Name _____ Class _____ Date _____

CHAPTER 9 Classification

SECTION 1

Sorting It All Out

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What is classification?
- How do scientists classify organisms?
- How do scientists name groups of organisms?

National Science Education Standards
LS 5a

Why Do We Classify Things?

Imagine that you lived in a tropical rain forest and had to get your own food, shelter, and clothing from the forest. What would you need to know to survive? You would need to know which plants were safe to eat and which were not. You would need to know which animals you could eat and which ones could eat you. In other words, you would need to study the organisms around you and put them into useful groups. You would *classify* them.

Biologists use a *classification* system to group the millions of different organisms on Earth. **Classification** is putting things into groups based on characteristics the things share. Classification helps scientists answer several important questions:

- What are the defining characteristics of each species?
- When did the characteristics of a species evolve?
- What are the relationships between different species?

STUDY TIP

Organize As you read, make a diagram to show the eight-level system of organization.

Say It

Discuss With a partner, describe some items at home that you have put into groups. Explain why you grouped them and what characteristics you used.

How Do Scientists Classify Organisms?

What are some ways we can classify organisms? Perhaps we could group them by where they live or how they are useful to humans. Throughout history, people have classified organisms in many different ways.

In the 1700s, a Swedish scientist named Carolus Linnaeus created his own system. His system was based on the structure or characteristics of organisms. With his new system, Linnaeus founded modern taxonomy. **Taxonomy** is the science of describing, classifying, and naming organisms. ☑

READING CHECK

1. Explain How did Linnaeus classify organisms?

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Critical Thinking

2. Infer What is the main difference between organisms that share many characteristics and organisms that do not?

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CLASSIFICATION TODAY

Taxonomists use an eight-level system to classify living things based on shared characteristics. Scientists also use shared characteristics to describe how closely related living things are.

The more characteristics organisms share, the more closely related they may be. For example, the platypus, brown bear, lion, and house cat are thought to be related because they share many characteristics. These animals all have hair and mammary glands, so they are grouped together as mammals. However, they can also be classified into more specific groups.

BRANCHING DIAGRAMS

Shared characteristics can be shown in a *branching diagram*. Each characteristic on the branching diagram is shared by only the animals above it. The characteristics found higher on the diagram evolved more recently than the characteristics below them.

In the diagram below, all of the animals have hair and mammary glands. However, only the brown bear, lion, and house cat give birth to live young. More recent organisms are at the ends of branches high on the diagram. For example, according to the diagram, the house cat evolved more recently than the platypus. ☑

READING CHECK

3. Identify On a branching diagram, where would you see the characteristics that evolved most recently?

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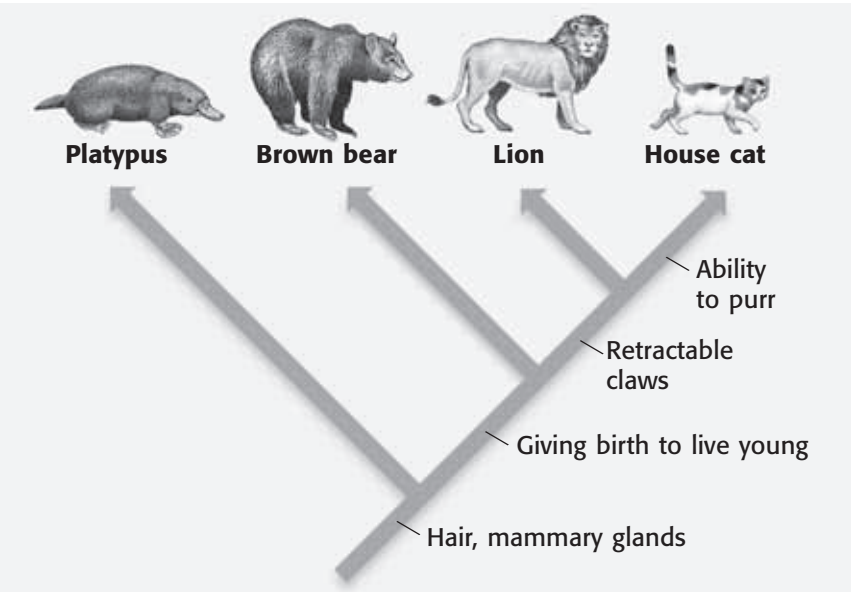

This branching diagram shows the similarities and differences between four kinds of mammals. The bottom of the diagram begins in the past, and the tips of the branches end in the present.

TAKE A LOOK

4. Identify According to the diagram, which organisms evolved before the lion? Circle these organisms.

What Are the Levels of Classification?

Scientists use shared characteristics to group organisms into eight levels of classification. At each level of classification, there are fewer organisms than in the level above. A domain is the largest, most general level of classification. Every living thing is classified into one of three domains.

Species is the smallest level of classification. A species is a group of organisms that can mate and produce fertile offspring. For example, dogs are all one species. They can mate with one another and have fertile offspring. The figure on the next page shows each of the eight levels of classification.

