## Chapter Resources

### Invertebrate Animals

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Reproducible Student Pages
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Invertebrate Animals 1
Hands-On Activities
MODELING CEPHALOPOD PROPULSION

Procedure
1. Blow up a balloon. Hold the end closed, but don’t tie it.
2. Let go of the balloon.
3. Repeat steps 1 and 2 three more times.

Data and Observations

Analysis
1. In the Data and Observations section, describe how the balloon moved when you let go.
2. If the balloon models an octopus or squid as it swims through the water, infer how cephalopods can escape from danger.
**Mini LAB**

**Observing Sow Bugs**

**Procedure**

1. Place six *sow bugs* in a clean, flat *container*.
2. Put a damp *sponge* at one end of the container.
3. Cover the container for 60 s. Remove the cover and observe where the sow bugs are. Record your observations in the space below.

**Data and Observations**

__________________________

__________________________

__________________________

**Analysis**

1. What type of habitat do the sow bugs seem to prefer?

__________________________

2. Where do you think you could find sow bugs near your home?

__________________________
Lab Preview

Directions: Answer these questions before you begin the Lab.

1. Why is the animal safety symbol used in this lab?

2. Do you expect to see a nymph stage during this lab? Why or why not?

Many insects go through complete metamorphosis during their life cycles. Chemicals that are secreted by the body of the animal control the changes. How different are the body forms of the four stages of metamorphosis?

Real-World Question

What do the stages of metamorphosis look like for a mealworm?

Safety Precautions

WARNING: Be careful when working with animals. Never touch your face during the lab. Wash your hands thoroughly after completing the lab.

Materials

- large-mouth jar or old fish bowl
- bran or oatmeal
- dried bread or cookie crumbs mixed with flour
- slice of apple or carrot
- paper towel
- cheesecloth
- mealworms
- rubber band

Goals

- Observe metamorphosis of mealworms.
- Compare the physical appearance of the mealworms at each stage of metamorphosis.

Procedure

1. Set up a habitat for the mealworms by placing a 1-cm layer of bran or oatmeal on the bottom of the jar. Add a 1-cm layer of dried bread or cookie crumbs mixed with flour. Then add another layer of bran or oatmeal.
2. Add a slice of apple or carrot as a source of moisture. Replace the apple or carrot daily.
3. Place 20 to 30 mealworms in the jar. Add a piece of crumpled paper towel.
4. Cover the jar with a piece of cheesecloth. Use the rubber band to secure the cloth to the jar.
5. Observe the mealworms daily for two to three weeks. Record daily observations on a separate piece of paper.
Conclude and Apply
1. Draw and describe the mealworms’ metamorphosis to adults under Data and Observations.
2. Describe some of the advantages of an insect’s young being different from the adults.

3. Infer where you might find mealworms or adult darkling beetles in your house.

Communicating Your Data
Draw a cartoon showing the different stages of metamorphosis from mealworm to adult darkling beetle. For more help, refer to the Science Skill Handbook.
Design Your Own
Garbage-Eating Worms

Lab Preview
Directions: Answer these questions before you begin the Lab.

1. What safety symbols are associated with this lab?

2. How do earthworms use the soil they live in?

Real-World Question
How does the presence of earthworms change the condition of the soil?

Form a Hypothesis
Based on your reading and observations, state a hypothesis about how earthworms might improve the conditions of soil.

Goals
- Design an experiment that compares the condition of soil in two environments—one with earthworms and one without.
- Observe the change in soil conditions for two weeks.

Safety Precautions
WARNING: Be careful when working with live animals. Always keep your hands wet when handling earthworms. Don’t touch your face during the lab. Wash your hands thoroughly after the lab.

Possible Materials
- worms (red wigglers)
- 4-L plastic containers with drainage holes (2)
- soil (7 L)
- shredded newspaper
- spray bottle
- chopped food scraps including fruit and vegetable peels, pulverized eggshells, tea bags, and coffee grounds (Avoid meat and fat scraps.)

Test Your Hypothesis
Make a Plan
1. As a group, agree upon a hypothesis and decide how you will test it. Identify what results will support the hypothesis.
2. List the steps you will need to take to test your hypothesis. Be specific. Describe exactly what you will do in each step. List your materials.
3. Prepare a data table on a separate piece of paper to record your observations.
4. Read over the entire experiment to make sure all the steps are in a logical order.

5. Identify all constants, variables, and controls of the experiment.

Follow Your Plan
1. Make sure your teacher approves your plan before you start.

Analyze Your Data
1. Compare the changes in the two sets of soil samples.

2. Compare your results with those of other groups.

3. Identify the control in this experiment.

4. What were your variables?

Conclude and Apply
1. Explain whether the results support your hypothesis.

