STUDENT'S NAME:________________________________DATE:________________________________

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Such Diversity!

What groups make up the diversity of animals?

Animals live in nearly every ecosystem on Earth. They are the most physically diverse kingdom of organisms. Some animals have four legs and some have none. Others, like rotifers, are smaller than the period ending this sentence. Blue whales are as big as two school buses! Besides shape and size, animals have body coverings that vary from feathers to hard shells to soft tissues.

One way to categorize animals is by symmetry or body plan. Some animals, such as sponges, are asymmetrical. You cannot draw a straight line to divide its body into equal parts. Animals like the sea anemone have a radial body plan, organized like the spokes of a wheel. Animals such as tortoises have bilateral symmetry with two mirror-image sides. Animals can also be categorized by internal traits, such as whether or not they have a backbone.

Outer Coverings

A ____________________

B ____________________

C ____________________

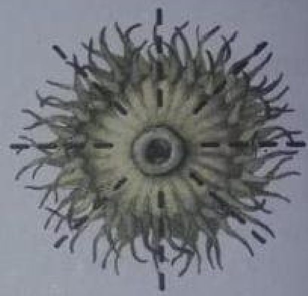
D ____________________

Visualize It!

8 Identify Name the outer covering of each animal on the lines provided.

Body Plans

Asymmetry In asymmetry, the animal is irregular in shape and, therefore, lacks symmetry.



Radial symmetry The bodies of animals with radial symmetry are organized like spokes on a wheel.

Bilateral symmetry Animals with bilateral symmetry have two sides that mirror each other along one plane through the central axis.

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Active Reading **9 Compare** As you read, underline the characteristics of invertebrates and vertebrates.

Invertebrates

An **invertebrate** is an animal without a backbone. In fact, invertebrates do not have any bones. Instead, many invertebrates have a hard, external covering, which supports the body, called an **exoskeleton**. Most animals on Earth—over 95% of all animal species—are invertebrates.

Asexual reproduction is more common in invertebrates than in other animals. For example, the phyla that include animals such as sponges, jellyfish, flatworms, and segmented worms use both sexual and asexual reproduction.

Two special kinds of invertebrates are tunicates and lancelets. Tunicates, such as sea squirts, are small, sac-shaped animals. Lancelets are small, fish-shaped animals as shown below. These invertebrate animals are unique because they share some characteristics with vertebrates.

Vertebrates

Tunicates and lancelets, along with vertebrates, are part of a group of animals called *chordates* (KOHR•dayts). Chordates have four traits at some point in their life: a notochord, a hollow nerve cord, pharyngeal (fuh•RIN•jee•uhl) slits, and a tail.

Animals that have a backbone are called **vertebrates**. The backbone is a part of an endoskeleton. An **endoskeleton** is an internal skeleton that supports an animal's body. The backbone is made up of bones called *vertebrae* (VER•tuh•bray) that protect part of the nervous system. Vertebrates also have a braincase, or skull, that protects their large brains. Almost all vertebrates reproduce sexually. In a few species, a female's egg can develop into an individual without being fertilized.

Visualize It!

10 Apply You may be unfamiliar with the lancelet shown here, but since lancelets are animals, what six things do you know must be true about them?

_____

_____

_____

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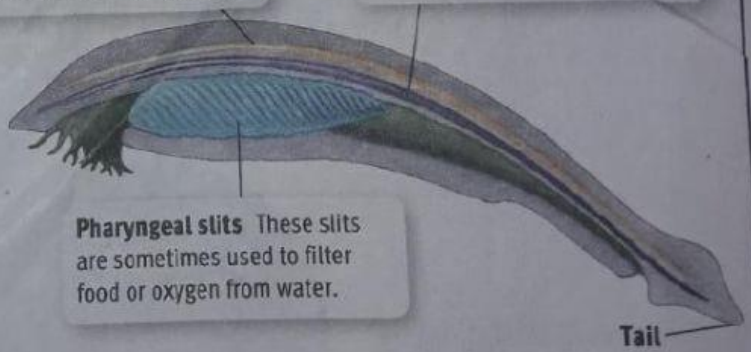

Lancelets burrow their bodies into the sand in shallow seas. A lancelet's notochord supports its body, but it does not have a backbone.

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Soft and Squishy?

What are some different kinds of invertebrates?

Most animal species are invertebrates. The figure shows some of the vast diversity of animals that make up this group. Scientists once used only structural characteristics to classify animals. Today, scientists also use DNA to place animals into groups related by their evolutionary history.

Active Reading **11 Identify** As you read the captions, underline the kind of environment where each group of invertebrates lives.

Invertebrate chordates

Echinoderms (ih•KY•nuh•derms), such as sand dollars, live in oceans. Their endoskeleton has plates with spines, and a water vascular system helps them move. They have a complete digestive system.

Cnidarians (ny•DAIR•ee•uhnz) sting prey with their tentacles. They live in oceans and have two body forms: polyp, like a sea anemone, or medusa, like a jellyfish.

Inquiry

12 Infer Why might stinging tentacles be advantageous for slow-moving predators, such as some cnidarians?

_____

_____

_____

_____

Ctenophores (TEN•uh•fohrz) are also called comb jellies because they use comb-like rows of cilia on their bodies to move around. Comb jellies live only in marine environments.

