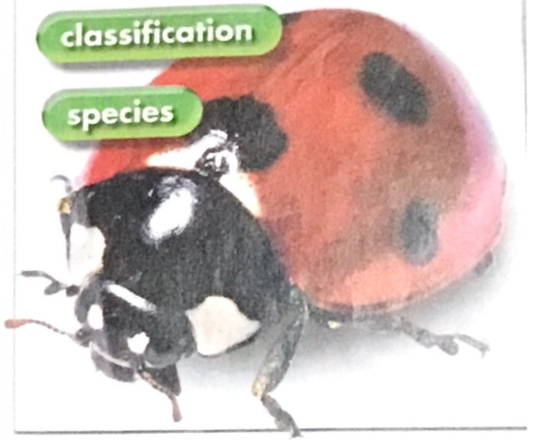
Science Book

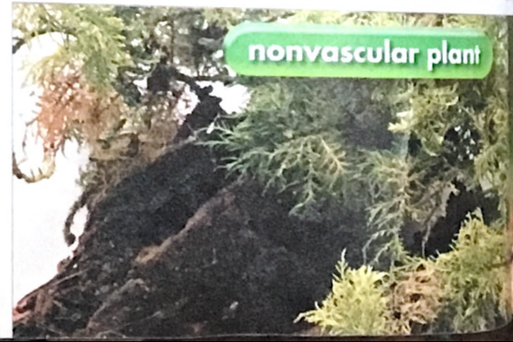
Chapter 1

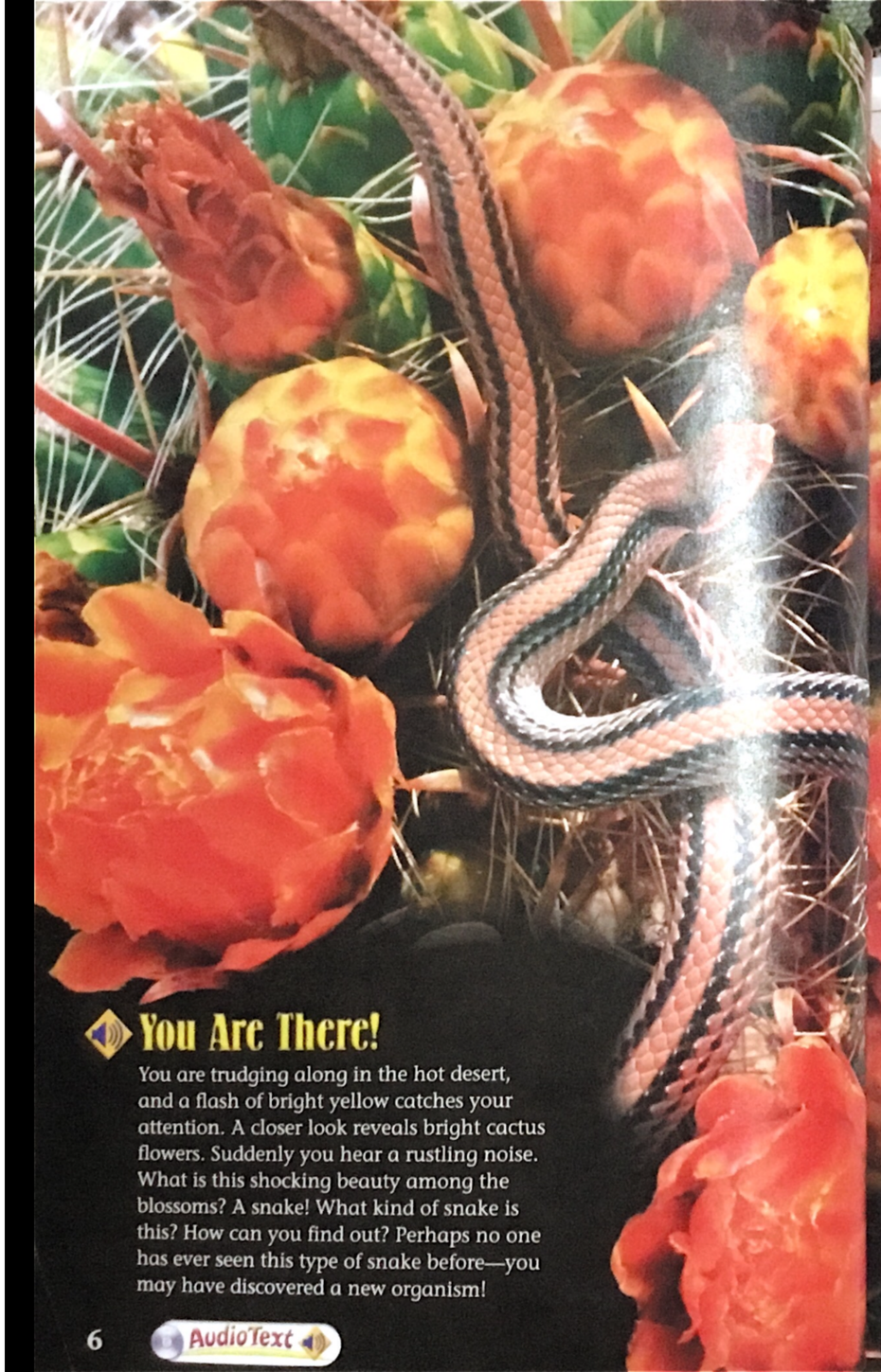
Chapter 1 Vocabulary



biosphere

The part of Earth that can support living things





You Are There!

You are trudging along in the hot desert, and a flash of bright yellow catches your attention. A closer look reveals bright cactus flowers. Suddenly you hear a rustling noise. What is this shocking beauty among the blossoms? A snake! What kind of snake is this? How can you find out? Perhaps no one has ever seen this type of snake before—you may have discovered a new organism!

AudioText

Lesson 1

Where on Earth do organisms live?

Earth is home to millions of different living things. A large number of living things have not yet been discovered.

The Biosphere

You probably know that living things are on almost every type of land, and also deep in the oceans and high in Earth's atmosphere. You may think that the area where things live is large. But if you could shrink Earth to the size of an apple, the area in which things can live would be less than the thickness of the apple's skin.

The part of Earth that can support living things is called the **biosphere.** Living things and their environments make up the biosphere. The biosphere has many environments, such as deserts, oceans, fields, beaches, backyards, and the sidewalks of the busiest streets.

Organisms in the Biosphere

Scientists have discovered and named nearly two million different organisms in Earth's biosphere. Even so, scientists think that millions more organisms have not been discovered.

Why are so many living things still unknown? Some parts of Earth have not been well studied. Earth's deep oceans, polar areas, dense rain forests, and vast deserts are just some of the areas about which we still have a lot to learn. Also, many of Earth's organisms are very tiny and hard to find.

Each organism in the biosphere interacts with other organisms and the environment to produce a web of interactions. Humans, too, play an important part in this changing web. Because all parts of the web are connected, a small change in one part can produce a large change in another part.