2. Describe what effect you think rain would have on the soil and worms.

Communicating Your Data
Write an informational pamphlet on how to use worms to improve garden soil. Include diagrams and a step-by-step procedure.
Laboratory Activity

Earthworm Anatomy

The earthworm is an invertebrate that has a segmented body and specialized body parts. Oxygen from the air moves into its body through its moist skin. Carbon dioxide moves out of its body through the skin. The earthworm has a closed circulatory system with five heart-like structures, called aortic arches. All the worms blood is contained in blood vessels. The segmented body plan makes an earthworm’s anatomy easy to study.

Strategy
You will observe the external parts of an earthworm.
You will dissect an earthworm.
You will identify the internal organs and organ systems of an earthworm.

Materials
- dissecting pan with wax
- earthworm (preserved)
- hand lens
- dissecting pins
- dissecting scissors
- dissecting needle

Procedure

Part A—External Structure
1. Place a preserved earthworm lengthwise in the dissecting pan with the darker side up. This is the dorsal or top side. **WARNING:** Wash hands thoroughly after handling worm.
2. Examine the external structure and identify the parts shown in Figure 1.
3. Run your fingers lightly across the top, bottom, and both sides of the earthworm. The bristles that you feel are called setae.
4. Examine the setae with a hand lens. Estimate the number of setae on each segment.
5. Locate the mouth. The part that hangs over the mouth is called the prostonium.
6. Find the thickened band circling the body. This is the clitellum. It forms a cocoon for depositing the eggs during reproduction.
7. Locate the anus (see Figure 1).

Figure 1

![Diagram of earthworm anatomy](image)
Part B—Internal Structure

Directions: Read the instructions carefully and study Figures 1 and 2 before you begin to dissect. Identify structures to be dissected before you begin.

WARNING: Always be careful with all sharp objects.

1. With the dorsal side up, pin both ends of the worm to the wax in the dissecting pan.
2. With scissors, begin about 2 cm in front of the clitellum and cut forward through the body wall just to the left of the dorsal blood vessel. Use care to cut through only the body wall. See Figure 3.
3. Separate the edges of the cut. Observe the space between the body wall and the intestine. This is the body cavity or coelom.
4. Observe the partitions between the segments. Use a dissecting needle to break these partitions. Then pin down the sides of the body wall.
5. Observe the tubelike digestive system. Identify the pharynx in segments 4 and 5. It is used to swallow food.
6. Follow the esophagus to segment 15.
7. Locate the large thin-walled crop. Food is stored in the crop until it is digested.
8. Locate the gizzard just behind the crop. Food is broken down by a grinding action in the gizzard here. The intestine extends from the gizzard to the anus. Digestion of food occurs in the intestine.
9. Each earthworm has both male and female reproductive organs. Alongside the esophagus in segments 9 and 10 are two pairs of seminal receptacles. The seminal receptacles receive sperm from another worm. In front of the receptacles in segments 10, 11, and 12 are seminal vesicles where sperm is stored.
10. Use a hand lens to find the small ovaries where eggs are produced. The ovaries are located under the seminal vesicles.
11. Locate the dorsal blood vessel. It carries blood to the heart-like structure, called the aortic arches. Carefully remove the white seminal vesicles from the left side of the body. Find the aortic arches, which branch from the dorsal blood vessel and pass around the esophagus.
These arches join the ventral blood vessel below the esophagus. These aortic arches contract and function as hearts. The ventral blood vessel carries blood toward the skin and intestine.

12. Use a hand lens to observe the small white tubes along each side of the digestive tract. These tubes are excretory organs called nephridia. They are found in all segments except the first three and the last. They remove the wastes from the body.

13. Find the double nerve ganglion, or brain, of the earthworm near segment 2. The brain connects with the ventral nerve cord, which extends the length of the body. The nerve cord is a white line on the ventral body wall.

14. WARNING: Give all dissected materials to your teacher for disposal. Always wash your hands after a dissection procedure.

Data and Observations
List the organs found in each system in Table 1.

Table 1

<table>
<thead>
<tr>
<th>System</th>
<th>Organs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Digestive</td>
<td></td>
</tr>
<tr>
<td>2. Reproductive</td>
<td></td>
</tr>
<tr>
<td>3. Circulatory</td>
<td></td>
</tr>
<tr>
<td>4. Excretory</td>
<td></td>
</tr>
<tr>
<td>5. Nervous</td>
<td></td>
</tr>
</tbody>
</table>

Questions and Conclusions
1. How many setae were located on each segment?

2. What is the function of the setae?

3. Describe the function of the following organs:
   a. pharynx
   b. crop
   c. gizzard
Laboratory Activity 1 (continued)

d. aortic arches

e. dorsal blood vessel

f. ventral blood vessel

g. clitellum

h. nephridia

i. seminal vesicles

j. intestine

k. ganglia

4. Why is it said that the earthworm has a “closed” circulatory system?

Strategy Check

Can you dissect an earthworm?

Can you identify the external parts of the earthworm?

