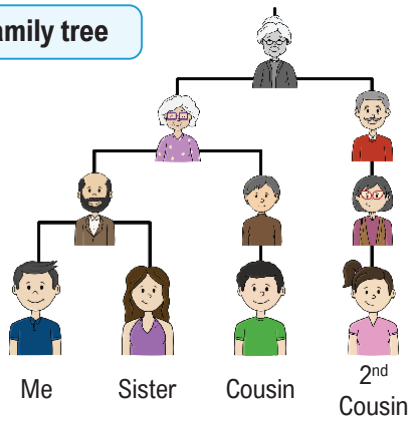
## TOPIC: PHYLOGENY

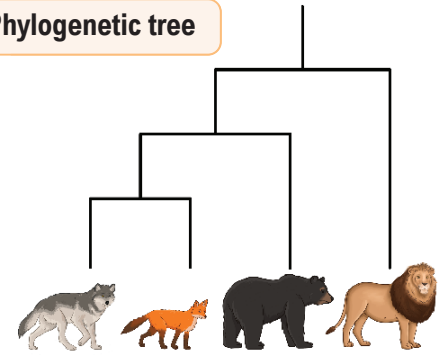
### Reading a Phylogenetic Tree

- **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.

**Family tree**




**Phylogenetic 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.

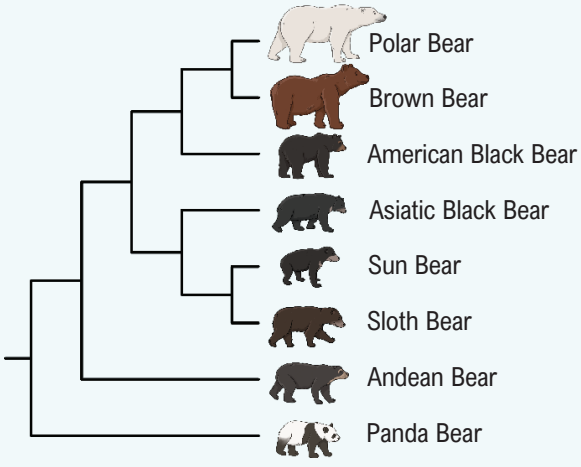
____ The American black bear and Asiatic black bear are most closely related to each other.

____ 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.

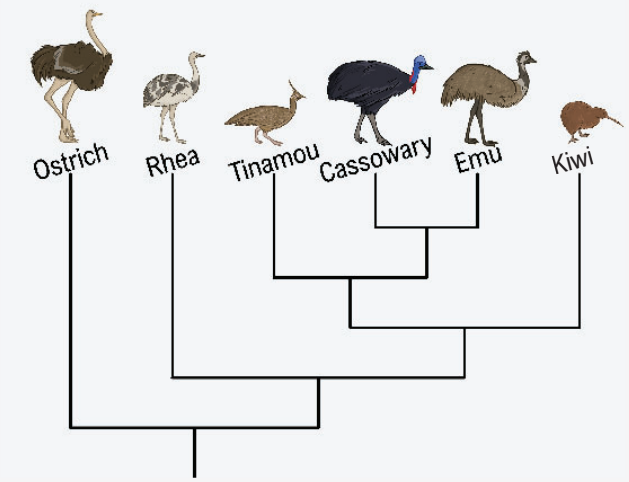


## TOPIC: PHYLOGENY

### PRACTICE

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

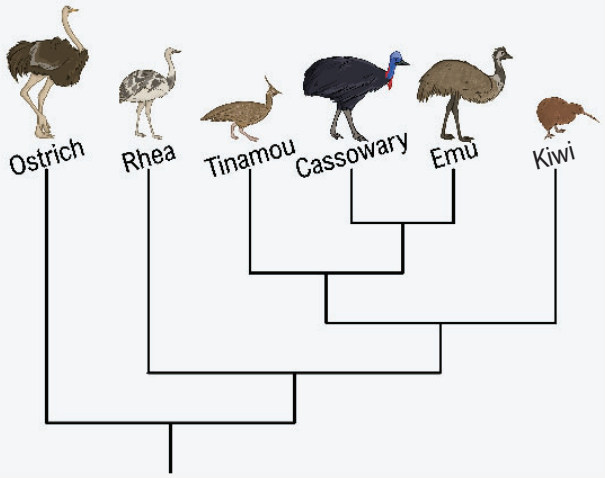
a) Rhea.
b) Kiwi.
c) Emu.
d) Ostrich.