1. **Checkpoint** What is the biosphere?
2. **Writing in Science** **Descriptive** Write a paragraph that describes an environment in your area. Name the types of organisms that live there.

These colorful fungi are well suited to grow on the damp forest floor.

Determined dandelions poke through this sidewalk. Your neighborhood is also part of the biosphere.

This blackside hawkfish spends much of its time motionless among the coral. Coral are living organisms. What you usually see are coral shells. The soft, living body of the coral grows inside holes in the shell.

How do the adaptations of this cactus help it survive?

The hard shells of these snails help protect their soft bodies, much the same as your skull protects your brain.

Each type of fish has a mouth designed for its own style of feeding. This parrotfish scrapes algae off the surrounding coral. Can you see how it gets its name?

Variety Among Living Things

If your class wrote the names of all the different organisms each student knows, imagine how long the list would be! But your list would be very small compared to all the known organisms on our planet.

Earth has an amazing variety of living things. These organisms have many different body plans and structures. These differences make it possible for organisms to live in almost every place on Earth.

Look at the plants and animals pictured on these pages. They all are alike in some ways. For example, they are made of cells, they require a source of energy, and they reproduce. But these organisms are also very different. The differences enable each kind of organism to survive in its particular environment.

A characteristic that enables an organism to survive and reproduce in its environment is called an **adaptation.** For example, the spines of the cactus are actually modified leaves. Their shape helps stop water loss from the plant. They also protect the cactus from being eaten. The thick, fleshy stems of a cactus can store a lot of water—an important adaptation for a plant that grows in such a dry environment. As you look at the other pictures on these pages, think about how each organism's adaptations help it survive in its environment.