Can you identify the internal organs and organ systems of an earthworm?
Grasshopper Anatomy

A grasshopper is well adapted to its way of life. Its features are representative of the insect group. A grasshopper is large enough that its features can be seen easily.

Strategy
You will observe and identify the specialized body parts of the grasshopper. You will examine and identify the internal structure of the grasshopper.

Materials
- dissecting pan
- grasshopper (preserved)
- hand lens
- forceps
- dissecting scissors

Procedure

Part A—External Structure
1. Place the grasshopper in the dissecting pan. Locate the head, thorax, and abdomen. (See Figure 1.) Use your hand lens to observe the grasshopper carefully. As you observe, record your data in Data and Observations.
2. Observe the parts of the head. The grasshopper has two compound eyes and three simple eyes. The sensory parts located on the head are antennae.
3. Identify the mouth parts. (Refer to Figure 2.) With your forceps, remove the parts. The labrum is the hinged upper lip that is used to hold food. The mandibles are crushing jaws. The maxillae are used to chew and taste food. The labium is the broad, fat lower lip used to hold food while it is being chewed.
4. Locate the eardrums or tympana, small drum-shaped structures on either side of the thorax.
5. All insects have six legs. In the grasshopper, the front pair is used for walking, climbing, and holding food. The middle legs are used for walking and climbing. The hind legs are large and enable the grasshopper to jump.
6. Locate the two pairs of wings.
7. Use the hand lens to look at the tiny openings along the abdomen. These are breathing pores called spiracles through which oxygen enters and carbon dioxide leaves.
8. A female grasshopper has a much longer abdomen than a male. It ends in a four-pointed tip, called an ovipositor, through which eggs are laid.

Figure 1
- Antenna
  - Simple eye
  - Compound eye
- Tympanum (eardrum)
- Forewing
- Foreleg
- Spiracles
- Ovipositor

Figure 2
- Mandible (jaw)
- Maxillae
- Labium (lower lip)
- Labrum (upper lip)
Part B—Internal Structure

1. Remove the three left legs. Insert the point of your scissors under the top surface of the last segment of the abdomen. Make a cut to the left of the mid-dorsal line. Be careful not to cut the organs underneath. In front of the thorax, cut down the left side to the bottom of the grasshopper. Cut down between the next to the last and last abdominal segments. **WARNING:** Always be careful with all sharp objects.

2. Use your forceps to pull down the left side. Locate the large dorsal blood vessel.

3. Use your scissors to cut the muscles close to the exoskeleton. Locate the finely branched trachea leading to the spiracles.

4. Cut through the exoskeleton over the top of the head between the left antenna and left eye to the mouth. Remove the exoskeleton on the left side of the head. Find the dorsal ganglion or brain.

5. Cut away the tissue to show the digestive system. Refer to Figure 3 and identify the mouth, esophagus, crop, gizzard, and stomach. Note that the gizzard and stomach are separated by a narrow place. The digestive glands, called gastric caeca, that secrete enzymes into the stomach are attached here.

6. Another narrow place separates the stomach from the intestine. Malpighian tubes, which collect wastes from the blood, are located here.

7. Observe the colon, which enlarges to form the rectum. Wastes collect here before passing out the anus.

8. In the female, the ovary is located above the intestines. In the male, a series of whitish tubes, the testes, are located above the intestine.

9. **WARNING:** Give all dissected materials to your teacher for disposal. Always wash your hands after a dissection procedure.
Data and Observations

1. What are the three sections of a grasshopper’s body?

2. Record your observations of grasshopper body parts in Table 1. Complete the table by listing the function of each part.

Table 1

<table>
<thead>
<tr>
<th>Body part</th>
<th>How many?</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Eyes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Antennae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Labrum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Mandibles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Maxillae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Labium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Eardrums</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Legs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Wings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Spiracles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Ovipositor (if female)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Digestive glands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Tubules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Rectum</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Questions and Conclusions

1. How is a grasshopper’s mouth adapted for plant eating?

2. What is the difference between a grasshopper’s skeleton and yours?
Laboratory Activity 2 (continued)

3. How is a grasshopper’s digestive system different from yours?

4. How does a grasshopper’s legs help it to survive?

5. To which animal group does the grasshopper belong?

6. How does a grasshopper breathe?

Strategy Check

_____ Did you observe specialized parts of the grasshopper?

_____ Can you identify the internal and external parts of the grasshopper?
Hands-On Activities

Directions: Use this page to label your Foldable at the beginning of the chapter.

Land Invertebrates

Water Invertebrates

Both

Characteristics

Characteristics

Characteristics

have segmented bodies

have a shell

can be parasitic

can be filter feeders

have no internal skeleton

cannot make their own food

reproduce asexually and sexually

have segmented bodies

have no internal skeleton

cannot make their own food
Meeting Individual Needs
Overview
Invertebrate Animals

Directions: Use the following terms to complete this concept map about invertebrates.

