Glencoe Science

Biology

Unit 7 Resources

Invertebrates

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Teacher Approval Initials
Date of Approval

Student Lab Safety Form

Student Name: _____

Date: _____

Lab Title: _____

In order to show your teacher that you understand the safety concerns of this lab, the following questions must be answered after the teacher explains the information to you. You must have your teacher initial this form before you can proceed with the lab.

1. How would you describe what you will be doing during this lab?

2. What are the safety concerns associated with this lab (as explained by your teacher)?

- _____
- _____
- _____
- _____
- _____

3. What additional safety concerns or questions do you have?

Adapted from Gerlovich, et al. (2004). The Total Science Safety System CD, JaKel, Inc.
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Table of Contents

Reproducible Pages

Chapter 24 Introduction to Animals

Name _____ Date _____ Class _____

Diagnostic Test

CHAPTER 24
Introduction to Animals

Before reading Chapter 24, predict answers to questions about the chapter content based on what you already know. Circle the letter of the correct answer, and then explain your reasoning.

1. A biologist is surveying the animal life found in the deciduous forests of the Adirondack Mountains in New York. He spots a mother black bear and cubs, a herd of white-tailed deer, 15 bird species, and two species of trout. Beneath decaying logs, he discovers centipedes, termites, salamanders, and earthworms. Under a microscope, he finds roundworms, amoebas, paramecia, and algae in a lake water sample. Which describes the variety of animals surveyed by the biologist?

A. Only vertebrates and invertebrates were surveyed in the forest.

B. The one group of animals surveyed was vertebrates, such as birds and fishes.

C. The only animals spotted by the scientist were two species of mammals.

D. Unicellular protists, invertebrates, and vertebrates were the animal types surveyed.

Explain.

_____

_____

_____

2. Kahlil's teacher is giving a presentation to his science class about the evolutionary history of animals. Which would be included in the lecture?

A. A diagram of the evolutionary history of animals resembles a branching tree.

B. Complex animals such as vertebrates evolved from simple animals.

C. Scientists have answered most of the major questions about animal evolution.

D. The major evolutionary groups of animals are vertebrates and invertebrates.

Explain.

_____

_____

_____

3. Tessema's cocker spaniel has a litter of four puppies. The father of the puppies is a neighborhood dog. Tessema wonders if all animals use sexual reproduction to create offspring, and she decides to research animal reproductive strategies and methods. What will her research yield?

_____

_____

_____

Name _____ Date _____ Class _____

Launch Lab

CHAPTER 24

What is an animal?

Although animals share some characteristics with all other living organisms, they also have unique characteristics. In this lab, you will compare and contrast two organisms and determine which one is an animal.

Procedure

1. Read and complete the lab safety form.
2. Observe the **two organisms** you are given.
3. Compare and contrast the organisms using a **magnifying lens** or **dissecting microscope** if available.
4. In the space below, describe any specialized structures that you observe.
5. Based on your observations, use the space below to predict how the form of each organism might be an adaptation to its habitat.

Data and Observations

Analysis

1. **Identify** any structures that might be specific to animals.

_____

_____

2. **Predict** Based on your observations, can you predict which one of these organisms is more likely an animal? Explain.

_____

_____

_____

Name _____ Date _____ Class _____

MiniLab

CHAPTER 24

Investigate Feeding in Animals

How do animals obtain food? Small aquatic animals called hydras consume brine shrimp to obtain food.

Procedure

1. Read and complete the lab safety form.
2. Obtain several **hydras** in a **plastic petri dish** containing **water.**
3. Add several **brine shrimp** to the dish. Using a **magnifying lens** or **dissecting microscope,** observe the activity of the hydras.
4. Record your observations.

Data and Observations

Analysis

1. **Draw Conclusions** Based on your observations, how do the hydras react to the food?

_____

_____

2. **Infer** What factors in their environment might influence how the hydras find food?

_____

_____

Name _____ Date _____ Class _____

MiniLab

CHAPTER 24

Examine Body Plans

What is the importance of a body plan? One way to classify animals is by body plan. Looking at cross sections of different animals can help you distinguish between the different body plans.

Procedure

1. Read and complete the lab safety form.
2. Obtain **prepared slides of cross sections of an earthworm and a hydra.** Using a **microscope,** observe each slide under low-power magnification.
3. In the space below, sketch each cross section.
4. Obtain **labeled diagrams of cross sections of each animal** from your teacher. On a separate sheet of paper, make a list of how your sketches are like the diagrams and another list of how they are different.

Data and Observations

Analysis

1. **Compare and Contrast** What type of body cavity does each of these animals have? Are they acoelomate or coelomate? What do your observations tell you about the phylogeny of these animals?

2. **Infer** how the body plan of each animal is related to how each of these animals obtains food.

Name _____ Date _____ Class _____

Design Your Own
BioLab

CHAPTER 24
Field Investigation: What characteristics do animals have?

Background: A small pond is an ecosystem in which organisms interact to accomplish essential life functions. They exhibit a wide variety of body plans, obtain food in different ways, and use various methods of movement.

Question: *What kinds of animals live in ponds?*

Materials

Choose materials that would be appropriate for this lab. Possible materials include:
wading boots
forceps
aquarium
petri dishes
dissecting microscopes

Safety Precautions

WARNING: ***Handle living animals with care.***

Plan and Perform the Experiment

1. Read and complete the lab safety form.
2. Locate a pond to use for your observations and collections. Make sure you have permission to use the pond.
3. Determine methods to observe and record animals you see at the pond that you do not collect.
4. In the space below, design and construct a data table to record your observations.
5. Make sure your teacher approves your plan before you proceed.
6. **Cleanup and Disposal** Wash your hands after handling any live organisms. Return the animals and any pond water to the pond. Wash and return all reusable lab materials and correctly dispose of other materials used in the lab as directed by your teacher.

Data and Observations

Analyze and Conclude

1. **Use Scientific Explanations** How were you able to determine if the organisms you observed were animals?

2. **Summarize** the adaptations you observed used for obtaining food. Were any of the adaptations similar to those you observed in **MiniLab:** *Investigate Feeding in Animals*?

3. **Compare** and **contrast** the methods of movement used by each of the animals you observed.

4. **Interpret Data** Look at drawings or photographs of the animals you observed. What do these illustrations tell you about the body plan of each organism? What gut type does each animal have?

5. **Error Analysis** What other types of observations could you make to verify your conclusions about each organism?

Name _____ Date _____ Class _____

Real-World Biology: **Lab**

CHAPTER 24

Symmetry: A Point of View

Body symmetry is one characteristic that can be used to group animals. The bodies of animals in phylum Porifera are asymmetrical because they cannot be divided into two equal halves. Animals in phylum Cnidaria and the adult form of animals in phylum Echinodermata have bodies that can be divided along many planes through a central axis. Regardless of what plane is used, two equal halves can be formed—these animals have radial symmetry. The bodies of animals in most phyla have bilateral symmetry. They can be divided into two equal halves along one plane through a central axis. The formed right and left halves are mirror images of each other. Animals with bilateral symmetry also have dorsal (top) and ventral (bottom) body parts and two distinct ends—an anterior (front) end and a posterior (back) end.

In this activity, you will make clay models of three imaginary animals. Symmetry will be an important factor when you design the body plans for your animals.

Procedure

1. Read and complete the lab safety form.
2. In **Figure 1,** draw a central axis through each animal. Draw lines on each animal to indicate one or more planes that will divide the animal into equal halves. In the space provided, label each drawing with the type of symmetry that the animal exhibits.
3. Use **modeling clay** to make models of three imaginary animals. The first animal should be asymmetrical, the second should illustrate radial symmetry, and the third should illustrate bilateral symmetry. Use your imagination when making your animal models. They should not look like the animals in **Figure 1.**
4. Think about how your three imaginary animals will capture food. Will they be mobile or sessile?
5. Compare your three imaginary animals with others in the class. Discuss the similarities and differences.
6. Complete **Table 1.**

Figure 1

_____ _____ _____

Table 1

Type of Symmetry	Method Used to Capture Food	Mobile or Sessile
Asymmetry		
Radial symmetry		
Bilateral symmetry		

Analyze and Conclude

Respond to each question and statement.

1. **Identify** two everyday objects for each of the following: asymmetrical, radially symmetrical, and bilaterally symmetrical.

2. **Describe** the advantages of radial symmetry and bilateral symmetry for your model animals, when capturing food.

3. **Infer** Most bilaterally symmetrical animals have an anterior end where most of the sense organs are located. How is this body plan an advantage?

4. **Explain** Why are mobile organisms more likely to be bilaterally symmetrical? Why are sessile organisms more likely to be radially symmetrical?

CAREERS IN BIOLOGY

Embryology Visit biologygmh.com for information on embryologists. What are the responsibilities of an embryologist?

Name _____ Date _____ Class _____

Enrichment

CHAPTER 24

Diagramming: Nematocysts—Weapons of War

It's easy to think of sponges and cnidarians as simple animals. Yet, members of both phyla have evolved some sophisticated mechanisms of feeding, reproduction, defense, and other essential life functions. Perhaps no feature of cnidarian life illustrates that point as well as nematocysts. Nematocysts are harpoonlike projectiles used by cnidarians to defend themselves, to capture prey, and to communicate with others of their own type. Various species of cnidarians have evolved different forms of nematocysts to perform specific functions.

Distinguish The table below lists the three primary types of nematocysts produced by cnidarians. Use library resources to research the way each type of nematocyst is used against prey. Based on your findings, write brief descriptions in the table.

Replicate In the space below the table, make a drawing that shows (a) how a nematocyst is stored in the body of a cnidarian, (b) the chemical and physical mechanism by which the nematocyst is released, and (c) the appearance of the nematocyst after release.

Indicate In your research, you will discover that various cnidarians use many different types of nematocysts. Indicate the species from which your nematocyst comes. Then compare your drawing with drawings of other types of nematocysts made by other members of the class.