Groups of Organisms

Although there is great variety among organisms, some groups of organisms share many of the same characteristics. These organisms may be members of the same species. A **species** is a group of very similar organisms whose members can mate with one another and produce offspring that are able to produce offspring. For example, the horses in the photo are members of the same species. Each species has a two-part scientific name. The scientific name for the horse is *Equus caballus*.

Like the horses below, individuals in the same species often don't look exactly alike. In fact, they can be different in many ways, including size, color, and shape. But they do share similar body plans and structures.

As you can see from the chart, the number of species for different kinds of organisms is very large. The chart, however, only includes the species that have been identified and live today. Some scientists think that 99 percent of all species that have ever lived on Earth no longer exist. Most of them have left no fossil evidence that they lived.

Group	Number of Living Species
Vertebrates	**42,000**
Mammals	4,000
Birds	9,000
Reptiles	6,000
Amphibians	4,000
Fish	19,000
Invertebrates	**980,000**
Plants	**248,000**

What characteristics do these horses share?

Lesson Checkpoint

1. Why haven't scientists identified all species that live today or lived in the past?
2. What is a species? What are some ways members of a species differ?
3. Writing in Science **Expository** Choose an organism that you are familiar with. Describe its environment and some of its adaptations. Tell how the organism's adaptations help it survive in its environment.

SciLinks Take It to the Net pearsonsuccessnet.com keyword: adaptation

Lesson 2

How do scientists group organisms?

Scientists sort organisms into groups with similar characteristics. Grouping organisms makes studying them easier. Many scientists today divide all Earth's organisms into six main groups called kingdoms.

How Organisms Are Grouped

With so many kinds of organisms, how can scientists study them? Think about how a music store organizes the CDs it sells. Most music stores group together musicians that share certain characteristics.

A music store may sort the musicians by the type of music they play. In a similar way, scientists group Earth's many organisms by the similarities of their characteristics. These similarities may or may not be easily seen. The grouping of things according to their similarities is called **classification.**

Throughout history, scientists have used different classification systems. Even today, scientists do not agree on a single system. However, most scientists today use a system similar to the one developed by Carolus Linnaeus in the 1700s.

Linnaeus first grouped all organisms into two very large groups, called kingdoms. These were the plant kingdom and the animal kingdom. Then Linnaeus divided each kingdom into smaller groups based on the features of the organisms. The most common classification system scientists use today is based on six kingdoms, which are divided into smaller and smaller groups. Study the pictures below to see how many scientists today divide the animal kingdom.

1. **Checkpoint** Why do scientists classify organisms?
2. **Math in Science** Scientists have discovered about 800,000 species of insects. But scientists think that there may be as many as 10,000,000 insect species. What percentage of the total number of insect species have been discovered?

Organisms in The Six Kingdoms

Linnaeus did not have the scientific tools that scientists have today, such as powerful microscopes to study an organism's cells. As scientists developed new tools for studying organisms, they recognized living things that didn't fit into Linnaeus's two kingdoms—plants and animals. For example, scientists discovered **bacteria**, single-celled organisms that do not have a nucleus. Both plant and animal cells contain a nucleus. This important difference caused many scientists to think that bacteria should be grouped separately from plants or animals. Today most scientists classify organisms according to their cell structure and how they get food and reproduce.

Many scientists put organisms into six kingdoms. Kingdom Archaebacteria includes bacteria that live where most other organisms cannot—in water that has a lot of salt or is very hot. The kingdom Eubacteria includes all other bacteria. They live in almost every environment, including your body. In fact, there are more bacteria in your mouth than there are people on Earth!

Like most fungi, this mold absorbs nutrients from other organisms—in this case a strawberry.

Protists and Fungi

The more than 200,000 known species of protists are mostly one-celled organisms. Some scientists think that this kingdom should be broken into smaller kingdoms. The cells of all protists contain a nucleus.

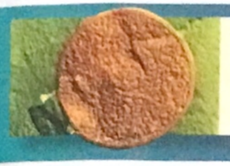
Some protists are like animals. They get energy by eating other organisms. The ameba is an example. Plantlike protists contain chlorophyll that they use to make their own food during photosynthesis. Algae are plantlike protists. Some protists are like fungi. They grow in damp, nutrient-rich environments, where they absorb food through their cell membranes.

Fungi are mostly many-celled organisms that often grow in moist, dark places. Many give off chemicals that break down the organisms on which they grow. In the process, fungi get the nutrients they need. In two types of fungi, mushrooms and molds, cells form threadlike strands called hyphae. The hyphae take in the nutrients for the organism. Hyphae can form thick, large mats. One single mushroom in Oregon has a web of underground hyphae that spreads 2,200 acres. That's the size of 1,665 football fields! Yeast cells, another kind of fungus that you can see in the picture, are not connected by hyphae.