### 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

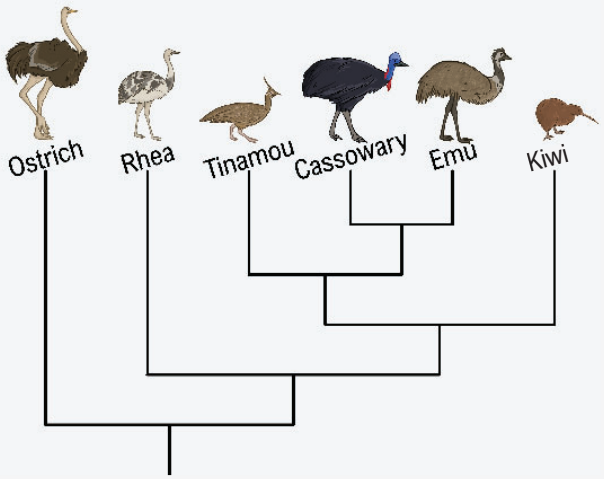
Based on the tree below, which of the birds listed is most distantly related to the tinamou?

a) Cassowary.

b) Kiwi.

c) Rhea.

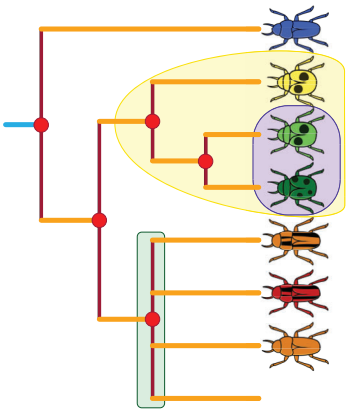
d) Emu.



## 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.

a. Put a star on the node that represents the last common ancestor of the tinamou and the emu.

b. Circle the branch that leads to the ancestor of the kiwi and the cassowary.

c. The cassowary is a sister taxon to which other organism?

_____

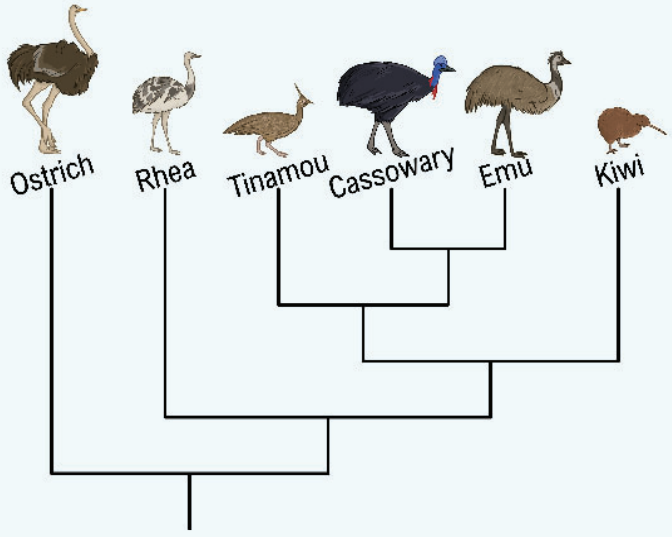
d. Put a box around the root of the tree.

e. What does the root of the tree represent?

_____

f. Does this tree contain a polytomy? _____

g. If it does contain a polytomy, mark the polytomy with an asterisk.



## TOPIC: PHYLOGENY

### PRACTICE

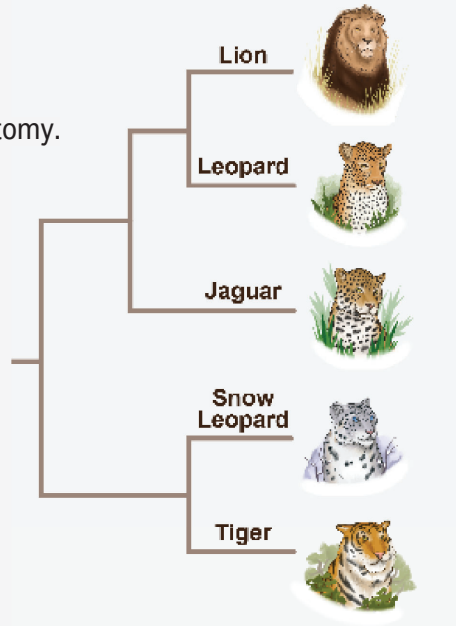
Based on the tree below, which statement is true?

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.