Type of Nematocyst	How Used
Glutinant	
Penetrant	
Volvent	

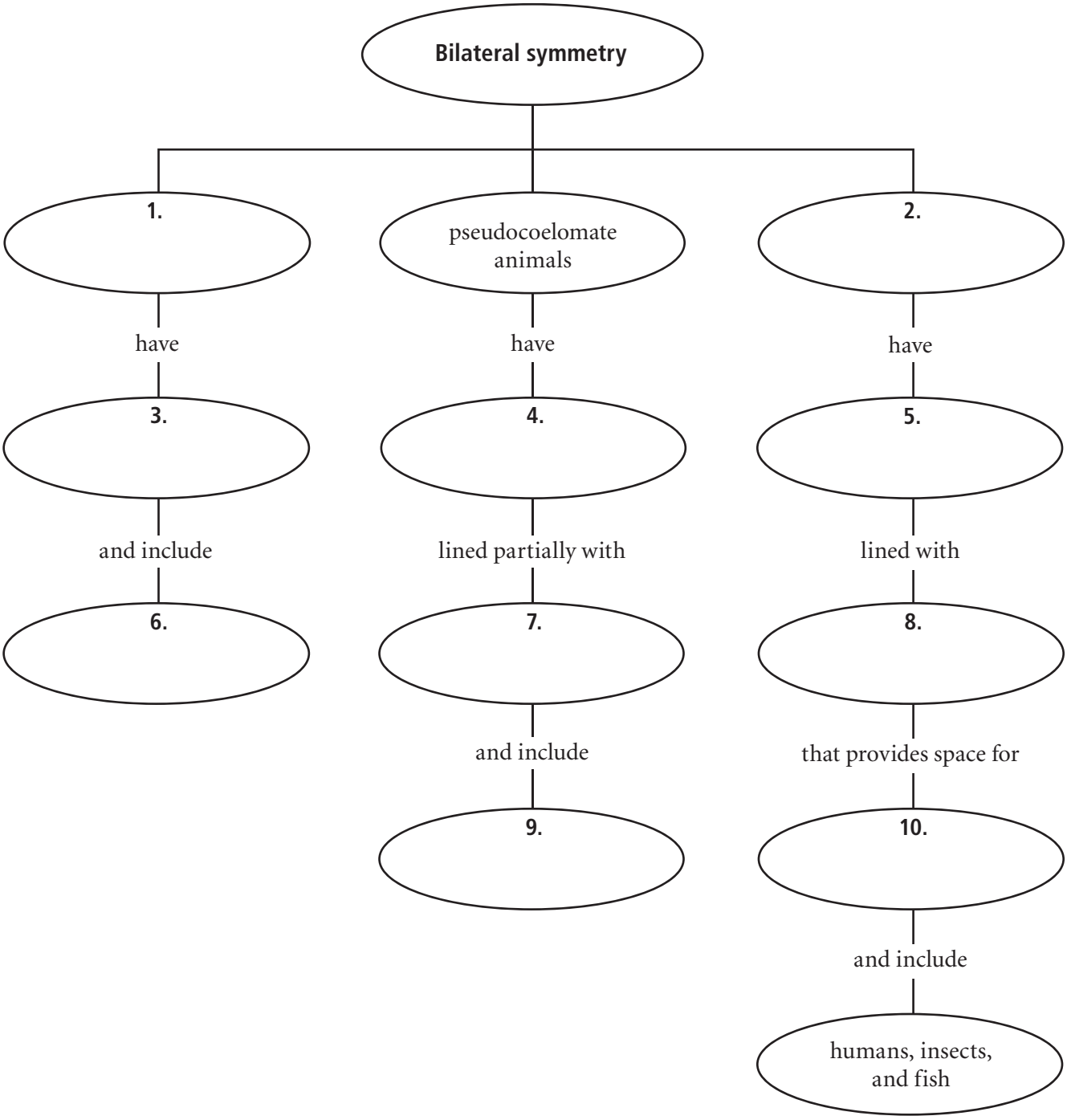
Name _____ Date _____ Class _____

Concept **Mapping**

CHAPTER 24

Body Plans of Animals with Bilateral Symmetry

Complete the network tree about body plans of animals with bilateral symmetry. These terms may be used more than once: acoelomate animals, coelomate animals, complex internal organs, flatworms, fluid-filled body cavities, mesoderm, no body cavities, roundworms.



Name _____ Date _____ Class _____

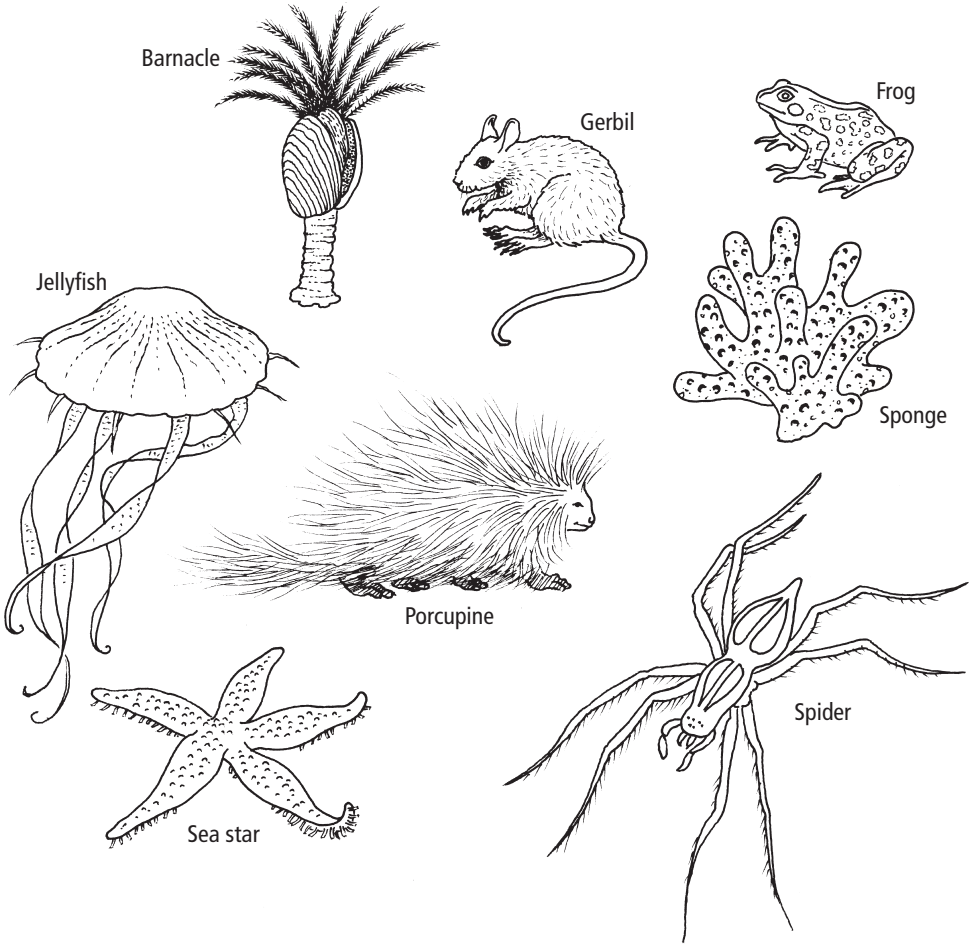
Study Guide

CHAPTER 24

Section 1: Animal Characteristics

In your textbook, read about animal characteristics.

Refer to the illustration. Respond to each statement.



1. **Identify** the characteristics of all animals.

_____

_____

_____

_____

2. **List** the three organisms that are vertebrates.

_____

_____

_____

In your textbook, read about reproduction in animals.

Use each of the terms below only once to complete the passage.

asexually	**budding**	**external**	**fragmentation**
hermaphrodites	**identical**	**internal**	**single**

Many animals reproduce sexually, but some reproduce **(3)** _____ . In the process of sexual reproduction, the male usually produces sperm and the female produces eggs. Some species produce both sperm and eggs. They are called **(4)** _____ , and fertilization can be **(5)** _____ or **(6)** _____ . Asexual reproduction occurs when a(n) **(7)** _____ parent produces offspring that are **(8)** _____ to the parent. Two types of asexual reproduction are **(9)** _____ and **(10)** _____ .

In your textbook, read about early development.

Label the diagram. Use these choices:

2-cell stage	**16-cell stage**	**blastula**	**fertilization**	**gastrula**

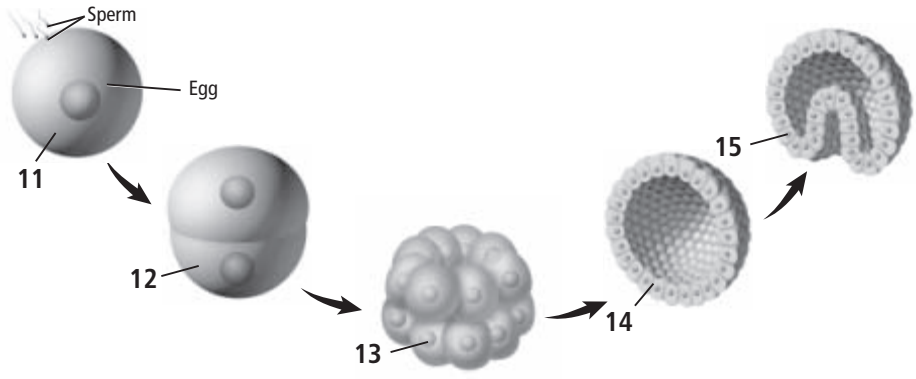
11. _____

12. _____

13. _____

14. _____

15. _____



In your textbook, read about tissue development.

Complete the table by checking the correct column(s) for each description.

Description	Endoderm	Mesoderm	Ectoderm
16. Gives rise to digestive tract			
17. Becomes nervous tissue and skin			
18. Gives rise to muscles			
19. Inner layer of cells in the gastrula			
20. Continues to grow and divide			

Name _____ Date _____ Class _____

Study Guide

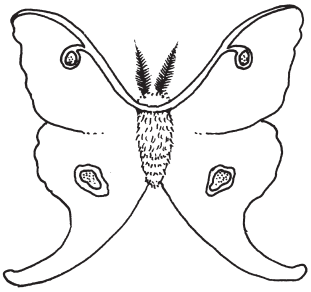
CHAPTER 24

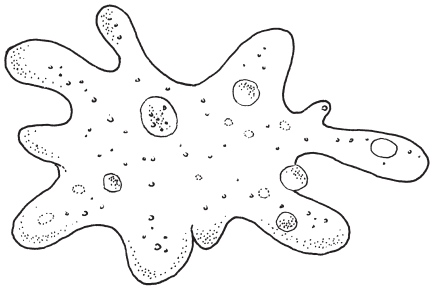
Section 2: Animal Body Plans

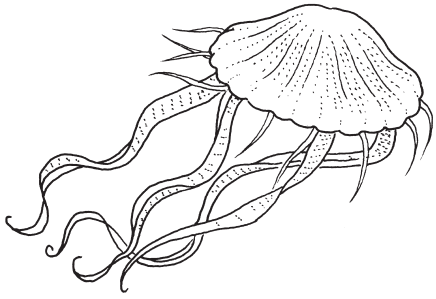
In your textbook, read about symmetry.

Label the organism with the type of symmetry it shows. Use these choices:

asymmetrical **bilateral** **radial**







1. _____ **2.** _____ **3.** _____

In your textbook, read about body cavities.

Identify the following as being either coelomates, pseudocoelomates, or acoelomates.