- earthworms
- sea cucumbers
- cephalopods
- insects
- leeches
- arachnids
- centipedes
- medusa bodies
- bivalves

sponges

polyp bodies

1. cnidarians

2. segmented worms

3. marine worms

4. gastropods

5. mollusks

6. crustaceans

7. millipedes

8. sea stars

9. echinoderms

Meeting Individual Needs
Section 1 = What is an animal?
Section 2 = Sponges, Cnidarians, Flatworms, and Roundworms

Directions: Use the following terms to complete the crossword puzzle.

- stinging cells
- parasites
- invertebrates
- sponges
- sucker
- cnidarians
- medusa
- sea stars

Across
3. Animals with no backbone
5. Animals that live on or in another animal
7. Echinoderms that can regenerate damaged parts
8. Structures used by jellyfish to catch or stun prey

Down
1. Hydras and corals belong to this animal group.
2. Another name for the bell-shaped body of a jellyfish
4. Animals that stay in one place and filter food from water
6. The part of a tapeworm that helps it hold onto its host
Section 3 • Mollusks and Segmented Worms

Section 4 • Arthropods and Echinoderms

Directions: Draw a line from the picture to its animal group. There are two pictures for each group.

1. [Picture]  
   mollusk

2. [Picture]  
   segmented worm

3. [Picture]  
   arthropod

4. [Picture]  
   echinoderm
Key Terms

Invertebrate Animals

Directions: In the space at the left, write the letter of the term that correctly completes each sentence.

1. An invertebrate is an animal with no ______.
   a. appendages  
   b. backbone

2. A ______ is the vase-shaped body of a cnidarian.
   a. polyp  
   b. medusa

3. A ______ is an organism that depends on a host for food and a place to live.
   a. parasite  
   b. bivalve

4. In a(n) ______ circulatory system, blood is carried within vessels.
   a. open  
   b. closed

5. A ______ is the scratchy tonguelike organ of many mollusks.
   a. gill  
   b. radula

6. The lightweight body covering that protects and supports arthropods is an ______.
   a. exoskeleton  
   b. endoskeleton

7. ______ are structures, such as claws or legs, that grow from the body.
   a. Antennae  
   b. Appendages

8. The change in body form that insects undergo as they mature is ______.
   a. metamorphosis  
   b. passive feeding

9. A ______ is a soft-bodied invertebrate that has a mantle, a muscular foot, and usually a shell.
   a. cnidarian  
   b. mollusk

10. Water mollusks use ______ to breathe by exchanging carbon dioxide for oxygen.
    a. gills  
    b. symmetry
Sinopsis
Animales invertebrados

Instrucciones: Usa los siguientes términos para completar este mapa de conceptos sobre invertebrados.

- esponjas
- cuerpos de pópilos

1. celentéreos
2. gusanos segmentados
3. gusanos marinos

- moluscos
- gasterópodos
- artrópodos
- milpies
- estrellas marinas

4. arácnidos
5. ciempiés
6. cuerpos de medusa
7. crustáceos
8. bivalvos

Nombre Fecha Clase


**Sección 1 - Qué es un animal?**

**Sección 2 - Esponjas, celentéreos, platelmintos y ascárides**

**Instrucciones:** Utiliza la siguiente lista de términos para completar el crucigrama.

<table>
<thead>
<tr>
<th>Células urticantes</th>
<th>Parásitos</th>
<th>Invertebrados</th>
<th>Esponjas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventosa</td>
<td>Cnidarios</td>
<td>Medusa</td>
<td>Estrellas marinas</td>
</tr>
</tbody>
</table>

**Horizontales**

1. Estructuras que usan las aguamalas para atrapar presas.
2. Parásitos invertebrados.
3. Parte de la solitaria que le ayuda a adherirse a su huésped.
4. Equinodermos que pueden regenerar partes lesionadas.
5. Animales que permanecen en el mismo lugar y filtran alimento del agua.

**Verticales**

1. Las hidras y los corales pertenecen a este grupo de animales.
2. Animales sin columna vertebral.
3. Animales que viven sobre o dentro de otro animal.
4. Otro nombre para la forma de campana de una aguamala.
Sección 3 • Moluscos y gusanos segmentados
Sección 4 • Artrópodos y equinodermos

Instrucciones: Traza una línea desde el animal hasta el grupo al que pertenece. Hay dos dibujos para cada grupo.

1. molusco
2. gusano segmentado
3. artrópodo
4. equinodermo
Instrucciones: En el espacio de la izquierda, escribe la letra del término que complete correctamente la oración.