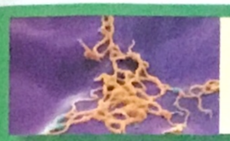
Yeasts are important fungi used in the process of making bread.

Many fungi look like plants and have cells similar to plants. But plant cells contain chlorophyll, which plants use as they make food. Fungi do not have chlorophyll. Instead they take in nutrients from other organisms.

The Six Kingdoms



Archaebacteria
Archaebacteria have been on Earth for billions of years. Some can live in hot springs where water temperatures can reach 110°C. Archaebacteria can grow in water that is ten times saltier than seawater.



Eubacteria
Eubacteria can cause disease, but many are helpful. They make soil fertile and are necessary for making foods such as yogurts and cheeses. Some eubacteria make vitamins in the human body.

Protists
Protists formed much of the gas and oil we use today. Although some protists are harmful, most are helpful. Many are food for other organisms, including Earth's largest organisms—whales.

Fungi
Fungi are used to make foods and medicines such as penicillin. Some fungi can cause human diseases, such as athlete's foot and ringworm. They also cause plant diseases called rusts.

Plants
Without plants, life on Earth would not exist. These trout lilies have roots, stems, and leaves—characteristics of all plants. Like all plants, they can trap the Sun's energy to produce glucose.

Animals
Animals get energy by eating other organisms or their remains. Topi, such as this one, live in Africa. Like all organisms, a topi has special adaptations that make it able to find and eat the type of food it needs.

Lesson Checkpoint

1. What are the six kingdoms of organisms? Give an example of each.
2. **Compare and Contrast** How do fungi differ from plants?
3. Writing in Science **Descriptive** Collect leaves from local trees and write descriptions of them. Use your descriptions and a field guide for trees from your local library or other sources to identify the trees the leaves came from.

Lesson 3

How are plants and animals classified?

Plants can make their own food. Animals get energy from other living things. Organisms in the plant and animal kingdoms can be classified into smaller groups.

Plant Classification

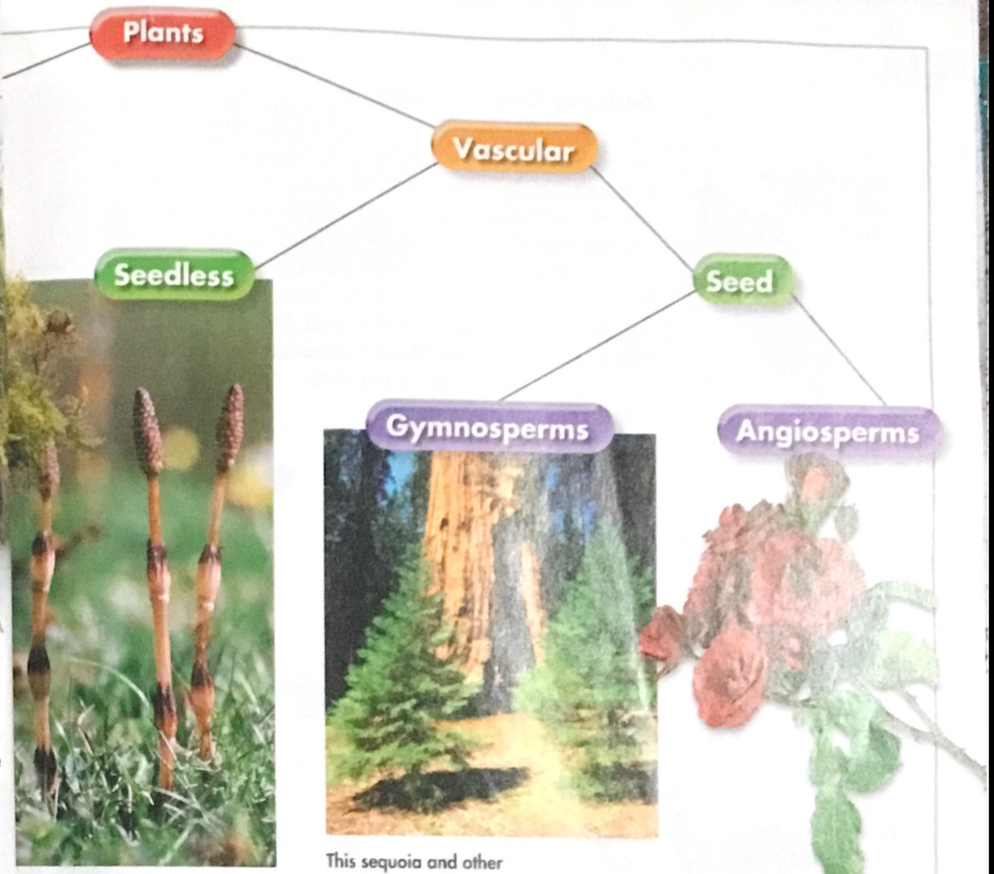
Look around. How many different kinds of plants do you see? Plants come in many colors, sizes, and shapes. Some are as tall as the coast redwoods in California, which can rise 112 meters. Others, like the duckweed that covers many ponds, are tiny—as little as 0.6 millimeters tall. But whether big or small, plants are important to all other living organisms on Earth. Most living things gain energy directly or indirectly from plants. Besides being a source of food, plants also help make Earth's climate stable.