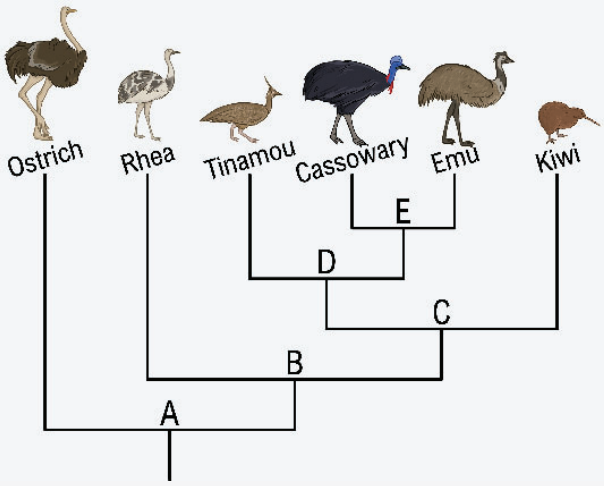
a) I & II.
c) II & III.
b) I & III.
d) I, II, & III.




### 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

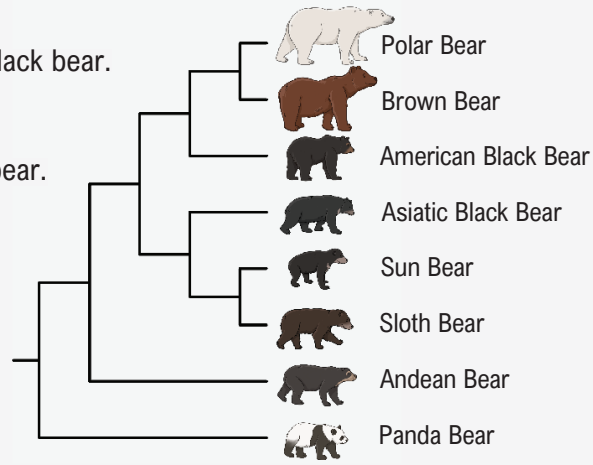
Which group represents a clade according to the tree below?

a) Asiatic black bear & sun bear.

b) Asiatic black bear & American black bear.

c) Panda bear & Andean bear.

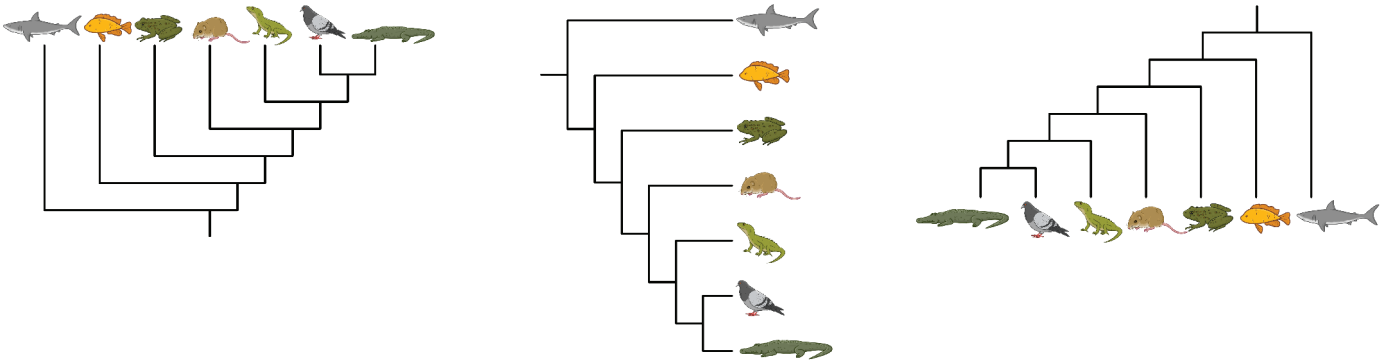
d) All the bears except the panda bear.



