Name _____ Class _____ Date _____

18.2 Modern Evolutionary Classification

Lesson Objectives

- Explain the difference between evolutionary classification and Linnaean classification.
- Describe how to make and interpret a cladogram.
- Explain the use of DNA sequences in classification.

Lesson Summary

Evolutionary Classification The study of evolutionary relationships among organisms is called **phylogeny**. Classification based on evolutionary relationships is called phylogenetic systematics, or evolutionary classification.

- Evolutionary classification places organisms into higher taxa whose members are more closely related to one another than they are to members of any other group. The larger the taxon, the further back in time all of its members shared a common ancestor.
- In this system, organisms are placed into groups called clades. A **clade** is a group of species that includes a single common ancestor and all descendants of that ancestor. A clade must be a monophyletic group. A **monophyletic group** must include all species that are descended from a common ancestor, and cannot include any species that are not descended from that common ancestor.

Cladograms A **cladogram** is a diagram that shows how species and higher taxa are related to each other. A cladogram shows how evolutionary lines, or lineages, branched off from common ancestors.

- In a cladogram, the place where the ancestral lineage splits is called a fork, or a node. Nodes represent the point where new lineages last shared a common ancestor.
- The bottom of the diagram, or the root, represents the ancestor shared by all of the organisms on the cladogram.
- Cladistic analysis relies on specific shared traits, or characters. A **derived character** is a trait that arose in the most recent common ancestor of a particular lineage and was passed to all of its descendants.

DNA in Classification All organisms have DNA. Because DNA is so similar across all forms of life, this molecule can be compared in different species. In general, the more derived genetic characters two species share, the more recently the species shared a common ancestor and the more closely related they are.

Evolutionary Classification

1. How did Darwin's theory of evolution change the way biologists thought about classification categories?

_____

_____

2. Describe the goal of phylogenetic systematics (evolutionary classification).

_____

_____

3. Which group of organisms would have the most recent common ancestor: the members of a clade corresponding to a genus or the members of a clade corresponding to an order? Explain your answer.