Notice in the diagram on the next page that all plants can be divided into two groups—vascular plants and nonvascular plants. **Vascular plants** have cells that form tubes for carrying water and nutrients throughout the plants. These tubes can carry materials long distances, such as up the trunk of a 112-meter redwood.

Vascular plants can be divided into two groups—plants that make seeds and plants that do not. You probably are most familiar with plants that produce seeds. Some examples of seed plants are tulips, grasses, maple trees, and tomato plants. Some seed plants are gymnosperms, seed plants that do not produce flowers. They include plants that you might call "evergreens," such as pine or fir. Angiosperms are seed plants that produce flowers. Horsetails and ferns are two kinds of seedless plants.

Other plants, called **nonvascular plants,** do not have tubes to carry materials. Instead materials must pass slowly from one cell to another. For this reason, most nonvascular plants, such as mosses, are small. There are at least 232,000 species of vascular plants and about 16,000 species of nonvascular plants.

Materials cannot travel quickly through nonvascular plants, so nonvascular plants such as this moss live in damp places, where water is plentiful.



Horsetails were very common hundreds of millions of years ago. Then they grew as tall as trees. Today only about 35 species can be found, and they are much smaller.

This sequoia and other gymnosperms do not produce flowers. They make seeds in cones.

Roses are flowering plants that produce seeds. Flowering seed plants are the most abundant type of plant today.

1. **Checkpoint** Name the two groups of vascular plants and give examples of each.
2. **Social Studies** in Science The first person to develop a way to classify living things was Aristotle, a Greek scholar. Research Aristotle's classification system. Summarize Aristotle's system in a graphic organizer.

Animal Classification

You probably recognize some of the organisms pictured on these two pages as animals. But you might think that some, such as the peacock worms or sea fans, are plants. The animal kingdom is divided into about 35 different phyla. You can read about six of these phyla on the next page.

Although animals can be very different, they all share certain characteristics. Animals are multicellular organisms, and they cannot make their own food. They get food by eating other organisms. The cells of animals contain a nucleus but do not have a cell wall.

About 95 percent of all animal species on Earth are invertebrates. Invertebrates are animals that do not have a backbone. They range in size from microscopic mites that cover your body to the giant squid, which can be 20 meters long.

Only the phylum Chordates contains animals that are vertebrates, or animals with backbones. Fishes, amphibians, reptiles, birds, and mammals are vertebrates.

How is this squid similar to other mollusks?

The segmented body, jointed legs, and hard outer skeleton make this centipede a member of what phylum?

Lesson Checkpoint

1. Use the information on page 17 to identify one characteristic of each phylum.
2. Give at least three details to support this statement: The plant kingdom includes species with a variety of characteristics.
3. **Compare and Contrast** Use a compare and contrast graphic organizer to show how plants and animals are alike and different.

Animal Phyla

Cnidarians

These beauties on the coral reef are animals, not exotic plants. The fan-shaped creatures are corals called sea fans. The phylum Cnidarians also includes jellyfish and anemones. Cnidarians have a single body opening that is usually surrounded by a ring of stinging cells.

Mollusks

It's hard to believe, but this graceful animal is related to a clam. This nautilus belongs to the invertebrate phylum Mollusks, which includes clams, squid, octopuses, snails, and slugs. All mollusks have soft bodies, and most have hard shells.