4. fish _____ **7.** planaria _____

5. roundworms _____ **8.** humans _____

6. snails _____ **9.** earthworms _____

In your textbook, read about development in coelomate animals.

Complete the table by checking the correct column(s) for each description.

Description	Protostomes	Deuterostomes
10. Will not develop normally if a cell is removed		
11. Top four cells aligned directly on the bottom four cells		
12. Are coelomates		
13. Include snails, earthworms, and spiders		
14. Develop mouth from the opening in the gastrula		

Name _____ Date _____ Class _____

Study Guide

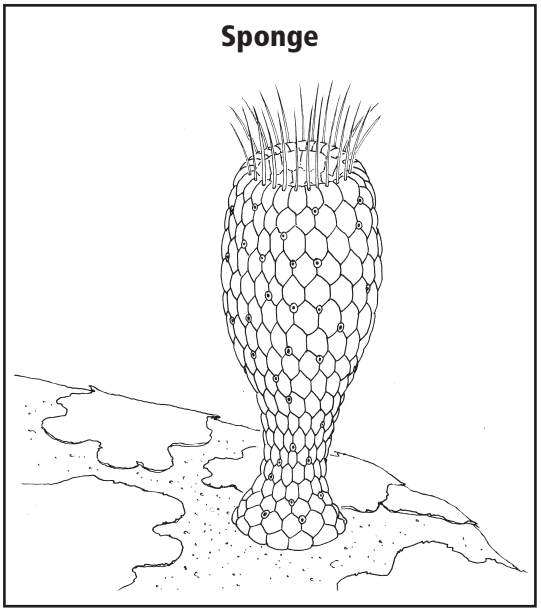
CHAPTER 24

Section 3: Sponges and Cnidarians

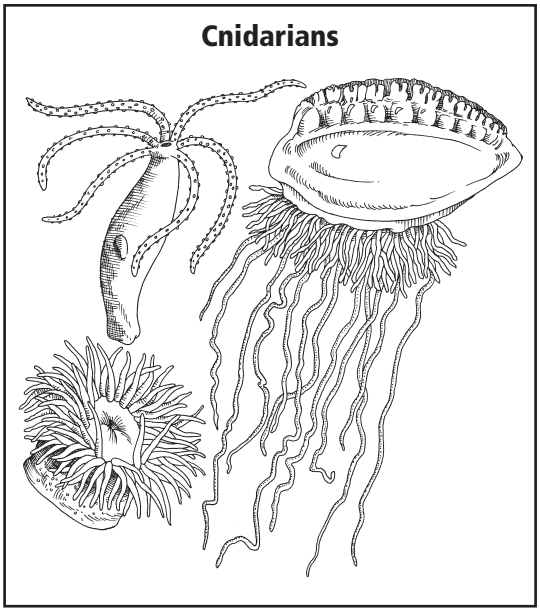
In your textbook, read about sponges and cnidarians.

Refer to the illustrations. Respond to each statement.

Sponge



Cnidarians



1. **Recall** how sponges obtain food.

_____

2. **Tell** how the body structure of cnidarians is different from the body structure of sponges.

_____

3. **Explain** how cnidarians capture prey.

_____

For each answer below, write an appropriate question.

4. **Answer:** They are capsules that hold coiled, threadlike tubes containing poison and barbs.

   Question: _____

5. **Answer:** They reproduce asexually by fragmentation, budding, and producing gemmules.

   Question: _____

6. **Answer:** The two forms are polyp and medusa.

   Question: _____

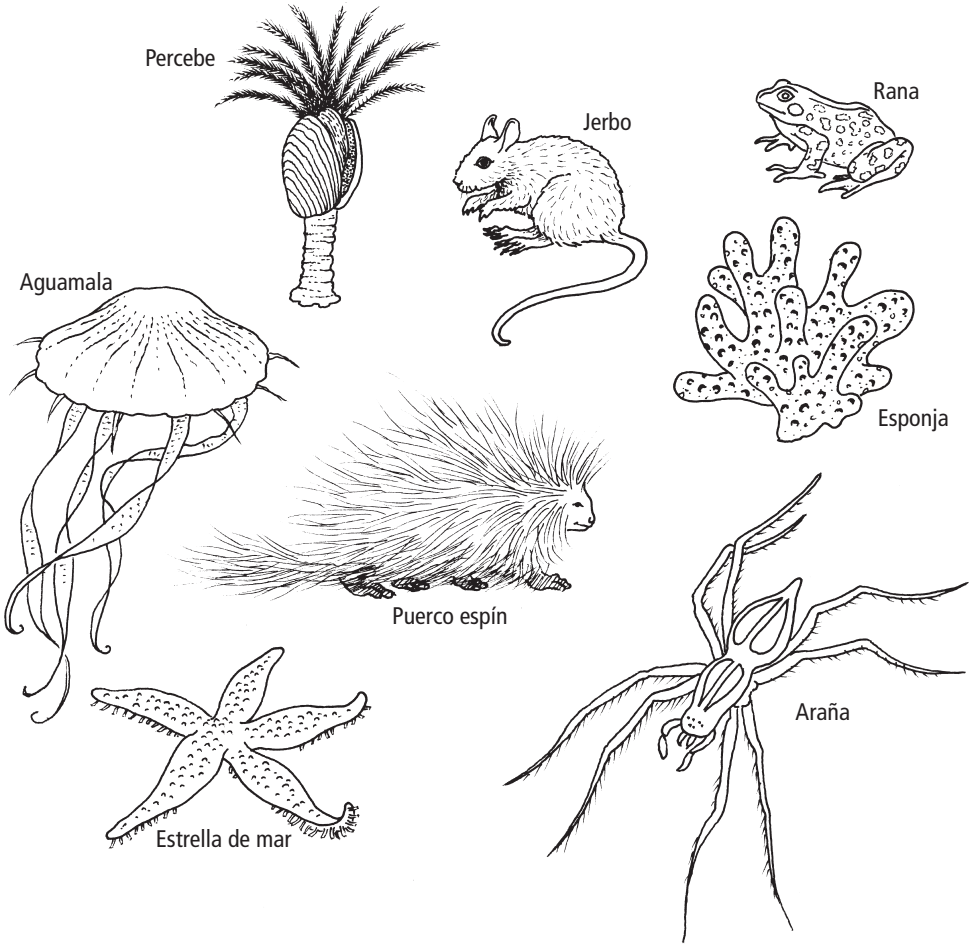
Nombre _____ Fecha _____ Curso _____

Guía de estudio

CAPÍTULO 24
Sección 1: Características de los animales

En tu libro de texto, lee acerca de las características de los animales.

Consulta la ilustración. Responde a cada afirmación.



1. **Identifica** las características de todos los animales.

_____

_____

_____

_____

2. **Enumera** los tres organismos que son vertebrados.

_____

_____

_____

_____

En tu libro de texto, lee acerca de la reproducción en los animales.

Usa cada uno de los siguientes términos sólo una vez para completar el párrafo.

asexualmente	**externa**	**fragmentación**	**germinación**
hermafroditas	**idénticas**	**interna**	**solo**

Muchos animales se reproducen sexualmente, pero algunos animales se reproducen (**3**) _____ . En el proceso de reproducción sexual, el macho por lo general produce esperma y la hembra produce huevos. Algunas especies producen tanto esperma como huevos. Éstas se denominan (**4**) _____ , y la fertilización puede ser (**5**) _____ o (**6**) _____ . La reproducción asexual ocurre cuando un (**7**) _____ padre produce crías que son (**8**) _____ al padre. La (**9**) _____ y la (**10**) _____ son dos clases de reproducción asexual.

En tu libro de texto, lee acerca de la etapa temprana del desarrollo.

Identifica el diagrama. Usa estas opciones:

blástula **etapa de 2 células** **etapa de 16 células** **fertilización** **gástrula**

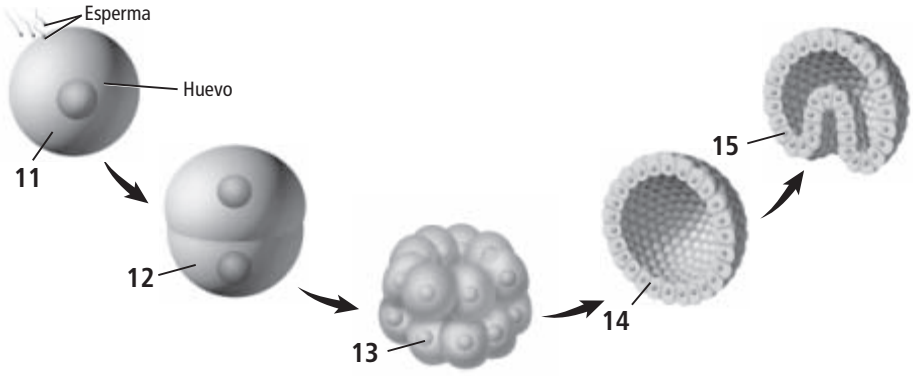
11. _____

12. _____

13. _____

14. _____

15. _____



En tu libro de texto, lee acerca del desarrollo del tejido.

Completa la tabla marcando la(s) columna(s) correcta(s) para cada descripción.

Descripción	Endodermo	Mesodermo	Ectodermo
16. Da lugar al tracto digestivo			
17. Se convierte en el tejido nervioso y la piel			
18. Da lugar a los músculos			
19. Capa interna de células en la gástrula			
20. Continúa creciendo y dividiéndose			

Nombre _____ Fecha _____ Curso _____

Guía de estudio

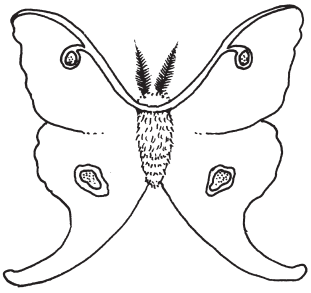
CAPÍTULO 24

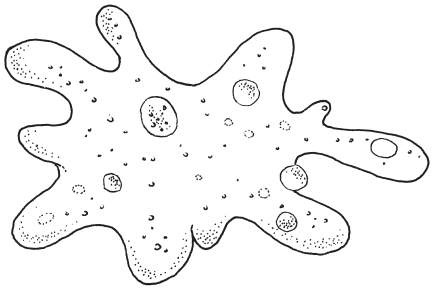
Sección 2: Formas del cuerpo de los animales

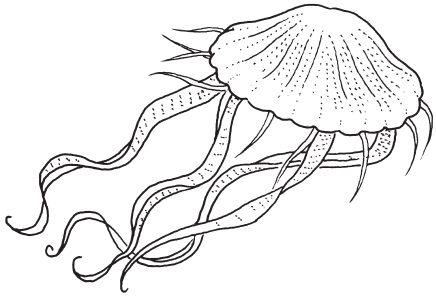
En tu libro de texto, lee acerca de la simetría.