_____ 1. Un animal invertebrado es aquel que no tiene ______.
   a. apéndices               b. columna vertebral

_____ 2. ______ es la forma de florero del cuerpo de los celentéreos.
   a. Un pólipo               b. Una medusa

_____ 3. Un(a) ______ es un organismo que depende de un huésped para su alimentación y refugio.
   a. parásito               b. bivalvo

_____ 4. En un sistema circulatorio ______, la sangre fluye dentro de los vasos.
   a. abierto                b. cerrado

_____ 5. La(s) ______ es(son) el órgano parecido a una lengua raspante de muchos moluscos.
   a. branquias              b. rádula

_____ 6. La cubierta liviana del cuerpo que protege y sostiene los artrópodos se llama ______.
   a. exoesqueleto           b. endoesqueleto

_____ 7. ______ son estructuras, como las pezuñas y las garras, que crecen del cuerpo.
   a. Las antenas             b. Los apéndices

_____ 8. El cambio en forma corporal que ocurre en un insecto al madurar se llama ______.
   a. metamorfosis           b. alimentación pasiva

_____ 9. Un ______ es un invertebrado de cuerpo blando que tiene un manto, una pata muscular y, generalmente, una concha.
   a. equinodermo            b. molusco

_____ 10. Los moluscos acuáticos tienen ______ para respirar intercambiando dióxido de carbono por oxígeno.
    a. branquias               b. simetría
What is an animal?

Directions: Each statement is an example of a characteristic shared by most or all animals. Write the characteristic on the line provided.

1. Sponges filter microscopic organisms from the water for food.

2. Enzymes are secreted in an earthworm’s digestive tract.

3. Gorillas travel many miles in search of food.

4. The soft body of a mollusk has many different types of tissue.

5. Each cell of a jellyfish has a nucleus surrounded by a membrane.

Directions: Describe each animal shown below by using one of the following terms: radial symmetry, bilateral symmetry, or no symmetry.

6. ____________________________

7. ____________________________

8. ____________________________

9. ____________________________

10. ____________________________

11. ____________________________
Sponges, Cnidarians, Flatworms, and Roundworms

Directions: Define the underlined term on the lines provided.

1. Sponges are **sessile** animals.

2. Sponges are **filter feeders**.

3. Spicules support and protect a sponge’s body.

Directions: Study the following diagram. Fill in the blanks with the correct terms.

- Male
- Medusae
- Female

4. 5. 

6. reproduction

7. 

8. 9. reproduction

Directions: Answer the following questions on the lines provided.

10. The word *cnidarian* means “stinging cells.” Why is this a good name for this group?

11. Explain the difference between a free-living and a parasitic flatworm.

12. Describe a roundworm.
**Mollusks and Segmented Worms**

**Directions:** Answer the following questions on the lines provided.

1. Define the following groups of animals and give an example of each.
   
   a. mollusks ____________________________
   
   b. gastropods __________________________
   
   c. bivalves ____________________________
   
   d. cephalopods _________________________

2. What is the difference between an open and a closed circulatory system?
   
   a. open circulatory system __________________________
   
   b. closed circulatory system _______________________

3. Many mollusks gather food with a radula, but bivalves are filter-feeders. Explain the difference between the two types of feeding.

   __________________________________________

4. Describe the way in which squids and octopuses move through the water.

   __________________________________________

5. Why is the segmented structure of segmented worms important?

   __________________________________________

6. Describe the following structures in earthworms.
   
   a. coelom ____________________________
   
   b. setae ____________________________

7. What is unique about the earthworm’s diet and skin?

   __________________________________________

8. Leeches are parasites. How do they eat?

   __________________________________________

9. How are marine worms different from earthworms?

   __________________________________________
Arthropods and Echinoderms

Directions: Answer the following questions on the lines provided.

1. Arthropods have appendages instead of setae. What different kinds of appendages do they have?

2. What is the main difference between centipedes and millipedes?

3. What is attached to an insect's thorax?

4. In insects, what does the blood transport? What is not transported by the blood?

5. What are the four stages of complete metamorphosis?

6. If spiders cannot chew, how can they eat?

7. Why is a large heavy exoskeleton less limiting for arthropods that live in water?

8. Describe how a sea star feeds on a clam.

9. What happens if a sea star loses an arm?

10. Why are echinoderms important to the marine environment?

11. What functions do tube feet serve in an echinoderm such as a sea star?
Looking at Animal Characteristics

Directions: Your textbook names five characteristics that all animals have in common. Prove to yourself that together, these characteristics define only animals. First, briefly write a description of each characteristic. Then, fill in the table of living things by writing yes or no in each box, depending on whether that living thing has that characteristic.

<table>
<thead>
<tr>
<th>Characteristic 1:</th>
<th>Characteristic 2:</th>
<th>Characteristic 3:</th>
<th>Characteristic 4:</th>
<th>Characteristic 5:</th>
</tr>
</thead>
</table>
1. kelp
2. bacterium
3. bird
4. dog
5. fern
6. flatworm
7. insect
8. jellyfish
9. lobster
10. mushroom
11. paramecium
12. snail
13. tree

Note: When completing the table below, you may want to look at other chapters in your textbook or consult an encyclopedia.