Segmented Worms

These feathers are actually the tentacles of peacock worms that live on the ocean floor. The worm uses its tentacles to catch food. Other animals in this phylum are the common earthworm and leeches.

Arthropods

This tarantula spider is not an insect, but it belongs to the same phylum as insects—Arthropods. Other spiders, crabs, millipedes, and centipedes are also arthropods. All arthropods have segmented bodies, jointed appendages, and hard skeletons on the outside of their bodies. Arthropods include almost 85 percent of Earth's animal species.

Echinoderms

Sea stars are echinoderms, animals that live in the ocean and have tough, spiny skins. This phylum also includes brittle stars, sea lilies, sea urchins, and sea cucumbers. Echinoderm bodies have a unique five-part balanced arrangement of parts that makes these animals easy to recognize. They have skeletons made of hard calcium plates inside their bodies.

Chordates

This impressive gorilla belongs to a group of animals called vertebrates, which is one kind of animal in the Chordate phylum. Most vertebrates have a spinal cord and brain. The gorilla is warm-blooded, which means that its body can keep a certain temperature no matter what the outside temperature is. Other vertebrates, such as reptiles, are cold-blooded. Their body temperature changes with that of their environments.

Lab zone

Guided Inquiry

Investigate How can you identify and classify organisms?

An identification key is a tool that helps a user to identify an organism based on its characteristics.

Materials

watermelon

Fuji apple

orange

lemon

banana

How to Read and Construct Keys

Process Skills

Following the steps in an identification key can help you identify and **classify** organisms.

What to Do

1. Study the steps in the first part of How to Read and Construct Keys. Then follow the steps to learn how to use a key to identify the insects below.

Ladybug

flight wings: protected
shape: round

Dragonfly

flight wings: unprotected
wings: stick out from body

June Beetle

flight wings: protected
shape: oblong

Housefly

flight wings: unprotected
wings: point to back end of body

Sample Identification Key

1. a. If the flight wings are protected by a hard covering, go to step 2.
   b. If the flight wings are not protected by a hard covering, go to step 3.
2. a. If the body has a round shape, it is a ladybug.
   b. If the body has an oblong shape, it is a June beetle.
3. a. If the wings stick out from the side of the body, it is a dragonfly.
   b. If the wings point to the back end of the body, it is a housefly.

2. First, think of ways to **classify** the fruits based on their characteristics. Then, study the second part of How to Read and Construct Keys. Use what you learn to help you complete the Fruit Identification Key.

shape: oval
skin: smooth
color: 2-tone, striped

shape: round
skin: smooth
color: solid, red

shape: round
skin: bumpy
color: solid, orange

shape: oval
skin: bumpy
color: solid, yellow

shape: long, narrow
skin: smooth
color: solid, yellow

Fruit Identification Key

1	**a.** If the skin is bumpy, go to step 2.
	b. If the skin is smooth, go to step 3.
2	**a.** If the fruit is round, it is an _____.
	b. If the fruit is oval, it is a _____.
3	**a.** If the color is solid, go to step 4.
	b. If the color is striped, it is a _____.
4	**a.** If the shape is long and narrow, it is a _____.
	b. If the shape is round, it is a _____.

Explain Your Results

1. The key lists one special characteristic for each fruit. How does this help you identify a fruit?
2. **Infer** What other characteristics of fruits could be used in an identification key?

Go Further

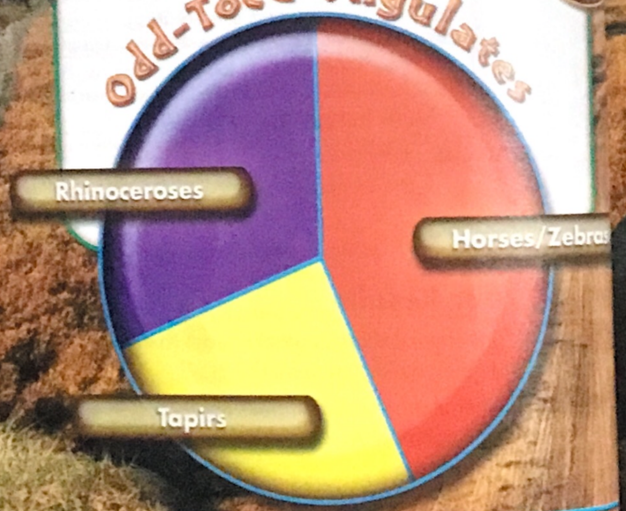
How would you classify another group of things, such as seashells? Design a key that identifies 6 different things in 5 steps.