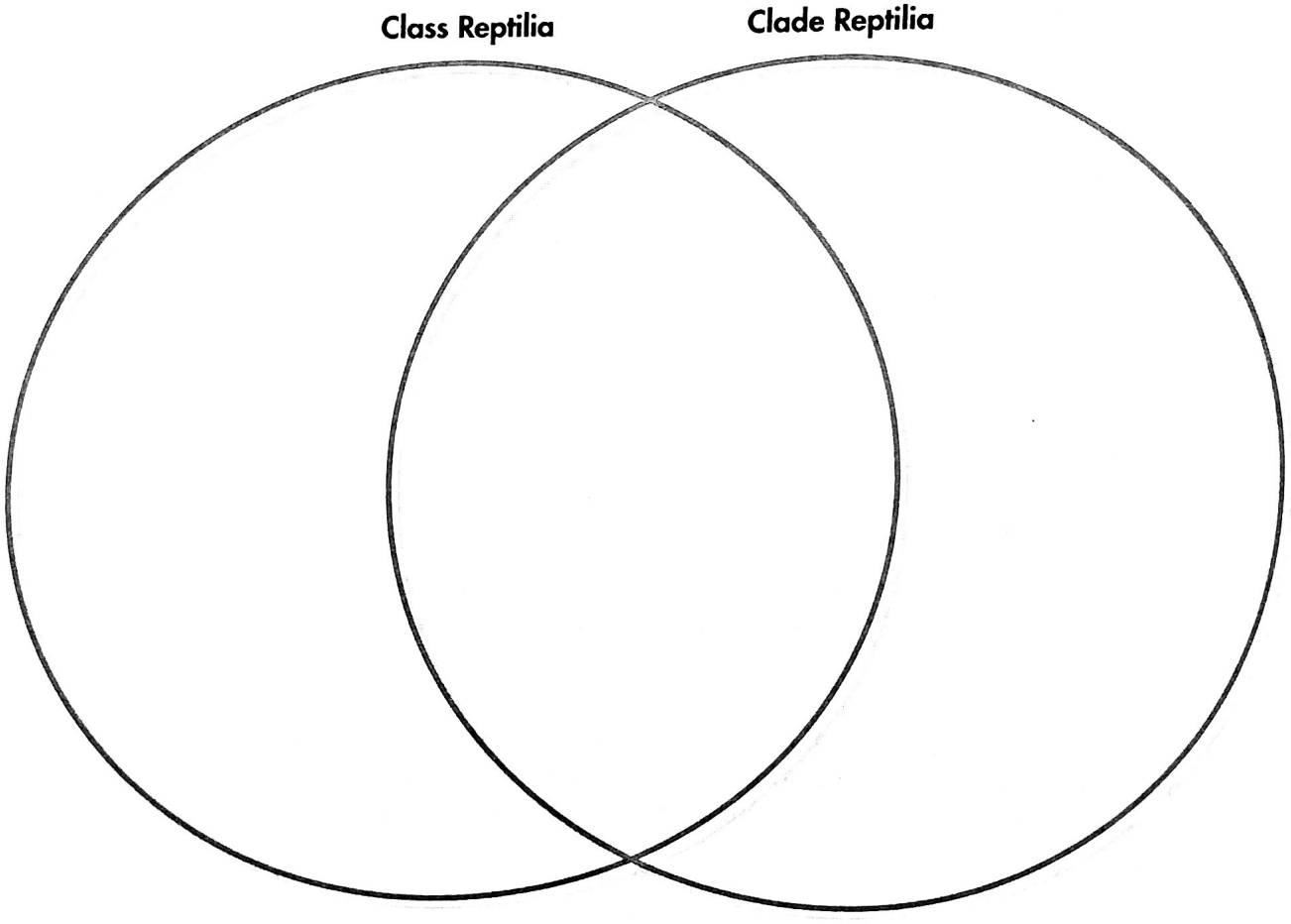
_____

_____

_____

_____

4. Use the Venn diagram to compare and contrast the definitions of the Linnaean class Reptilia and the clade Reptilia.



For Questions 5–7, complete each statement by writing the correct word or words.

5. All species descended from a(n) _____ are part of a monophyletic group.

6. _____ is the study of how living and extinct organisms are related to one another.

7. A clade includes a common ancestor and all its descendants, living or _____.

Cladograms

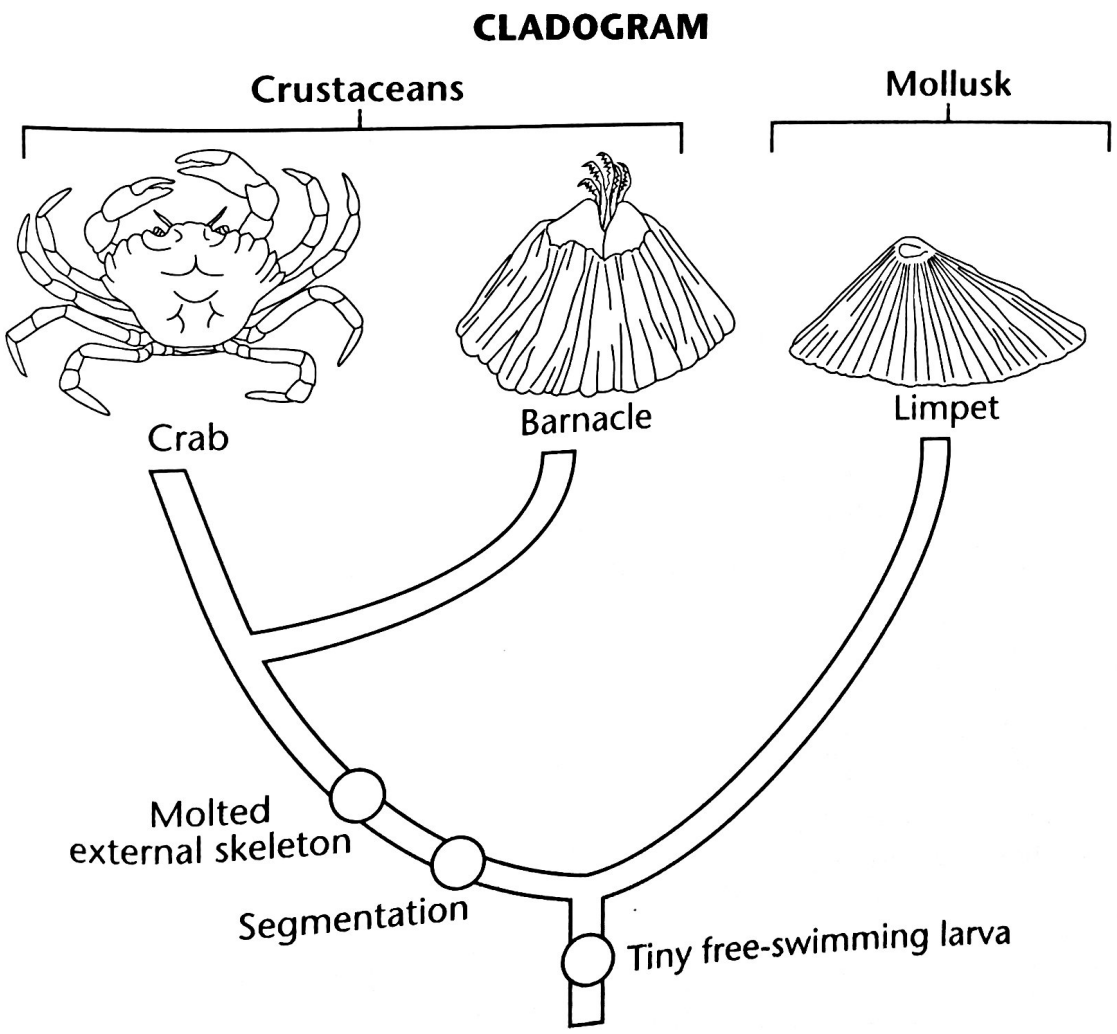
For Questions 8–10, complete each statement by writing the correct word or words.