### Table 1

<table>
<thead>
<tr>
<th>Living thing</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. kelp</td>
<td></td>
</tr>
<tr>
<td>7. bacterium</td>
<td></td>
</tr>
<tr>
<td>8. bird</td>
<td></td>
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<tr>
<td>9. dog</td>
<td></td>
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<tr>
<td>10. fern</td>
<td></td>
</tr>
<tr>
<td>11. fish</td>
<td></td>
</tr>
<tr>
<td>12. flatworm</td>
<td></td>
</tr>
<tr>
<td>13. insect</td>
<td></td>
</tr>
<tr>
<td>14. jellyfish</td>
<td></td>
</tr>
<tr>
<td>15. lobster</td>
<td></td>
</tr>
<tr>
<td>16. mushroom</td>
<td></td>
</tr>
<tr>
<td>17. paramecium</td>
<td></td>
</tr>
<tr>
<td>18. snail</td>
<td></td>
</tr>
<tr>
<td>19. tree</td>
<td></td>
</tr>
</tbody>
</table>

20. Which organisms are animals? ____________________________
Planarian Regeneration

Materials
large wide-mouth jar
magnifying glass
pond water
art knife
spring water at room temperature
cooked egg yolks or raw meat

Procedure
1. Planarians can be found near the shoreline of ponds that have decaying leaves and other debris. Fill your wide-mouth jar with this shoreline material and a few inches of pond water.
2. Let the jar sit overnight. In the morning, planarians will likely be clinging to the side of the jar. Planarians look like small, dark, jelly-like blobs. Remove much of the shoreline material, and add some more pond water.
3. Using the magnifying glass and art knife, carefully cut two planarians in half as shown above.

WARNING: The art knife is very sharp. Be careful when using sharp objects. Wash your hands thoroughly after handling the worms. Return cut planarians to the jar.
4. Once a day, feed the planarians some egg yolk or raw meat. After about an hour, remove the remaining yolk or meat, drain as much of the water away as possible, and replace with fresh pond water or bottled spring water.
5. Observe the planarian parts for a week and then return them to the pond.

Data and Observations
What do your planarian parts look like after a week?

Conclude and Apply
1. Why did the planarian parts change?

2. How would regeneration affect the planarian population? Explain your answer.

Meeting Individual Needs

Enrichment

Invertebrate Animals
Snail Behavior

As you know from your textbook, snails are a type of mollusk in the class known as gastropods. Snails like damp, dark environments and can be found under leaves and near rotting logs. When searching for snails, go to a natural area in a park or woodlot. Use gloves when picking up snails. Handle them gently.

Materials
old aquarium or wide-mouthed jar
snails
glass top for aquarium or jar lid with holes
fresh lettuce

Procedure
1. Search for snails near a rotting log. Turn over moist logs, boards, or leaves.
2. Place the snails into an aquarium or jar along with woodland materials. Punch holes in the top of the jar for air, or place a glass top over the aquarium leaving a small opening for air.
3. Feed the snails fresh lettuce every day.
4. Observe the snails eating.
5. Watch for snail activity during daytime hours and nighttime hours.
6. For one 24-hour period, place the jar or aquarium into a dark closet during the day and shine a strong light onto the environment all night long. Observe the snails' activity.
7. When your observations are completed, return the snails to their natural environments.

Data and Observations
1. How fast does a snail move? _______________________________________________________
2. How long does it take a snail to eat a leaf of lettuce? ___________________________________
3. Were the snails more active during the day or night? ___________________________________
4. What happened when you changed the pattern of light? _________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
5. From your observations, would you conclude that snails in their natural environment are more active at night or during the day? ______________________________________
Crickets

A common arthropod of the insect class is the cricket, a small bug with antennae, wings, and powerful hind legs. The word cricket comes from a French word meaning “to click or creak.” Anyone who has had a cricket in the house has heard their noise-making abilities. Crickets can easily be found from spring through fall in fields and vacant lots. They can also be purchased at pet stores or at bait stores that sell fishing supplies.

Materials
- cricket(s)
- scissors
- indoor thermometer
- wide-mouthed, clear glass jar
- rubber band
- clock with second hand
- old nylon stocking

Procedure
1. Catch a cricket in a field or buy one from a pet or bait store.
2. Place the cricket in the jar. Cut a top for the jar from the old nylon stocking. Secure the cover with the rubber band.
3. Observe the cricket’s body parts and make a sketch of the arthropod. Label your sketch with these terms: head, thorax, abdomen.
4. Place an indoor thermometer near the jar. Record the temperature of the room.
5. Wait until the cricket is chirping regularly.

Data and Observations

Directions: Make a sketch of your cricket in the space below. Label the parts.

Conclude and Apply
1. How did the sum of the number of chirps compare with the temperature reading?