Identifica el organismo según el tipo de simetría que presenta. Usas estas opciones:

asimétrico **bilateral** **radial**







1. _____ **2.** _____ **3.** _____

En tu libro de texto, lee acerca de las cavidades del cuerpo.

Identifica los siguientes como celomados, pseudocelomados o acelomados.

4. peces _____ **7.** planarias _____

5. ascárides _____ **8.** humanos _____

6. caracoles _____ **9.** lombrices _____

En tu libro de texto, lee acerca del desarrollo en los animales celomados.

Completa la tabla marcando la(s) columna(s) correcta(s) para cada descripción.

Descripción	Protóstomos	Deuteróstomos
10. No se desarrollan normalmente si se elimina una célula		
11. Las cuatro células superiores se alinean directamente en las cuatro células inferiores		
12. Son celomados		
13. Entre ellos se cuentan los caracoles, las lombrices y las arañas		
14. Desarrollan la boca desde la abertura de la gástrula		

Nombre _____ Fecha _____ Curso _____

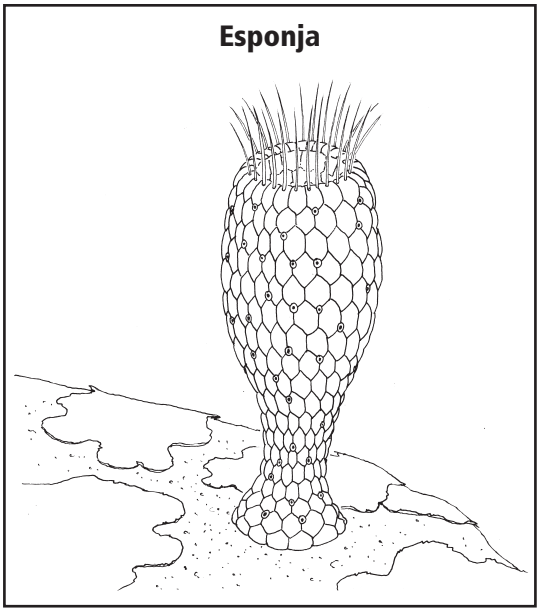
Guía de estudio

CAPÍTULO 24
Sección 3: Las esponjas y los cnidarios

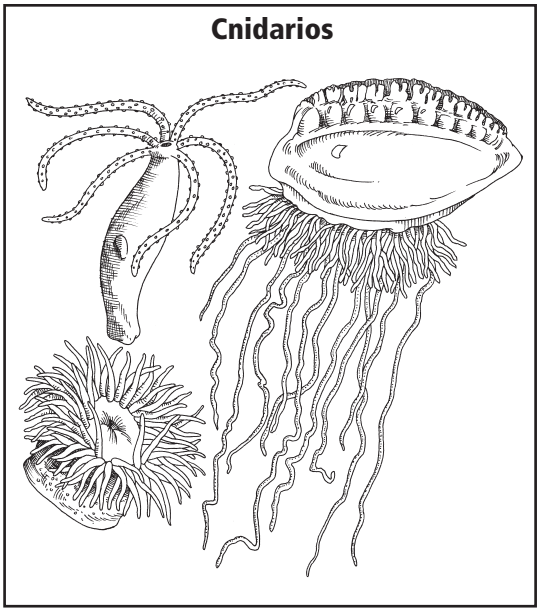
En tu libro de texto, lee acerca de las esponjas y los cnidarios.

Consulta las ilustraciones. Responde a cada afirmación.

Esponja



Cnidarios



1. **Recuerda** cómo las esponjas obtienen el alimento.

_____

2. **Describe** cómo la estructura corporal de los cnidarios es diferente a la estructura corporal de las esponjas.

_____

3. **Explica** cómo los cnidarios capturan su presa.

_____

Para cada respuesta a continuación, escribe una pregunta adecuada.

4. **Respuesta:** Son cápsulas que sostienen unos tubos enroscados como hilos que contienen veneno y púas.

   Pregunta: _____

5. **Respuesta:** Se reproducen asexualmente por medio de la fragmentación, germinación y producción de brotes.

   Pregunta: _____

6. **Respuesta:** Las dos formas son pólipo y medusa.

   Pregunta: _____

Name _____ Date _____ Class _____

Section **Quick Check**

CHAPTER 24

Section 1: Animal Characteristics

After reading the section in your textbook, respond to each statement.

1. **State** what it means to say that animals are heterotrophic.

2. **Define** *external fertilization.* **Tell** why it requires an aquatic environment.

3. **Summarize** the differences between the ectoderm, endoderm, and mesoderm.

4. **Compare** and **contrast** the support systems of cicadas and sea urchins.

5. **Propose** a method to determine if a cell is a plant cell or an animal cell.

Name _____ Date _____ Class _____

Section **Quick Check**

CHAPTER 24

Section 2: Animal Body Plans

After reading the section in your textbook, respond to each statement.

1. **List** two advantages of segmentation.

2. **Explain** the term *cephalization*. Use the terms *anterior* and *posterior* in your answer.

3. **Compare** the symmetry of animals with tissues and without tissues.

4. **Predict** if a coelomate or an acoelomate would be larger.

5. **Determine** what would happen if embryonic cells were removed in a protostome embryo and in a deuterostome embryo.

Name _____ Date _____ Class _____

Section
Quick Check

CHAPTER 24
Section 3: Sponges and Cnidarians

After reading the section in your textbook, respond to each statement.

1. **Describe** Name and describe the two body forms of cnidarians.

2. **Discuss** how cnidarians respond to stimuli.

3. **Tell** what archaeocytes are. **Explain** their roles in a sponge.

4. **Relate** the structure and function of collar cells.

5. **Compare** how sponges and cnidarians obtain and digest food.

6. **Infer** what would happen if hermit crabs disappeared from the seas.

Name _____ Date _____ Class _____

CHAPTER 24

Assessment Student Recording Sheet

Section 24.1

Vocabulary Review

Write the vocabulary term that best matches each definition.

1. _____ **2.** _____ **3.** _____

Understand Key Concepts

Select the best answer from the choices given, and fill in the corresponding circle.

4. Ⓐ Ⓑ Ⓒ Ⓓ **5.** Ⓐ Ⓑ Ⓒ Ⓓ **6.** Ⓐ Ⓑ Ⓒ Ⓓ

Constructed Response

7. _____

_____

_____

8. _____

_____

_____

_____

Think Critically

9. _____

_____

_____

10. _____

_____

_____

Section 24.2

Vocabulary Review

Explain the difference between the vocabulary terms in each pair.

11. _____

_____

12. _____

_____

_____

Name _____ Date _____ Class _____

CHAPTER 24
Assessment
Student Recording Sheet

13. _____

_____

Understand Key Concepts

Select the best answer from the choices given, and fill in the corresponding circle.

14. Ⓐ Ⓑ Ⓒ Ⓓ
15. Ⓐ Ⓑ Ⓒ Ⓓ
16. Ⓐ Ⓑ Ⓒ Ⓓ
17. Ⓐ Ⓑ Ⓒ Ⓓ
18. Ⓐ Ⓑ Ⓒ Ⓓ
19. Ⓐ Ⓑ Ⓒ Ⓓ
20. Ⓐ Ⓑ Ⓒ Ⓓ

Constructed Response

21.–22. Record your answers for questions 21 and 22 on a separate sheet of paper.

Think Critically

23. _____

_____

_____

24. _____

_____

_____

Section 24.3

Vocabulary Review

Choose the vocabulary term that does not belong, and explain why it does not belong.

25. _____

_____

26. _____

_____

27. _____

_____

Understand Key Concepts

Select the best answer from the choices given, and fill in the corresponding circle.

28. Ⓐ Ⓑ Ⓒ Ⓓ
29. Ⓐ Ⓑ Ⓒ Ⓓ
30. Ⓐ Ⓑ Ⓒ Ⓓ
31. Ⓐ Ⓑ Ⓒ Ⓓ
32. Ⓐ Ⓑ Ⓒ Ⓓ

Name _____ Date _____ Class _____

CHAPTER 24
Assessment

Student Recording Sheet

Constructed Response

33. _____

_____

_____

_____

Think Critically

34. _____

_____

35. Record your answer for question 35 on a separate sheet of paper.

Additional Assessment

36. Writing in Biology Record your answer for question 36 on a separate sheet of paper.

Document-Based Questions

37. _____

_____

38. _____

_____

39. _____

_____

_____

Cumulative Review

40. _____

_____

_____

_____

_____

_____

Name _____ Date _____ Class _____

CHAPTER 24
Assessment

Student Recording Sheet

Standardized Test Practice

Multiple Choice

Select the best answer from the choices given, and fill in the corresponding circle.

1. Ⓐ Ⓑ Ⓒ Ⓓ	**3.** Ⓐ Ⓑ Ⓒ Ⓓ	**5.** Ⓐ Ⓑ Ⓒ Ⓓ	**7.** Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ	**4.** Ⓐ Ⓑ Ⓒ Ⓓ	**6.** Ⓐ Ⓑ Ⓒ Ⓓ	**8.** Ⓐ Ⓑ Ⓒ Ⓓ

Short Answer

Answer each question with complete sentences.

9. _____

_____

10. _____

11. _____

12. _____

_____

13. _____

_____

_____

14. _____

_____

_____

Extended Response

Answer each question with complete sentences.

15. Record your answer for question 15 on a separate sheet of paper.

16. _____

_____

17. _____

_____

_____

Essay Question

18. Record your answer for question 18 on a separate sheet of paper.

Table of Contents

Reproducible Pages

Chapter 25 Worms and Mollusks

Name _____ Date _____ Class _____

Diagnostic Test

CHAPTER 25
Worms and Mollusks

Before reading Chapter 25, predict answers to questions about the chapter content based on what you already know. Circle the letter of the correct answer, and then explain your reasoning.

1. Dalila is working with a local nature center to survey and clean up a stream. After removing several tires from the streambed, Dalila and the other volunteers start picking up rocks and looking on their undersides. By surveying the different types of organisms living in the stream, she can evaluate its health. She finds a 0.5-cm organism with a dark, flat body gliding smoothly across a rock's surface. Which type of organism did she find?

A. aquatic flatworm
B. freshwater mollusk
C. macroscopic rotifer
D. parasitic earthworm

Explain.

_____

_____

2. Peter finds an earthworm on the sidewalk. His friend states that worms are disgusting and have no value. Which could be Peter's response to explain to his friend that worms have value?

A. Aquatic worms filter water to improve the overall water quality.
B. Earthworms create tunnels in soil for water to flow and roots to grow.
C. Freshwater planarians hunt and eat pests such as mosquito larvae.
D. Microscopic worms living in mammal intestines aid with digestion.