TWO-PART NAMES

We usually call organisms by common names. For example, "cat," "dog," and "human" are all common names. However, people who speak a language other than English have different names for a cat and dog. Sometimes, organisms are even called by different names in English. For example, cougar, mountain lion, and puma are three names for the same animal! ☑

Scientists need to be sure they are all talking about the same organism. They give organisms *scientific names*. Scientific names are the same in all languages. An organism has only one scientific name.

Scientific names are based on the system created by Linnaeus. He gave each kind of organism a two-part name. The first part of the name is the *genus*, and the second part is the *species*. All genus names begin with a capital letter. All species names begin with a lowercase letter. Both words in a scientific name are underlined or italicized. For example, the scientific name for the Asian elephant is *Elephas maximus*. ☑

READING CHECK

5. List What are two problems with common names?

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READING CHECK

6. Identify What are the two parts of a scientific name?

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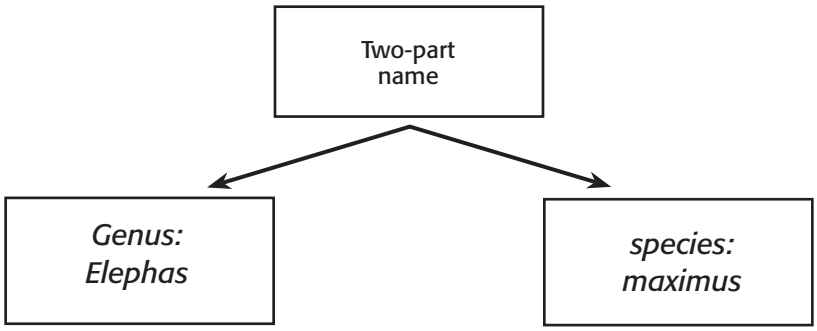

Levels of Classification of the House Cat

Kingdom Animalia: All animals are in the kingdom Animalia.

Phylum Chordata: All animals in the phylum Chordata have a hollow nerve cord. Most have a backbone.

Class Mammalia: Animals in the class Mammalia have a backbone. They also nurse their young.

Order Carnivora: Animals in the order Carnivora have a backbone and nurse their young. They also have special teeth for tearing meat.

Family Felidae: Animals in the family Felidae are cats. They have a backbone, nurse their young, have special teeth for tearing meat, and have retractable claws.

Genus *Felis:* Animals in the genus *Felis* share traits with other animals in the same family. However, these cats cannot roar; they can only purr.

Species *Felis catus*: The species *Felis catus* is the common house cat. The house cat shares traits with all of the organisms in the levels above the species level, but it also has unique traits.

TAKE A LOOK

7. Identify Which level contains organisms that are more closely related: a phylum or a class?

_____

8. Describe How does the number of organisms change from the level of kingdom to the level of species?

_____

_____

_____

What Is a Dichotomous Key?

What could you do if you found an organism that you did not recognize? You could use a special guide called a dichotomous key. A **dichotomous key** is set of paired statements that give descriptions of organisms. These statements let you rule out out certain species based on characteristics of your specimen. There are many dichotomous keys for many different kinds of organisms. You could even make your own!

In a dichotomous key, there are only two choices at each step. To use the key, you start with the first pair of statements. You choose the statement from the pair that describes the organism. At each step, the key may identify the organism or it may direct you to another pair of statements. By working through the statements in order, you can identify the organism.

Critical Thinking

9. Infer Why couldn't one single dichotomous key be used for all of the organisms on Earth?

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Dichotomous Key to 10 Common Mammals in the Eastern United States

1. a. This mammal flies. Its "hand" forms a wing. **b.** This mammal does not fly. It's "hand" does not form a wing.	**little brown bat** **Go to step 2.**
2. a. This mammal has no hair on its tail. **b.** This mammal has hair on its tail.	**Go to step 3.** **Go to step 4.**
3. a. This mammal has a short, naked tail. **b.** This mammal has a long, naked tail.	**eastern mole** **Go to step 5.**
4. a. This mammal has a black mask across its face. **b.** This mammal does not have a black mask across its face.	**raccoon** **Go to step 6.**
5. a. This mammal has a tail that is flat and paddle shaped. **b.** This mammal has a tail that is not flat or paddle shaped.	**beaver** **opossum**
6. a. This mammal is brown and has a white underbelly. **b.** This mammal is not brown and does not have a white underbelly.	**Go to step 7.** **Go to step 8.**
7. a. This mammal has a long, furry tail that is black on the tip. **b.** This mammal has a long tail that has little fur.	**longtail weasel** **white-footed mouse**
8. a. This mammal is black and has a narrow white stripe on its forehead and broad white stripes on its back. **b.** This mammal is not black and does not have white stripes.	**striped skunk** **Go to step 9.**
9. a. This mammal has long ears and a short, cottony tail. **b.** This mammal has short ears and a medium-length tail.	**eastern cottontail** **woodchuck**

TAKE A LOOK

10. Identify Use this dichotomous key to identify the two animals shown.

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Section 1 Review

NSES **LS 5a**

SECTION VOCABULARY

classification the division of organisms into groups, or classes, based on specific characteristics **dichotomous key** an aid that is used to identify organisms and that consists of the answers to a series of questions	**taxonomy** the science of describing, naming, and classifying organisms

1. List Give the eight levels of classification from the largest to the smallest.

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2. Identify According to the branching diagram below, which characteristic do ferns have that mosses do not?