Math in Science

Analyzing Data About Species

Have you ever seen an ungulate? You have probably seen many of them, even different kinds of ungulates. Ungulates are animals with toes that end in hooves.

Among ungulates there are two orders—those that have an even number of toes and those that have an odd number of toes. The circle graph below shows the number of species within each family of odd-toed ungulates.



Use the circle graph to answer the questions.

1. Are there more species of rhinoceroses or tapirs?
2. Which group has about 25% of the species?
3. If the total number of species is 16, which most likely gives the number of species in each family?
   - A. 8 species of horses and zebras
     4 species of rhinoceroses
     4 species of tapirs
   - B. 5 species of horses and zebras
     5 species of rhinoceroses
     6 species of tapirs
   - C. 7 species of horses and zebras
     5 species of rhinoceroses
     4 species of tapirs
   - D. 9 species of horses and zebras
     4 species of rhinoceroses
     3 species of tapirs

Lab zone

Take-Home Activity

Choose one of the ungulate families shown on the circle graph. Research to find estimates of how many animals for each species in that family are alive today. Write a report or make a bar graph showing what you learned.

Tools Take It to the Net pearsonsuccessnet.com

Chapter 1 Review and Test Prep

Use Vocabulary

adaptation (p. 8)	**fungi** (p. 12)
bacteria (p. 12)	**nonvascular plant** (p. 14)
biosphere (p. 7)	**species** (p. 8)
classification (p. 11)	**vascular plant** (p. 14)

Write the word from the list above that best matches each description.

___ **1.** A group of similar organisms that can mate and reproduce

___ **2.** The grouping of things according to their similarities

___ **3.** Plant with tubes for carrying water and nutrients

___ **4.** The part of Earth that can support living things

___ **5.** Plant that does not have tubes for carrying water and nutrients

___ **6.** Usually many-celled organisms that often grow in moist, dark places

___ **7.** Single-celled organisms that do not have a nucleus

___ **8.** A characteristic that enables an organism to survive and reproduce in its environment

Explain Concepts

9. Why do scientists classify organisms?

10. Explain how mushrooms, molds, and yeasts are alike and different.

11. What percentage of all vertebrate species are mammals? Use the table below to help you answer the question.

Vertebrate Species	
Group	**Number of species**
Fish	19,000
Amphibians	4,000
Reptiles	6,000
Birds	9,000
Mammals	4,000

Process Skills

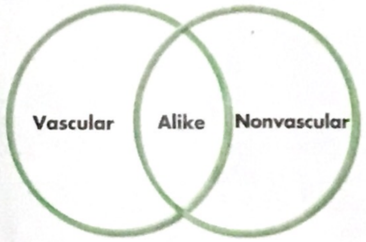
12. **Predict** You find an unknown organism that you think is a plant. You decide to look at some of its cells under the microscope. Predict what substance you will find in the cells if the organism is a plant.

13. **Questions and Hypotheses** You want to grow some mushrooms in the classroom, but you aren't sure what conditions are best for growth. Use what you learned about fungi in this chapter to write a testable hypothesis for finding out

14. **Classify** An organism has the following characteristics: It is made of a single cell with a nucleus, it lives in a pond, and it can make its own food as well as take in nutrients from other organisms. Into what kingdom would you classify this organism? Why?

Compare and Contrast

15. Make a graphic organizer like the one shown below. Fill in the circles to compare and contrast vascular and nonvascular plants.



Test Prep

Choose the letter that best completes the statement or answers the question.

16. Which feature is probably not the same for all organisms in the same species?

Ⓐ how they obtain nutrients
Ⓑ their size
Ⓒ how they reproduce
Ⓓ their body structure

17. Which is an example of a kingdom?

Ⓕ Arthropod
Ⓖ Archaebacteria
Ⓗ Angiosperm
Ⓘ Vertebrate

18. Which is NOT a characteristic of bacteria?

Ⓐ single-celled organisms
Ⓑ cells without a nucleus
Ⓒ found almost everywhere on Earth
Ⓓ cells containing chlorophyll

19. Explain why the answer you chose for Question 18 is the best. For each of the answers that you did not choose, give a reason why it is not the best choice.

20. Writing in Science **Descriptive** Write a paragraph that explains why most nonvascular plants are small.