Porifera includes sponges. They have specialized cells connected by jelly-like material, spend most of their lives fixed to the ocean floor, and filter food particles from water.

Arthropods (ar•THRAHP•uh•duhz) includes animals that live on land and in water. They have jointed appendages and an exoskeleton that protects them from predators and prevents drying out.

Annelida includes segmented worms that live on land and in the ocean. Earthworms break down dead organisms in the soil. Some marine annelids filter food from the water.

Mollusca live in water or on land, and have soft bodies. Many, such as snails and clams, have a protective outer shell and a muscular foot. Squids have complex eyes.

Nematoda are roundworms. They live in fresh water, soil, or other animals. Many of these animals, such as hookworms, are parasites that cause disease.

Think Outside the Book

13 Apply On your way home from school, write a list of all the invertebrate animals you see. Then do research to try to classify each one.

Platyhelminthes (plat•ih•hel•MIN•theez), such as planaria, flukes, and tapeworms, are the simplest worms. Parasitic flatworms have simple tissues and a head with eyespots.

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Some Familiar Faces...

What are some different kinds of vertebrates?

Vertebrates are divided into five main groups: fish, amphibians, reptiles, birds, and mammals. Vertebrates live in water, on land, or in both places. Some eat only plants, only animals, or both plants and animals. Today, both DNA and body form and structure are used to classify vertebrates.

Active Reading **14 Identify** As you read the captions, underline how vertebrates reproduce.

Reptiles have bodies covered with scales or plates, and reproduce by laying eggs. Examples of reptiles include turtles, snakes, lizards, and crocodiles. Reptiles can live nearly anywhere on land because they can lay eggs out of the water. Their eggs are protected from drying out by membranes and shells.

Birds have unique traits such as hollow bones, wings, and feathers. Birds lay eggs and must keep them warm by sitting on them. Most birds can fly, but a few, such as penguins, are flightless.

Mammals all have hair, a jaw, three middle-ear bones, and produce milk. Monotremes are mammals that lay eggs with shells. Marsupials have embryos that develop in a pouch. Placental mammals, such as wolves, beavers, and sloths, have embryos that develop inside their bodies.

Amphibians live both on land and in water. Most amphibians have four limbs. Most live near fresh water because their eggs and larvae need water to survive. Also, all amphibians have thin skins that must be kept moist. Frogs, toads, and salamanders are examples of amphibians.

Fish live in water. Cartilaginous fish, such as sharks and stingrays, have a skeleton made of a flexible cartilage. Most fish are bony fish, so their skeleton is made of bone. Some fish reproduce by laying eggs. Others have embryos that develop inside the female.

15 **Relate** What is the difference between an invertebrate chordate and a vertebrate chordate?

_____

_____

_____

_____

_____

Invertebrate chordates

Vertebrate chordates

Visualize It!

16 **Compare** What are some physical characteristics that scientists use to classify these vertebrates?

_____

_____

_____

_____

_____

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Visual Summary

To complete this summary, fill in the blank with the correct word or phrase. Then, use the key below to check your answers. You can use this page to review the main concepts of the lesson.

Animals are multicellular, reproduce sexually, have specialized parts, move, eat food, and maintain body temperature.

17 An organism that gets energy by eating other organisms is a(n) _____

Invertebrates are animals that have no backbone.

19 An invertebrate that hunts prey with stinging tentacles is a(n) _____

Introduction to Animals

Animals have a diversity of sizes, shapes, and coverings. They can have asymmetry, radial symmetry, or bilateral symmetry.

18 An animal with two identical sides has _____ symmetry.

Vertebrates are animals that have a supportive backbone.

20 A skeleton that is inside the body and attaches to muscles is called a(n) _____

21 **Classify** Think of five different animals and make a list of the characteristics they share.

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Lesson Review

Lesson 5

Vocabulary

Fill in the blank with the term that best completes the following sentence.

1 _____ are organisms with a backbone.

2 Tunicates and lancelets are classified as _____ chordates.

3 The hard external covering of some invertebrates is called an _____.

Key Concepts

4 **Identify** List the six characteristics that animals share.

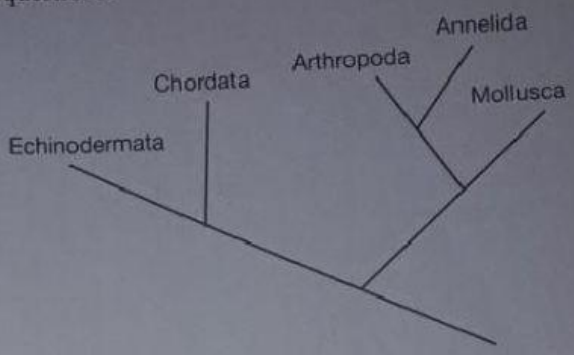
5 **Explain** How do tunicates and lancelets differ from other chordates?

6 **Compare** What is the major difference between invertebrates and vertebrates?

7 **Identify** What are two unique characteristics shared by all birds?

Critical Thinking

Use the diagram to answer the following questions.



8 **Analyze** Which groups shown on the tree include invertebrates? Explain.

9 **Infer** Do any of the groups shown on this tree include vertebrates? Explain.

10 **Conclude** Assess what kinds of traits make invertebrates such a diverse group of animals.