Explain.

_____

_____

_____

3. Derek's science class takes a field trip to the local aquarium. Derek is studying invertebrates in class, and his teacher wants to focus on the aquatic invertebrates displayed at the aquarium. Derek observes octopuses, scallops, Caribbean lobsters, reef shrimps, sea stars, zebra mussels, sea urchins, reef squids, horseshoe crabs, and spider crabs. Identify the mollusks Derek observed.

_____

_____

_____

Name _____ Date _____ Class _____

Launch Lab

CHAPTER 25

What do earthworms feel like?

In this lab, you will examine a familiar worm—an earthworm.

Procedure

1. Read and complete the lab safety form.
2. Obtain an **earthworm** from your teacher. **WARNING:** ***Treat the earthworm in a humane manner at all times.***
3. Run your finger along the ventral side, or underside, of the earthworm. Repeat in the opposite direction. Record your observations.
4. Examine the ventral side of the earthworm with a **magnifying glass.** Record your observations.
5. Wash your hands and return the earthworm to your teacher.

Data and Observations

Analysis

1. **Compare** the way the earthworm felt to you when you brushed it in each direction.

_____

_____

2. **Infer** how any differences you observed might be important adaptations.

_____

_____

3. **Interpret** What did you see on the worm's ventral side that might explain how the worm felt to you?

_____

_____

Name _____ Date _____ Class _____

MiniLab

CHAPTER 25

Observe a Planarian

How does a planarian behave? Investigate the physical features and behavior of a planarian by observing this common flatworm.

Procedure

1. Read and complete the lab safety form.
2. Observe the **planarian** in a **water-filled observation dish** by using a **magnifying glass.**
3. Create a data table to record your observations.
4. Record the physical characteristics and behaviors of the flatworm.
5. Place a small piece of **cooked egg white** into the dish, and observe the feeding behavior of the planarian.

Data and Observations

Analysis

1. **Compare** and **contrast** the physical features of the planarian with the features of the earthworm you observed in the Launch Lab.

2. **Analyze** how the body shape and movement of a planarian enables it to live in its environment.

3. **Infer** why scientists classify planaria into a group separate from other worms.

Name _____ Date _____ Class _____

MiniLab

CHAPTER 25

Observe Blood Flow in a Segmented Worm

How does blood flow in a segmented worm? The California blackworm has a closed circulatory system and a transparent body. Its blood can be viewed as it flows along the dorsal blood vessel.

Procedure

1. Read and complete the lab safety form.
2. Moisten a piece of **filter paper** with **spring water** and place it in a **petri dish.**
3. Examine a **blackworm** on the moist paper using a **dissecting microscope.**
4. Locate the dorsal blood vessel in a segment near the midpoint of the worm. Observe how blood flows in each segment.
5. Use a **stopwatch** to record how many pulses of blood occur per minute. Repeat this for two more segments, one near the head and one near the tail of the worm.

Data and Observations

Analysis

1. **Summarize** how blood moves through each segment, including the direction of blood flow.

2. **Compare** and **contrast** the rate of blood flow near the head, at the midpoint, and near the tail of the worm.

Name _____ Date _____ Class _____

BioLab

CHAPTER 25

How do worms and mollusks move?

Background: The worm and mollusk phyla display wide diversity in behavior and physical characteristics. Throughout this chapter, you have been introduced to some of the various species that make up these phyla. In this lab, you will compare the form of movement used by a flatworm (a planarian), a roundworm (a vinegar eel), a mollusk (a land snail), and a segmented worm (a blackworm).

Question: *What kind of motion do worms and mollusks display?*

Materials

dropper (2)
petri dish (1 or 2)
microscope slide (1 or 2)
coverslip (1 or 2)
500-mL beaker
magnifying glass
dissecting microscope
light microscope
spring water or aged tap water (500 mL)
live cultures of planaria, vinegar eels, land snails, and blackworms

Safety Precautions

WARNING: ***Be sure to treat live animals in a humane manner at all times. Use caution when working with a microscope, glass slides, and coverslips.***

Procedure

1. Read and complete the lab safety form.
2. Create a data table to record your observations.
3. Observe the movement of a flatworm by placing it in a drop of water in a petri dish or on a slide with no coverslip.
4. Make a wet mount of a vinegar eel and observe its movement under low-power magnification.
5. Place a land snail on a petri dish. Gently tip the dish to observe the snail's movement from underneath.
6. Place a blackworm on a moist paper towel, and observe it with a magnifying glass.
7. Place the blackworm in a beaker of aged tap water, and observe its movement.
8. Record your observations in your data table.
9. **Cleanup and Disposal** Wash reusable materials and place them where your teacher directs. Return all live specimens to the cultures provided by your teacher.

Data and Observations

Analyze and Conclude

1. **Compare** and **contrast** the movements of the flatworm, roundworm, land snail, and segmented worm.

2. **Infer** how the forms of the flatworm, roundworm, land snail, and segmented worm are designed to move the animals.

3. **Describe** what happens to each segment of the blackworm as it crawls on land.

4. **Compare** the forward and backward motion of the blackworm on land. How might this be an adaptation for survival?

5. **Infer** how the blackworm might be able to escape from predators in the water.

Name _____ Date _____ Class _____

Real-World Biology: Analysis

CHAPTER 25
Jewels of the Forest

You have probably seen land snails that are gray, brown, or tan in color. There is, however, another type of interesting snail. It is a tree snail with a conical, tapered shape and a beautifully colored spiral shell. These snails live in only one place in the world—on the island of Oahu, Hawaii. They live in moist-to-wet forests on isolated mountain ridges above 457 meters. The snails cannot travel easily, so there are many separate groups of snails. The snails eat a sooty, black mold off the leaves of trees. The removal of this fungus assists in photosynthesis. Rob Pacheco, a nature writer, said, "Their story is a classic Hawaiian natural history drama, punctuated with exceeding beauty, unusual biology, spectacular speciation, and tragic loss."

Part A: Snails in Peril

Oahu tree snails belong to the genus *Achatinella*, which consists of 41 species. Today 32 of these species are extinct, and the remaining species are classified as endangered. In the 1800s, these so-called "jewels of the forest" were so beautiful and plentiful that local residents collected them by the thousands. The snails hung from trees like bunches of grapes. It has been estimated there were thousands per tree. Today there might be one to 40 per tree. Often, no snails are seen.

The following table lists historical events that have caused the decline and extinction of *Achatinella* populations.

Date	Event	Cause
1850s	massive shell collecting	collectors, ornament producers
1850s–2000s	habitat destruction, leading to the death of snails	forest clearing, agricultural development, grazing, fire, construction projects
1800s(?) 1900s(?)	introduction of rats, which destroy more than 80% of snail populations	ships carrying rats from other countries docking at the island
1955	introduction of a carnivorous snail, *Euglandina* (in an effort to control the alien African snail, an agricultural pest), which eats tree snails	a biological control decision
1990s	pigs chewing the tops of mountain trees and spitting out the leaves	periods of drought

Analyze and Conclude

Respond to each question.

1. Summarize How did the introduction of rats affect the snails?

_____

_____

_____

2. **Speculate** How did such a large number of species of *Achatinella* evolve on a single island?

3. **Infer** Pigs chew leaves for water when the land is dry. Leaves that the pigs were chewing were from trees on a mountaintop that had always been wet. What does this tell you about the local climate?

Part B: Saving the Snails

Dr. Michael Hadfield, Director of the University of Hawaii Kewalo Marine Laboratory, resembles a shopkeeper showing off a box full of precious jewels as he pulls a branch out of a small terrarium. Clinging to the leaves like ornaments are brilliantly colored tree snails.

Since 1991, scientists at the Kewalo Lab have been removing members of severely threatened wild populations and bringing them into captivity for propagation. Laboratory populations can then serve as stock for reintroduction or to augment existing natural populations.

Analyze and Conclude

Respond to each question.

1. **Infer** The laboratory staff is also maintaining captive breeding operations outdoors in the Makua Valley with enclosures protecting snail populations. The construction of the enclosures includes 1.2 m high walls with barbed wire and bait boxes filled with poison. What things is the staff trying to keep out?

2. **Evaluate** How might the preservation of *Achatinella* snails contribute to the overall health of the trees the snails inhabit?

CAREERS IN BIOLOGY

Invertebrate Biology Visit biologygmh.com for information on invertebrate biologists. What are the responsibilities of an invertebrate biologist?

Name _____ Date _____ Class _____

Enrichment

CHAPTER 25

Drawing: Some Strange and Wonderful Worms and Mollusks

Worms and mollusks have evolved to take advantage of virtually every ecological niche available on Earth. Still, scientists were surprised in the late 1970s when they found worms and mollusks living in what had seemed to be the most remote, most desolate, most unfriendly habitat on the planet—the ocean bottoms.

Researchers made two fascinating discoveries. The first was the existence of some unusual geological phenomena: hot springs, lava flows, and miniature volcanoes known as "black smokers." The second was the presence of large, diverse, and active populations of worms, mollusks, and other sea organisms.

As you can imagine, these organisms have developed structures rarely seen in their land-based counterparts in order to adapt to the harsh conditions on the ocean bottom. Some deep-sea worms and mollusks look more like creatures from science fiction than like the worms and mollusks shown in your textbook.

Exhibit The table lists some of the worms and mollusks that have been discovered on the ocean bottom. Choose one of the organisms listed or find an organism of your choice and read more about it in reference books. Then, in the space below, making a drawing of the organism. Write a caption for your drawing that provides additional information about its habitat. Try to include information about how it moves, feeds, reproduces, and protects itself against predators. Be sure to mention any special forms of adaptation the organism has developed to make life on the ocean bottom possible.