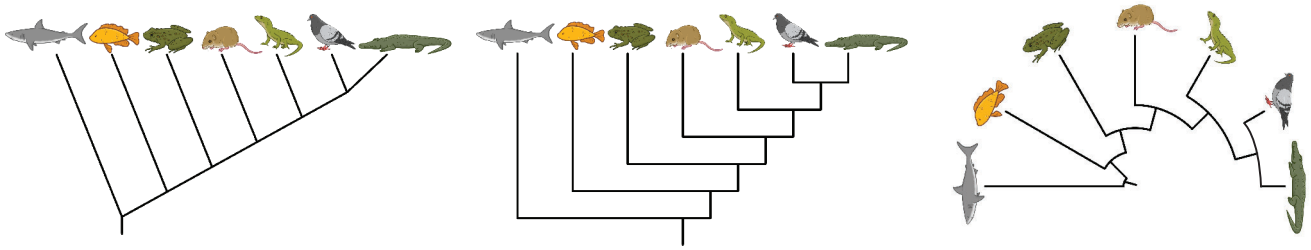
**TOPIC: PHYLOGENY**

## Different Ways to Draw a Phylogenetic Tree

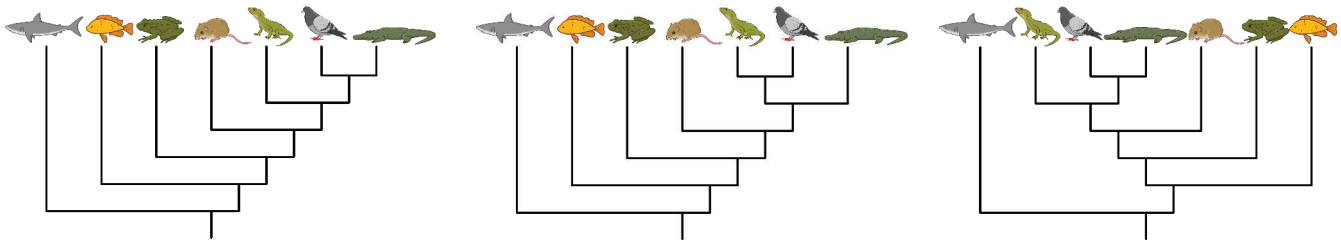
**Identical trees with different _____.**



**Identical trees with different _____.**



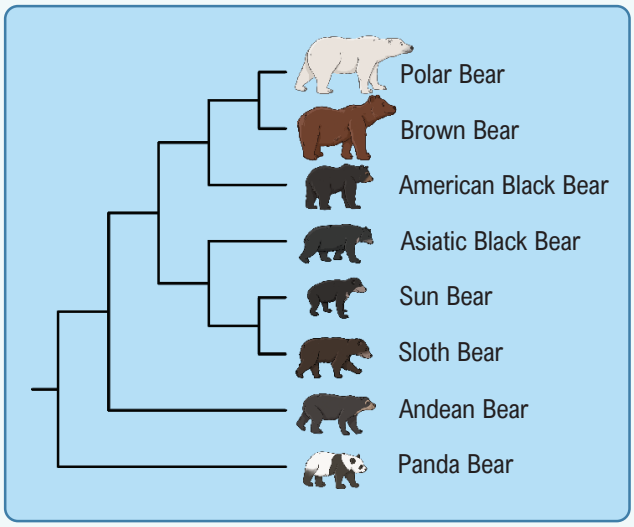
**Identical trees with _____ on nodes.**

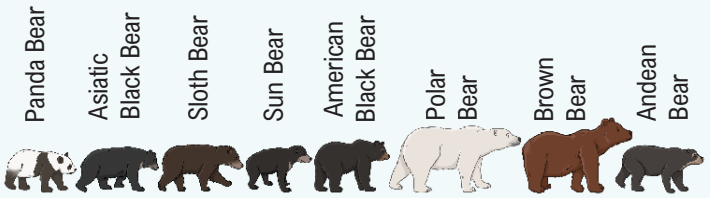


## TOPIC: PHYLOGENY

### 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.

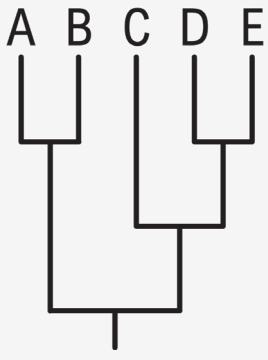


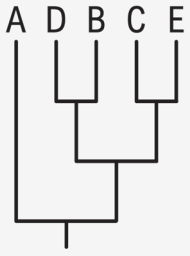

Willey, C., Korstanje, R., (2022). Sequencing and assembling bear genomes: the bare necessities. *Frontiers in Zoology*, 19(30), https://doi.org/10.1186/s12983-022-00475-8

### PRACTICE

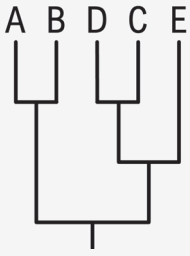
Based on the tree below, which tree shows the same evolutionary relationships?