8. A diagram that shows the evolutionary relationships among a group of organisms is called a(n) _____.

9. The place where the ancestral lineage splits on a cladogram is called a fork, or a(n) _____.

10. Characteristics shared by members of a clade and only by members of that clade are called _____.

11. THINK VISUALLY Examine the cladogram below:
- Shade in the two organisms that belong to a clade that does not include the third organism. Cross-hatch the organism that does not belong to the clade.
- Circle the point on the cladogram that shows the most recent common ancestor of the crab and the barnacle.
- Mark an X on the point on the cladogram that shows the most recent common ancestor of mollusks and crustaceans.
- Underline the characteristic that all three organisms have in common.



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DNA in Classification

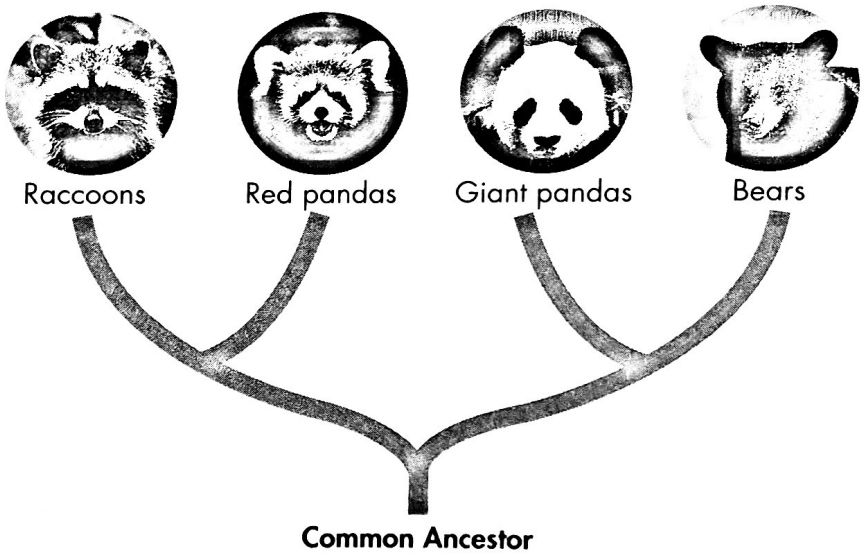
12. Why can genes be considered derived characters?

_____

_____

_____

Use the figure below to answer Questions 13–15.



13. According to the figure, which species is most closely related to red pandas?

_____

14. Although giant pandas and raccoons share some distinct anatomical similarities, they are in different clades. What type of evidence do you think was used to construct this diagram?

_____

15. Biologists had previously classified giant pandas together with raccoons and red pandas. What did DNA analysis reveal about giant pandas and bears?

_____

_____

Apply the Big Idea

16. Both humans and yeasts have a gene that codes for a myosin protein. What does this indicate about their ancestry?

_____

_____

_____