Organism
Alvinella pompejana
Amphisamytha galapagensis
Bathymodiolus elongatus
Bathymodiolus thermophilus
Calyptogena magnifica
Escarpia spicata
Helicoradomenia juani
Oasisia alvinae
Paralvinella grasslei
Provanna laevis
Ridgeia piscesae
Riftia pachyptila
Tevnia jerichonana

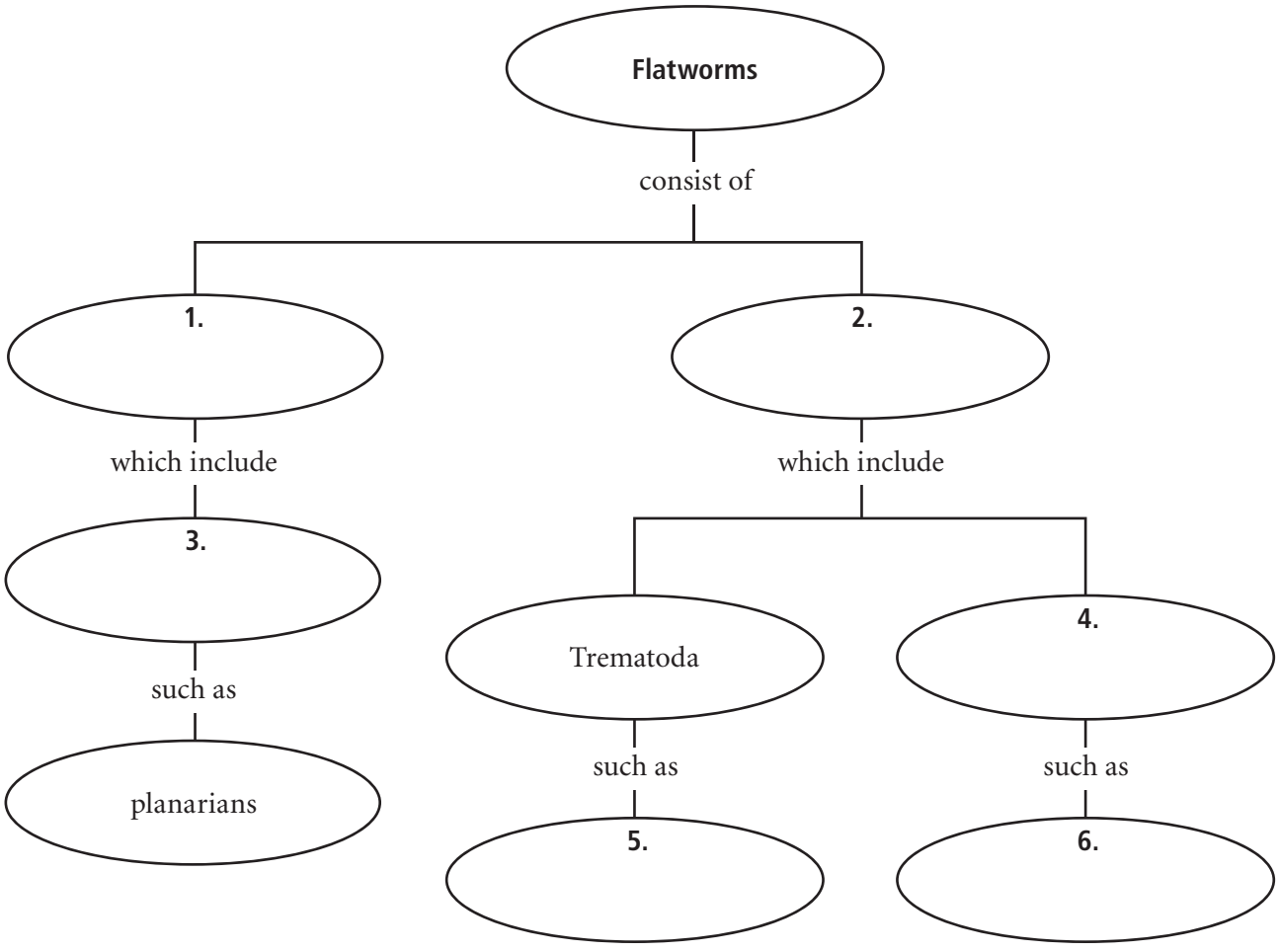
Name _____ Date _____ Class _____

Concept **Mapping**

CHAPTER 25

Classifying Flatworms

Complete the network tree about the flatworm. These terms may be used more than once:
Cestoda, flukes, free-living worms, parasitic worms, tapeworms, Turbellaria.



Name _____ Date _____ Class _____

Study Guide

CHAPTER 25

Section 1: Flatworms

In your textbook, read about feeding and digestion of flatworms.

Complete the table below by describing how free-living and parasitic flatworms take in and digest food.

Type	Food Source	Methods of Feeding	Methods of Digestion
Free-living	**1.**	**2.**	**3.**
Parasitic	**4.**	**5.**	**6.**

In your textbook, read about reproduction in flatworms.

Use each of the terms below only once to complete the passage.

asexually **hermaphrodites** **regeneration** **regrown** **zygotes**

Flatworms can reproduce **(7)** _____ by the process of **(8)** _____ . This helps the flatworms' survival because body parts can be **(9)** _____ . Flatworms also can be **(10)** _____ and produce both eggs and sperm. They release **(11)** _____ in cocoons into water where they hatch in a few weeks.

In your textbook, read about the diversity of flatworms.

Complete the table by checking the correct column(s) for each description.

Description	Turbellarians	Trematodes	Cestodes
12. Free-living flatworms			
13. Parasitic flatworms			
14. Live in water and moist soil			
15. Infect the blood or body organs of their hosts			
16. Tapeworms			

Name _____ Date _____ Class _____

Study Guide

CHAPTER 25

Section 2: Roundworms and Rotifers

In your textbook, read about the body structure of roundworms.

Complete the table by filling in one specific detail for each category. Two have been done for you.

Characteristics of Roundworms	
Body structure	bilateral symmetry
Feeding and digestion	**1.**
Respiration	**2.**
Circulation	depends on diffusion
Excretion	**3.**
Response to stimuli	**4.**
Movement	**5.**
Reproduction	**6.**

In your textbook, read about rotifers.

Respond to the following statement.

7. Describe how rotifers and roundworms are similar.

_____

_____

_____

_____

Name _____ Date _____ Class _____

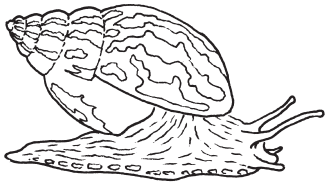
Study Guide

CHAPTER 25

Section 3: Mollusks

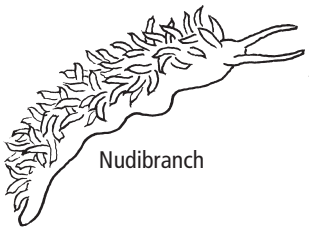
In your textbook, read about diversity of mollusks.

Refer to the illustrations of mollusks. Respond to each question or statement.

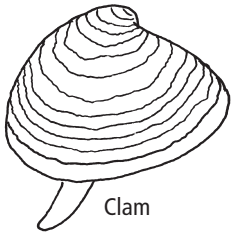


Snail

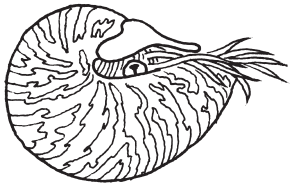
Slug



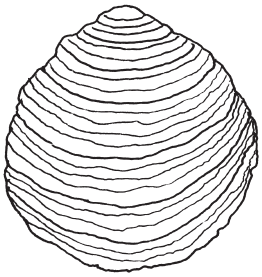
Nudibranch



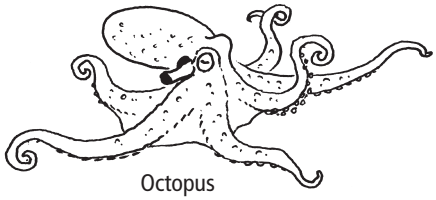
Clam



Nautilus



Oyster



Octopus

1. Classify Which of these mollusks are gastropods? List the characteristics of gastropods.

_____

_____

2. Classify Which of these mollusks are bivalves? List the characteristics of bivalves.

_____

_____

3. Classify Which of these mollusks are cephalopods? List the characteristics of cephalopods.

_____

_____

Name _____ Date _____ Class _____

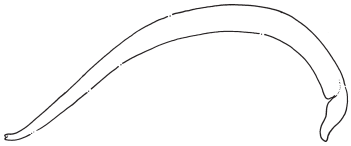
Study Guide

CHAPTER 25

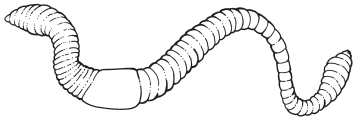
Section 4: Segmented Worms

In your textbook, read about the body structures of segmented worms.

Refer to the figures. Respond to the following statement.



Roundworm



Earthworm

1. Compare the body structures of earthworms and roundworms.

_____

_____

_____

If the statement is true, write true. *If the statement is false, replace the italicized word or phrase to make it true.*

2. Annelids have a circulatory system that includes *blood vessels and a heart.*

_____

3. Earthworms take in oxygen and give off carbon dioxide through *nephridia.*

_____

4. The brain and nerve cords of earthworms respond to *light only.*

_____

5. An earthworm moves by contracting its *circular and longitudinal muscles.*

_____

6. Annelids can reproduce *both sexually and asexually.*

_____

7. Earthworms reproduce by *laying eggs.*

_____

Nombre _____ Fecha _____ Curso _____

Guía de estudio

CAPÍTULO 25

Sección 1: Platelmintos

En tu libro de texto, lee acerca de la alimentación y digestión de los platelmintos.

Completa la siguiente tabla con la descripción de cómo los platelmintos de vida libre y parasitarios absorben y digieren la comida.

Tipo	Fuente de alimentos	Métodos de alimentación	Métodos de digestión
Vida libre	**1.**	**2.**	**3.**
Parasitarios	**4.**	**5.**	**6.**

En tu libro de texto, lee acerca de la reproducción de los platelmintos.

Usa cada uno de los siguientes términos sólo una vez para completar el párrafo.

asexualmente **cigotos** **hermafroditas** **regeneración** **volver a crecer**

Los platelmintos se pueden reproducir (**7**) _____ mediante el proceso de (**8**) _____ . Esto ayuda la supervivencia de los platelmintos debido a que las partes del cuerpo pueden (**9**) _____ . Los platelmintos también pueden ser (**10**) _____ y producir tanto huevos como esperma. Ellos liberan (**11**) _____ en capullos dentro del agua.

En tu libro de texto, lee acerca de la diversidad de los platelmintos.

Completa la tabla marcando las columnas correctas para cada descripción.

Descripción	Turbelarios	Trematodos	Cestodos
12. Son platelmintos de vida libre.			
13. Son platelmintos parasitarios.			
14. Viven en agua y tierra húmeda.			
15. Infectan la sangre o los órganos corporales de sus huéspedes.			
16. Son solitarias.			

Nombre _____ Fecha _____ Curso _____

Guía de estudio

CAPÍTULO 25

Sección 2: Ascárides y rotíferos

En tu libro de texto, lee acerca de la estructura corporal de los ascárides.

Completa la tabla con un detalle específico para cada categoría. Se han completado dos.

Características de los ascárides	
Estructura corporal	simetría bilateral
Alimentación y digestión	**1.**
Respiración	**2.**
Circulación	dependiente de la difusión
Excreción	**3.**
Respuesta al estímulo	**4.**
Movimiento	**5.**
Reproducción	**6.**

En tu libro de texto, lee acerca de los rotíferos.

Responde a la siguiente afirmación.