2. What happened to the number of chirps when you moved the jar to a warmer place?

3. How does temperature affect cricket activity?
Invertebrate Animals

Section 1  What is an animal?

A. Animal characteristics—__________ features
   1. Composed of many eukaryotic _______, must find and digest their own _________, and usually can _________
   2. ____________—arrangement of parts
      a. ____________ symmetry—parts are arranged in a circle around a central point
      b. ____________ symmetry—parts are mirror images of each other
      c. ____________—no definite shape

B. Animal classification—placed into ___________ groups
   1. ____________—animals with a backbone
   2. ____________—majority of animals which lack a backbone

Section 2  Sponges, Cnidarians, Flatworms, and Roundworms

A. Sponges—don’t move to find food since adults are ___________ or stuck in one place
   1. Filter ____________—filter food out of water that flows through body
      a. __________ let water into central cavity.
      b. __________ keep water moving through sponge.
   2. Soft sponge bodies are protected by sharp ___________ or rubbery ___________.
   3. Sponges ____________ sexually and asexually.
      a. In __________ reproduction a new sponge grows from pieces of an old sponge
      b. Most sexually reproducing sponges are ____________, producing both eggs and sperm.

B. ____________—have tentacles and hollow bodies
   1. Two __________ shapes
      a. __________ cnidarians are usually sessile and have vase-shaped bodies
      b. A __________ body is free-swimming and bell-shaped
   2. Cnidarians ____________ both sexually and asexually.
      a. Polyp forms reproduce asexually by ____________.
      b. Some polyps also reproduce sexually by releasing _________ or _________.
      c. Medusa forms have a _________-stage life cycle in which they reproduce both sexually and asexually.
C. Flatworms—_________ for their food
   1. Have long, flattened bodies with _________ and systems
   2. Most are ______________ living off or in a host.
   3. _____________—a type of flatworm
      a. Lack a _____________ system and absorb nutrients from the host’s intestines
      b. Tapeworms reproduce _____________.

D. ___________—very common animals
   1. Body is a ______ within a tube.
   2. ______________ has both a mouth and an anus.
   3. ______ vary with some roundworms being decomposers, some predators, and some parasites.

Section 3  Mollusks and Segmented Worms

A. Characteristics of ____________—invertebrates usually with shells protecting their soft bodies, mantle, and muscular foot
   1. _________—tissue that covers a mollusk’s soft body and that may produce a shell
   2. Lungs or _________ exchange carbon dioxide from the animal for oxygen in the air or water.
   3. Many mollusks use a __________, a scratchy tongue-like organ, to help them eat
   4. Some mollusks have an ________ circulatory system which washes blood over organs and lacks blood vessels.

B. Types of Mollusks
   1. ____________—most have ________ shell
      a. Live in __________ or on __________
      b. Move by gliding their large muscular foot across a trail of __________
   2. ___________—have two shells
      a. Large ___________ open and close shell halves
      b. Water animals that ______________
      c. Use _________ to remove foot from water
   3. ____________—have no shell
      a. Have a foot divided into ____________ with suckers
      b. Move by using a mantle to quickly squeeze water through a funnel-like __________
      c. Have a _________ circulatory system with blood vessels
C. Segmented Worms—also called ________, have repeating segments, a closed circulatory system, and digest food in a complete system with two openings

1. __________________—have more than 100 body segments
   a. Use external bristle-like __________ and muscles to move
   b. Eat organic __________ in soil
   c. Exchange carbon dioxide and oxygen through mucus-covered _________

2. ______________—have flat bodies with sucking disks at both ends
   a. Attach to animals and remove __________ for food
   b. Can ________ enormous amounts of food for months

3. ______________—use bristles or setae for moving
   a. Some marine worms are ________ feeders.
   b. Some eat __________ or rotting material.
   c. Some marine worms are predators or ______________.

Section 4    Arthropods and Echinoderms

A. __________________—have appendages such as claws, legs, and antennae plus an exoskeleton

1. Insects—such as ants have three body regions called the head, the __________, and the abdomen
   a. Open circulatory system transports food and waste but __________ gather oxygen.
   b. Insects change body form in process called ____________________.

2. ______________—such as spiders have two body regions called the cephalothorax and the abdomen plus four pairs of legs

3. Centipedes and millipedes—long, thin, segmented animals
   a. __________—predators with one pair of jointed legs per segment
   b. __________—plant eaters with two pairs of jointed legs per segment

4. __________________—water animals such as lobsters usually having two pairs of antennae, three types of chewing appendages, and five pairs of legs

B. ______________—have radial symmetry

1. ________ vary—some are predators, some are filter feeders, some eat rotting material
2. Echinoderms have __________ skin covering an internal skeleton of plates.
3. Echinoderms have a ______________ system to help them move and eat.
4. Some echinoderms can reproduce through ______________ from parts.
Assessment
Invertebrate Animals

Part A. Vocabulary Review

Directions: Use the clues below to complete the crossword puzzle.