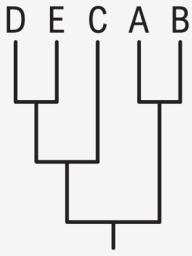

a)



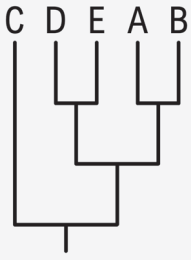

b)




c)



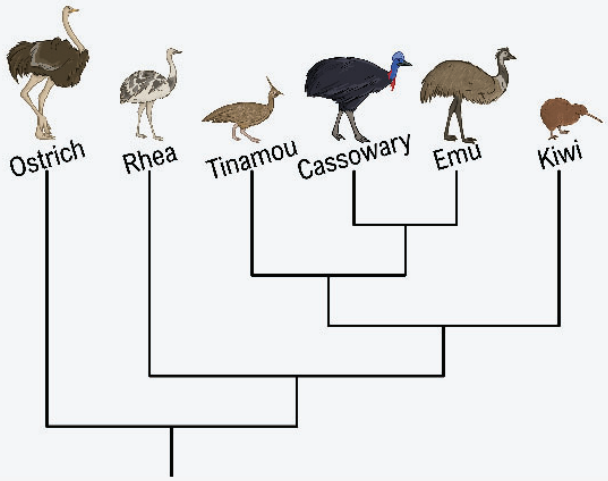

d)



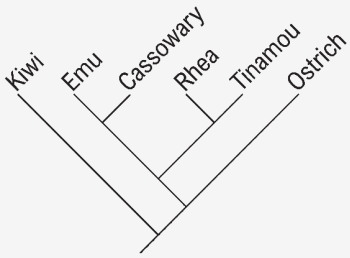
## TOPIC: PHYLOGENY

### PRACTICE

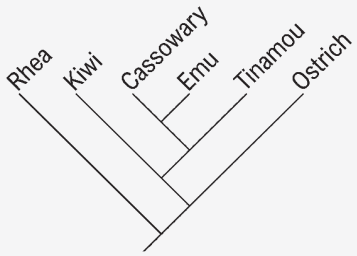
Based on the tree below, which tree shows the same evolutionary relationships?



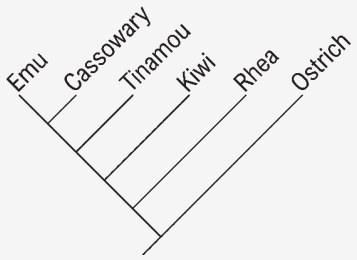

a)



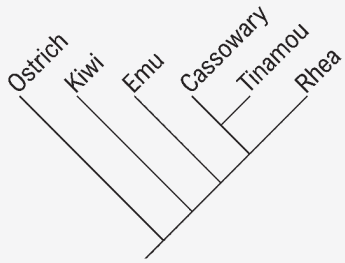

b)




c)

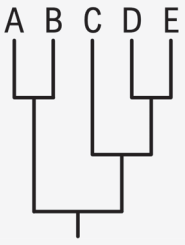



d)

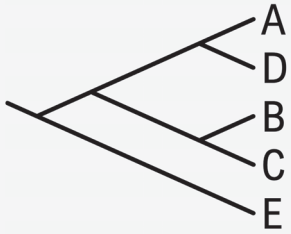



### PRACTICE

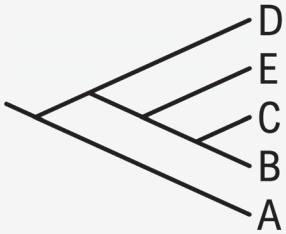
Which tree below shows the same evolutionary relationships?



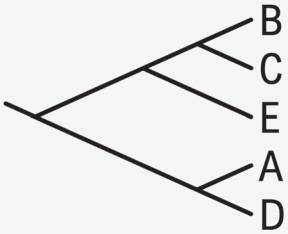

a)



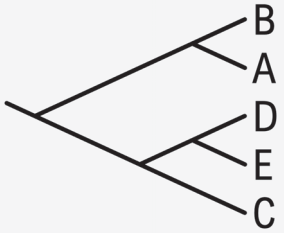

b)




c)




d)



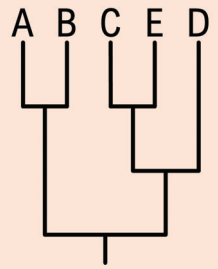
## TOPIC: PHYLOGENY

### Interpreting Branch Length

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

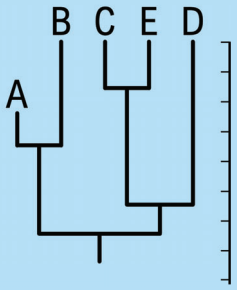
It could mean:

**1. Nothing:** only the branching _____ is important.




◆ Assume this unless otherwise stated.

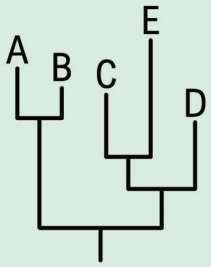
**2. Time:** nodes indicate _____ split occurred.




◆ 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.