7. Describe de qué manera los ascárides y rotíferos son similares.

_____

_____

_____

_____

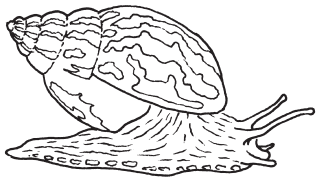
Nombre _____ Fecha _____ Curso _____

Guía de estudio

CAPÍTULO 25
Sección 3: Moluscos

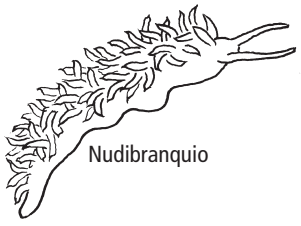
En tu libro de texto, lee acerca de la diversidad de los moluscos.

Consulta las ilustraciones de moluscos. Responde a cada pregunta o afirmación.

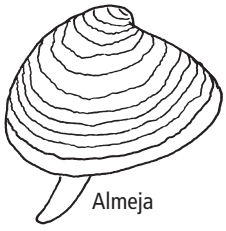


Caracol

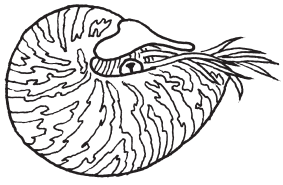
Babosa



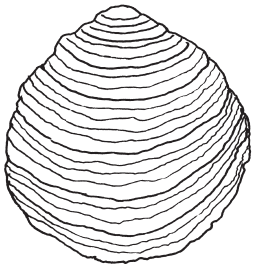
Nudibranquio



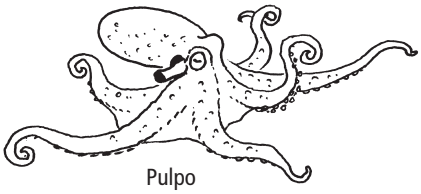
Almeja



Nautilo



Ostra



Pulpo

1. **Clasifica** ¿Cuáles de estos moluscos son gastrópodos? Enumera las características de los gastrópodos.

_____

_____

2. **Clasifica** ¿Cuáles de estos moluscos son bivalvos? Enumera las características de los bivalvos.

_____

_____

3. **Clasifica** ¿Cuáles de estos moluscos son cefalópodos? Enumera las características de los cefalópodos.

_____

_____

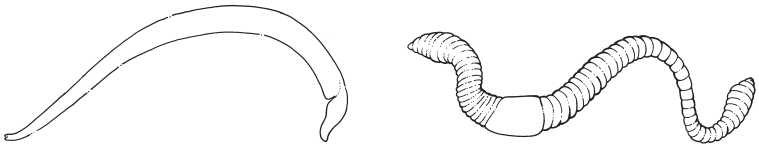
Nombre _____ Fecha _____ Curso _____

Guía de estudio

CAPÍTULO 25
Sección 4: Gusanos segmentados

En tu libro de texto, lee acerca de las estructuras corporales de los gusanos segmentados.

Consulta los dibujos. Responde a la siguiente afirmación.



Ascárides Lombrices

1. Compara las estructuras corporales de las lombrices y los ascárides.

_____

_____

_____

Si la afirmación es verdadera, escribe «verdadero». Si la afirmación es falsa, reemplaza el término o la frase en cursiva para convertirla en verdadera.

2. Los anélidos tienen un sistema circulatorio que incluye *vasos sanguíneos y corazón.*

_____

3. Las lombrices absorben oxígeno y despiden dióxido de carbono a través *del nefridio.*

_____

4. El cerebro y el cordón nervioso de las lombrices responden a *la luz únicamente.*

_____

5. Una lombriz se mueve al contraer sus *músculos circulares y longitudinales.*

_____

6. Los anélidos se pueden reproducir *tanto sexualmente como asexualmente.*

_____

7. Las lombrices se pueden reproducir por medio de *poner huevos.*

_____

Name _____ Date _____ Class _____

Section **Quick Check**

CHAPTER 25

Section 1: Flatworms

After reading the section in your textbook, respond to each statement.

1. **Cite** another name for cestodes. **State** where they live.

2. **Describe** the appearance of a pharynx and its function in digestion.

3. **Explain** how some parasitic flatworms can survive with no digestive system. Use the terms *host* and *body walls* in your answer.

4. **Illustrate** how a planarian, a free-living flatworm, can reproduce asexually by regeneration.

5. **Compare** and **contrast** the systems of flatworms to the systems of sponges and cnidarians. Use the terms *circulatory system, respiratory system,* and *excretory system* in your answer.

Name _____ Date _____ Class _____

Section **Quick Check**

CHAPTER 25

Section 2: Roundworms and Rotifers

After reading the section in your textbook, respond to each statement.

1. **State** the body plan of a roundworm.

2. **Explain** how roundworms reproduce.

3. **Describe** how rotifers reproduce. Use the terms *diploid* and *haploid* in your answer.

4. **Indicate** how roundworms survive without organs for circulation and respiration.

5. **Classify** these roundworms as beneficial to humans or not beneficial to humans: filarial worms, hookworms, ascarid worms, trichinella worms, and pinworms.

6. **Devise** methods to reduce your chances of becoming infected by roundworms.

Name _____ Date _____ Class _____

Section **Quick Check**

CHAPTER 25

Section 3: Mollusks

After reading the section in your textbook, respond to each statement.

1. **List** the two features scientists use to divide mollusks into classes.

2. **Describe** the mantle of a mollusk.

3. **Summarize** the structure and function of gills in mollusks.

4. **Analyze** whether the cuttlefish, a fast-moving mollusk, has an open or closed circulatory system. Explain.

5. **Assess** how the structure of the foot of a cephalopod aids in feeding.

Name _____ Date _____ Class _____

Section **Quick Check**

CHAPTER 25

Section 4: Segmented Worms

After reading the section in your textbook, respond to each statement.

1. **Tell** how setae aid in movement.

2. **Explain** two functions that earthworms have in healthy ecosystems.

3. **Illustrate** the body plan of leeches. Label your drawing. Use the terms *flattened body* and *suckers* in your answer.

4. **Differentiate** Identify the two main features of segmented worms that differ from features of flatworms and roundworms.

5. **Arrange** the following organs in the order that food passes through the earthworm: anus, crop, gizzard, intestine, and pharynx. **Summarize** the digestion process in your answer.

Name _____ Date _____ Class _____

CHAPTER 25
Assessment

Student Recording Sheet

Vocabulary Review

Write the vocabulary term that best answers each question.

1. _____ **2.** _____ **3.** _____

Understand Key Concepts

Select the best answer from the choices given, and fill in the corresponding circle.

4. Ⓐ Ⓑ Ⓒ Ⓓ **5.** Ⓐ Ⓑ Ⓒ Ⓓ **6.** Ⓐ Ⓑ Ⓒ Ⓓ **7.** Ⓐ Ⓑ Ⓒ Ⓓ

Constructed Response

8. _____

_____

9. Record your answer for question 9 on a separate sheet of paper.

Think Critically

10. Record your answer for question 10 on a separate sheet of paper.

Section 25.2

Vocabulary Review

Write the vocabulary term that makes each sentence true.

11. _____ **12.** _____ **13.** _____

Understand Key Concepts

Select the best answer from the choices given, and fill in the corresponding circle.

14. Ⓐ Ⓑ Ⓒ Ⓓ **15.** Ⓐ Ⓑ Ⓒ Ⓓ

Constructed Response

16.–17. Record your answers for questions 16 and 17 on a separate sheet of paper.

Think Critically

18. Record your answer for question 18 on a separate sheet of paper.

19. _____

_____

Section 25.3

Vocabulary Review

Write the vocabulary term that best completes each analogy.

20. _____ **21.** _____ **22.** _____

Name _____ Date _____ Class _____

CHAPTER 25

Assessment

Student Recording Sheet

Understand Key Concepts

Select the best answer from the choices given, and fill in the corresponding circle.

23. Ⓐ Ⓑ Ⓒ Ⓓ **24.** Ⓐ Ⓑ Ⓒ Ⓓ **25.** Ⓐ Ⓑ Ⓒ Ⓓ **26.** Ⓐ Ⓑ Ⓒ Ⓓ

Constructed Response

27. Record your answer for question 27 on a separate sheet of paper.

Think Critically

28. Careers in Biology Record your answer for question 28 on a separate sheet of paper.

Section 25.4

Vocabulary Review

Write the vocabulary term that best completes each analogy.

29. _____ **30.** _____ **31.** _____

Understand Key Concepts

Select the best answer from the choices given, and fill in the corresponding circle.

32. Ⓐ Ⓑ Ⓒ Ⓓ **33.** Ⓐ Ⓑ Ⓒ Ⓓ

Constructed Response

34. _____

_____

Think Critically

35. Careers in Biology Record your answer for question 35 on a separate sheet of paper.

Additional Assessment

36. Writing in Biology Record your answer for question 36 on a separate sheet of paper.

Document-Based Questions

37. _____

38. _____

39. _____

_____

Cumulative Review

Select the best answer from the choices given, and fill in the corresponding circle.

40. Ⓐ Ⓑ Ⓒ Ⓓ

Name _____ Date _____ Class _____

CHAPTER 25
Assessment

Student Recording Sheet

Standardized Test Practice

Multiple Choice

Select the best answer from the choices given, and fill in the corresponding circle.

1. Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ
4. Ⓐ Ⓑ Ⓒ Ⓓ
5. Ⓐ Ⓑ Ⓒ Ⓓ
6. Ⓐ Ⓑ Ⓒ Ⓓ
7. Ⓐ Ⓑ Ⓒ Ⓓ
8. Ⓐ Ⓑ Ⓒ Ⓓ

Short Answer

Answer each question with complete sentences.

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

Name _____ Date _____ Class _____

CHAPTER 25
Assessment
Student Recording Sheet

15. _____

_____

_____

_____

_____

_____

Extended Response

Answer each question with complete sentences.

16. _____

_____

_____

_____

_____

_____

17. _____

_____

_____

Essay Question

18. Record your answer for question 18 on a separate sheet of paper.

Table of Contents

Reproducible Pages

Chapter 26 Arthropods

Name _____ Date _____ Class _____

Diagnostic Test

CHAPTER 26
Arthropods

Before reading Chapter 26, predict answers to questions about the chapter content based on what you already know. Circle the letter of the correct answer, and then explain your reasoning.

1. While on a field trip, Roberto's class collects a wide diversity of arthropods from a stream, meadow, and forest. Roberto's teacher asks the students to identify the features arthropods have in common. Which common feature is observed?

A. jointed appendages
B. pinching jaws
C. three body parts
D. three pair of legs

Explain.

_____

_____

_____

2. While visiting a local nature center, an ecologist shows Sharon an insect larva. Which describes the larva Sharon observes?