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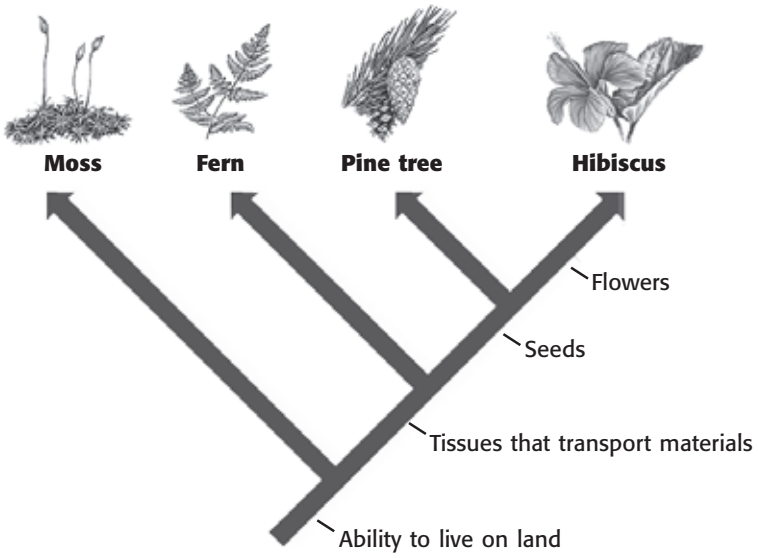

3. Analyze Which species in the diagram above is most similar to the hibiscus? Which is the least similar?

_____

_____

4. Identify What are the two parts of a scientific name?

_____

5. Infer Could you use the dichotomous key in this section to identify a species of lizard? Explain your answer.

_____

_____

10. a meteorite or comet impact
11. about 65.5 million years ago
12. Fossils from the Cenozoic are closer to the surface and easier to find. They have had less time to be destroyed.

Review

1. Precambrian time, Paleozoic era, Mesozoic era, Cenozoic era
2. Paleozoic era
3. The atmosphere contained very little oxygen. Impacts were more common. There was no ozone layer.
4. Through photosynthesis, cyanobacteria increased the oxygen levels in the atmosphere. They also lowered the carbon dioxide levels in the atmosphere.
5. a mass extinction
6. Birds and mammals could probably survive cooler temperatures than reptiles could.
7. Global temperatures drop, and ice sheets and glaciers grow larger.

SECTION 3 HUMANS AND OTHER PRIMATES

1. front-facing eyes and flexible fingers
2. during the early Cenozoic
3. chimpanzee
4. The human spine has an S-shaped curve, and the gorilla's spine has a C-shaped curve.
5. The oldest hominid fossils are found in Africa.
6. Two feet—all hominids are bipedal.
7. australopithecines
8. Possible answers: They were more like humans; they had larger brains, rounder skulls, and flatter faces.
9. They use information from bones.
10. Possible answers: fossils of hominids together with tools, preserved clothing
11. one

Review

1. All hominids are bipedal.
2. between 30 million and 6 million years ago
3. Possible answers: slender bodies, humanlike jaws and teeth, apelike skulls, habitation of forests and grasslands
4. *Homo erectus*: 1.8 million years ago
   Homo habilis: 2.4 million years ago
   Homo sapiens: 150,000 to 100,000 years ago
5. Possible answers: smaller, flatter face; rounder skull; extinction of Neanderthals
6. They have found fossils.
7. Answers will vary but may include: increased ability to reason, ability to make more advanced tools, better ability to adapt to changes, ability to communicate more clearly

Chapter 9 Classification

SECTION 1 SORTING IT ALL OUT

1. based on their structure and characteristics
2. Organisms that share many characteristics are more closely related than those that do not.
3. at the top
4. brown bear and platypus
5. Some organisms have more than one common name; names are different in different languages.
6. genus and species
7. class
8. There are fewer organisms in each level.
9. The key would have to include characteristics of all organisms on Earth. It would be impossibly long.
10. Left to right: long-tailed weasel, woodchuck

Review

1. domain, kingdom, phylum, class, order, family, genus, species
2. Ferns have tissues that transport materials.
3. The pine tree is the most similar; the moss is the least similar.
4. genus and species
5. No, the key in this section could only be used for some mammals. You would need a key that described lizards.

SECTION 2 DOMAINS AND KINGDOMS

1. Eukarya; all multicellular organisms are eukaryotes.
2. Their cell walls and cell membranes are made of different materials. Many can live in extreme environments.
3. No, only some bacteria cause disease. Other bacteria are helpful.
4. Archaea—some can live in extreme environments.
5. Fungi and Animalia—the groups closest to the top evolved most recently.