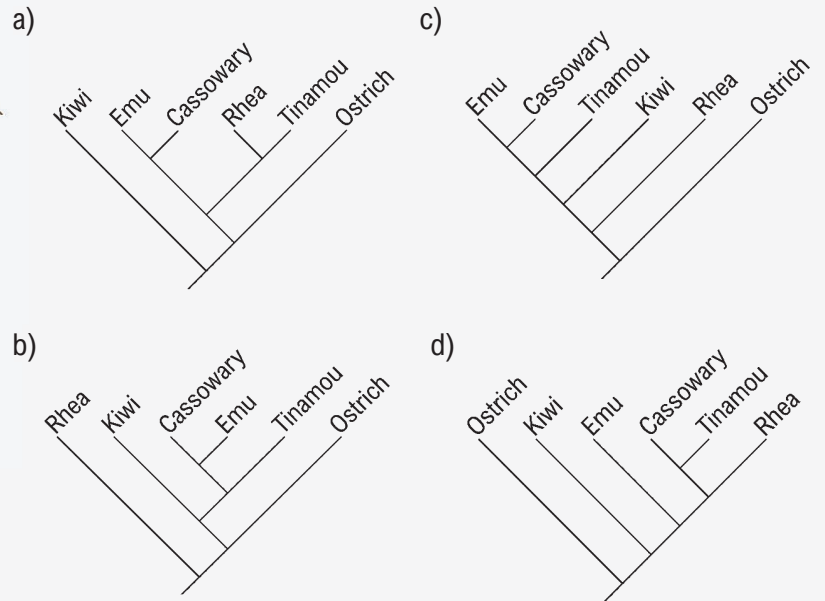
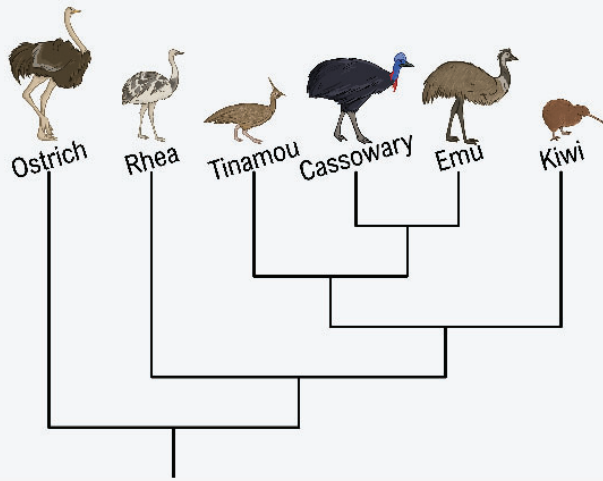
d)



TOPIC: PHYLOGENY

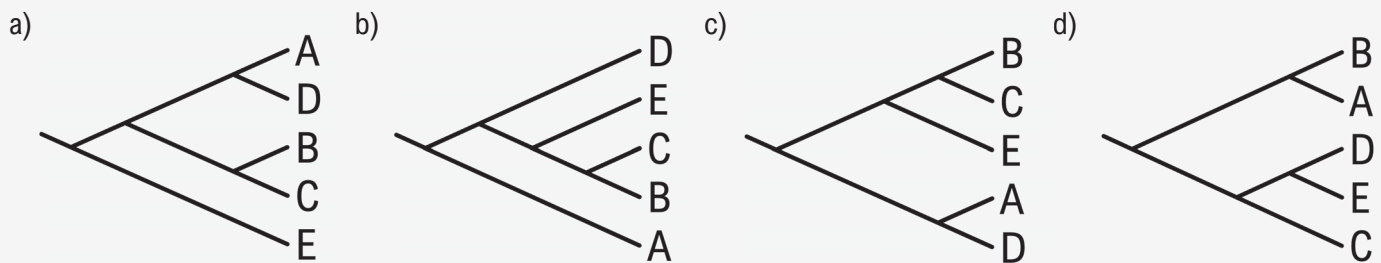
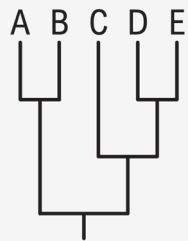
PRACTICE

Based on the tree below, which tree shows the same evolutionary relationships?



PRACTICE

Which tree below shows the same evolutionary relationships?



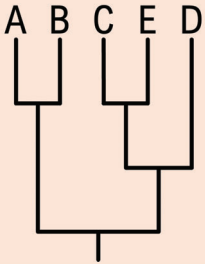
TOPIC: PHYLOGENY

Interpreting Branch Length

◆ In different phylogenetic trees, branch length may mean _____ things.

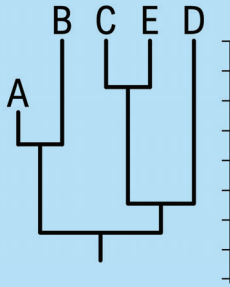
It could mean:

1. Nothing: only the branching _____ is important.



◆ Assume this unless otherwise stated.

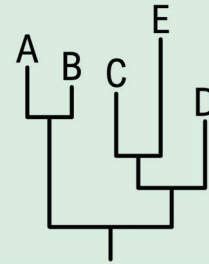
2. Time: nodes indicate _____ split occurred.



◆ Will have a _____.

◆ Can show _____.

3. Amount of evolution: length represents _____ changes.



◆ Longer = more _____.

◆ Taxa will be _____.

PRACTICE

In a tree that shows the amount of evolution, what does a shorter branch length indicate?

- a) Earlier branching events.
- b) Fewer genetic changes.
- c) Extinction events.
- d) Shorter time periods.

PRACTICE

From the phylogenetic tree below, what can you infer from the branch lengths for the organisms Pakicetus, Rodhocetus, and Dorudon?

- a) They are more closely related to each other than to other organisms on the tree.
- b) They are extinct taxa.
- c) Those taxa experienced less genetic change than other branches on the tree.
- d) They represent the ancestors of modern whales and dolphins.