Across
1. thin layer of tissue that secretes a mollusk’s shell
3. an animal with a backbone
5. spiny-skinned invertebrate that lives on the ocean bottom
7. circulatory system in which blood is not in vessels but surrounds organs
10. bell-shaped body plan, like that of a jellyfish
12. joint-footed animal
14. organs that exchange oxygen and carbon dioxide with water
15. tongue-like organ in mollusks that works like a file
16. remaining attached to one place
17. type of symmetry in which body parts are mirror images of each other
18. describing an organism that does not depend on another for food or a place to live

Down
1. change in body form some animals go through as they mature
2. an animal without a backbone
4. structures, like legs or antennae, that grow out from a body
6. hollow-bodied animal that has stinging cells
8. type of symmetry in which body parts are arranged in a circle around a central point
9. protective outer covering on arthropods
10. soft-bodied invertebrate usually with a shell
11. circulatory system in which blood is contained in vessels
13. vase-shaped body plan, like that of a hydra
Chapter Review (continued)

Part B. Concept Review

Directions: List five characteristics of animals.

1. 
2. 
3. 
4. 
5. 

Directions: Use the following groups to classify the animals listed below.

<table>
<thead>
<tr>
<th>annelid</th>
<th>arthropod</th>
<th>cnidarian</th>
</tr>
</thead>
<tbody>
<tr>
<td>mollusk</td>
<td>flatworm</td>
<td>echinoderm</td>
</tr>
</tbody>
</table>

6. sea anemone 12. lobster
7. planarian 13. squid
8. scorpion 14. sea star
9. earthworm 15. jellyfish
10. oyster 16. grasshopper
11. sea cucumber 17. leech

Directions: Answer the following questions on the lines provided.

18. How is a crustacean different from a gastropod?

19. Compare the body plan, symmetry, and feeding methods of cnidarians and roundworms.
Transparency Activities
Jellyfish are interesting animals whose bodies are comprised mostly of water. They drift with the currents, but they are also able to move by expelling a jet of water.

1. How are jellyfish similar to you? How are they different?
2. Describe a jellyfish’s shape.
3. Why are jellyfish classified as animals?
When you clean something with a sponge, you may be using the skeleton of an animal! People harvest sponges in areas like the Mediterranean Sea and the Gulf Stream. Most sponges you buy in stores, however, aren’t animals at all; they’re artificial sponges.

1. Why might scientists have originally thought sponges were plants?
2. How do animals get food? How do plants get food?
One thing these animals have in common is they’re occasionally served as dinner. Food is one way people use them, but they are also important for other reasons. For example, some of these creatures live in the sea near the shore and filter large amounts of water each day.

1. What similarities do these three animals share?
2. Describe some of the differences among the three animals.
Olfactory Feet

This fascinating sea creature is a brittle star. It has tube feet, which are located on its arms, that smell. Not that they stink, but the brittle star can use its feet to sense different aromas as well as light.

1. What other animals are similar to the brittle star?
2. How do you think brittle stars feed?
3. What do you notice about the skin of the brittle star?
Metamorphosis

**Teaching Transparency Activity**

- **Egg**
- **Larva**
- **Pupa**
- **Nymph**
- **Molt**
- **Adult**
1. Describe the stages of incomplete metamorphosis.

2. Describe the stages of complete metamorphosis.

3. What is a nymph?

4. What is the third stage of a bee’s metamorphosis?

5. Name five insects that undergo complete metamorphosis.
Directions: Carefully review the table and answer the following questions.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Body symmetry</th>
<th>Motility</th>
<th>Mode of feeding</th>
<th>Vertebrae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sponge</td>
<td>Asymmetrical</td>
<td>None</td>
<td>Filtration</td>
<td>None</td>
</tr>
<tr>
<td>Sandworm</td>
<td>Bilateral</td>
<td>Medium</td>
<td>Predation</td>
<td>None</td>
</tr>
<tr>
<td>Crab</td>
<td>Bilateral</td>
<td>High</td>
<td>Predation</td>
<td>None</td>
</tr>
<tr>
<td>Sea star</td>
<td>Radial</td>
<td>Medium</td>
<td>Predation</td>
<td>None</td>
</tr>
<tr>
<td>Flatworm</td>
<td>Bilateral</td>
<td>Low</td>
<td>Predation</td>
<td>None</td>
</tr>
</tbody>
</table>

1. According to the table, which characteristic do these animals have in common?
   A. All are invertebrates.
   B. All are mollusks.
   C. All are motile.
   D. All are predators.

2. According to the table, all of the following animals exhibit bilateral symmetry EXCEPT ____.
   F. flatworm
   H. sandworm
   G. crab
   J. sea star

3. According to the table, the animal with the LEAST motility is probably the ____.
   A. sandworm
   B. sponge
   C. flatworm
   D. sea star