A. a young insect that resembles a long worm
B. a young insect that resembles a small adult
C. an adult insect with wings
D. an adult insect without wings

Explain.

_____

_____

_____

3. While visiting her local natural museum of history, Amma enjoys a display of arthropods collected from around the world. The specimens are divided into several major groups. What arthropod groups are represented by the display?

_____

_____

_____

Name _____ Date _____ Class _____

Launch Lab

CHAPTER 26

What structures do arthropods have?

Arthropods form a group of animals that includes all bees, flies, crabs, millipedes, centipedes, spiders, and ticks. Discover the features arthropods share by observing two different arthropods.

Procedure

1. Read and complete the lab safety form.
2. Create a data table to record your observations.
3. Observe the physical characteristics of live or preserved **specimens of a crayfish** and a **pill bug.** Record your observations in your data table.

WARNING: ***Treat live animals in a humane manner at all times.***

4. Observe the movements of the two animals, if possible, and record your observations.

Data and Observations

Analysis

1. **Describe** the structures of the two animals that are similar.

_____

_____

_____

2. **Identify** the defensive structure that the two animals have in common. How does this feature allow them to protect themselves from predators?

_____

_____

_____

Name _____ Date _____ Class _____

MiniLab

CHAPTER 26

Compare Arthropod Mouthparts

How do the mouthparts of arthropods differ? Arthropods eat a wide variety of foods, from nectar and plants to fish and small birds. Explore how the mouthparts of different types of arthropods are designed for their specific diets.

Procedure

1. Read and complete the lab safety form.
2. Create a data table to record your observations about the mouthparts of the arthropods and your inferences about the function of each type of mouth.
3. Using a **magnifying lens** or a **dissecting microscope,** observe the **mouthparts of preserved specimens of different arthropods.** Record your observations in your data table.
4. Infer the specific function of each type of mouth based on the structure of its parts.

Data and Observations

Analysis

1. **Compare** and **contrast** the different mouthparts you observed.

_____

_____

_____

2. **Infer** the type of diet each arthropod might eat based upon your observations of their mouthparts.

_____

_____

_____

Name _____ Date _____ Class _____

MiniLab

CHAPTER 26

Compare Arthropod Characteristics

How do the physical characteristics of arthropods differ? Explore how scientists place arthropods into different taxonomic groups by observing specimens from the three major groups of arthropods.

Procedure

1. Read and complete the lab safety form.
2. Create a data table to record your observations of **live or preserved arthropod specimens.**

WARNING: ***Treat live specimens in a humane manner at all times.***

3. Observe the arthropod specimens and record your observations about their physical characteristics in your data table.

Data and Observations

Analysis

1. **Identify** the physical characteristics your arthropod specimens have in common.

_____

_____

2. **Classify** the arthropods into different taxonomic groups.

_____

_____

Name _____ Date _____ Class _____

BioLab

CHAPTER 26

Where are microarthropods found?

Background: Microarthropods range from 0.1 to 5 mm in size—barely visible to human eyes. Dozens of microarthropod species can be unearthed in one shovelful of soil. Discover these hidden animals during this investigation.

Question: *What types of microarthropods can be found in your local environment?*

Materials

soil sample
clear glass funnel
ring stand
gooseneck lamp
wire mesh
beaker
95% ethanol
plastic collection vials
magnifying lens
arthropod field guide
metric ruler

Safety Precautions

Procedure

1. Read and complete the lab safety form.
2. Obtain a sample of leaf litter and soil from your teacher.
3. Create a data table to record your observations.
4. Place the funnel in the ring stand.
5. Cut the mesh screen in a circle so it rests inside the funnel.
6. Pour ethanol into the beaker until the beaker is two-thirds full. Set the beaker under the funnel.
7. Remove your soil sample from the bag and place it carefully on the mesh screen in the funnel.
8. Place the lamp at least 10 cm above the sample. Switch on the light and leave it on for several hours. The heat from the lamp dries the soil. This forces the microarthropods downward until they fall through the screen and into the alcohol.
9. Use a magnifying lens to observe the physical characteristics of the microarthropods you collected.
10. **Cleanup and Disposal** Be certain to properly dispose of the alcohol and specimens you collected by following your teacher's instructions.

Data and Observations

Analyze and Conclude

1. **Classify** Place the microarthropods you collected into the three major groups of arthropods. Place unidentified specimens into a separate group.

2. **Graph** the results of your classifications of the microarthropods you collected.

3. **Describe** Write a description of the physical characteristics of the microarthropod specimens that you could not classify into any of the three major groups.

4. **Hypothesize** How do microarthropods help create a healthy soil ecosystem?

5. **Error Analysis** Check your findings against those for the microarthropods collected by other classmates. Did you classify the microarthropods into the same group? If not, explain why.

Name _____ Date _____ Class _____

Real-World Biology: **Analysis**

CHAPTER 26

Breeding Insect-Resistant Plants

One of the reasons for the great evolutionary success of insects has been their diversification into a number of dietary niches. Insects have evolved a variety of adaptations, such as small size and specialized mouthparts, that allow them to grind, slice, suck, and bore their way through all kinds of plants and other organic matter. Plants have, in turn, evolved structural and physiological mechanisms to fight insect attack. Some plants can withstand insect damage better than others, even within the same plant species. Insect resistance is important in agriculture, with many plants, such as wheat, corn, tomatoes, and soybeans, having resistant varieties. In this activity, you will learn how knowledge of insect anatomy and behavior can be important for the development of insect-resistant plant varieties.

Figure 1 shows three common insect pests. Descriptions of their anatomy and behavior follow.

a) Aphids and leafhoppers: order Homoptera; small, soft-bodied insects; mouthparts adapted for piercing plant stems and leaves and sucking out plant juices; will attack a variety of crops; common on plants with large leaves; prefer soft-plant tissues

b) Butterfly/moth larvae: order Lepidoptera; common names include earworms, caterpillars, armyworms, fruitworms, and cabbageworms; mouthparts adapted for chewing large amounts of plant tissue, especially leaves

c) Grubs: order Coleoptera; beetle larvae; possess strong, heavily muscled mouthparts adapted for chewing leaves, fruits, vegetables, and plant roots

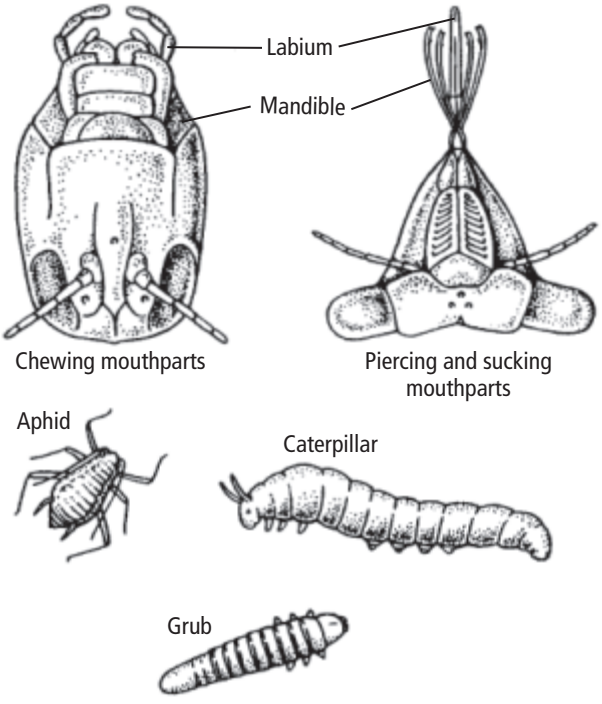


Figure 1

Analyze and Conclude

Respond to each question and statement.

1. **Apply** Imagine you are a plant breeder trying to design a plant that has two insect-resistant characteristics. Which two plant characteristics listed in **Table 1** would you choose to produce a plant that is resistant to each insect listed in **Table 2**? Record those characteristics in **Table 2.**

Table 1

Plant Part	Characteristics and Their Alleles
Chemical attractant	yes (*A*); no (*a*)
Fruit	thin-skinned (*T*); thick-skinned (*t*)
Flowers	bright colors that attract butterflies (*C*); dull colors (*c*)
Leaves	thin (*T*); thick (*t*); hairy (*H*); smooth (*h*)

Table 2

Insect	Chosen Insect-Resistant Characteristics of Plants	
Aphid		
Caterpillar		
Grub		

2. Predict Your genetics laboratory has seeds from five different varieties of a single plant species. The genotypes of the seeds are listed below. Each seed will develop into a plant with two prominent characteristics. What will be the phenotypes of the plants grown from each of the seeds?

Genotypes of Seeds	Phenotypes of Plants
llhh	
LlHH	
Ccaa	
ccAA	
TtLl	

3. Analyze Refer to the two insect-resistant plant characteristics that you chose for each insect listed in **Table 2.** Select the seeds from question 2 that carry those characteristics for the following insects. Write the genotypes of the seeds on the lines provided.

a. aphids _____

b. grubs _____

4. Construct For each of the insects in question 3 (aphids and grubs), construct a Punnett square that shows a cross between the plants grown from the seeds you selected.

Aphids

	LH	*LH*	*lH*	*lH*
lh				
lh				
lh				
lh				

Expected phenotypic frequency of desired F_1 offspring

Grubs

Expected phenotypic frequency of desired F_1 offspring

5. Predict What fraction of the offspring from each cross is expected to have the desired insect-resistant characteristics?

a. aphids _____

b. grubs _____

CAREERS IN BIOLOGY

Crop Technician Visit the biologygmh.com for information on crop technicians. What are the responsibilities of a crop technician?

Name _____ Date _____ Class _____

Enrichment

CHAPTER 26

Analyze a Problem: How do insects use pheromones to communicate?

Think of all the tools of communication that humans use: gestures, facial expressions, and, of course, words. Insects also use a range of tools to communicate with one another. One of the most important of those tools is pheromones. Pheromones are chemicals secreted by an organism of one species to produce a specific response from another member of the same species. Insects communicate as effectively with one another using pheromones as humans do using tools best suited to them.

Biologists' knowledge of pheromones has grown rapidly. In 1965, only three pheromones had been identified. Today, hundreds of pheromones are known. Pheromones are usually classified into a half dozen major groups, as shown in the table below.

Research Consult reference books or articles in scientific journals to learn more about each of the pheromone types listed in the table. Write the missing data in the table. Then select one type of pheromone to study in more detail.

Write Write a brief report that explains how insects communicate using the type of pheromone you have chosen. Explain how the pheromone is produced and released, how it is delivered to other members of the species, and how it affects those individuals.

Type of Pheromone	Example	Chemical Formula	Purpose
Alarm pheromone			
Social control pheromone			
Trail marking pheromone			
Aggregation pheromone			
Spacing pheromone			
Sex pheromone			

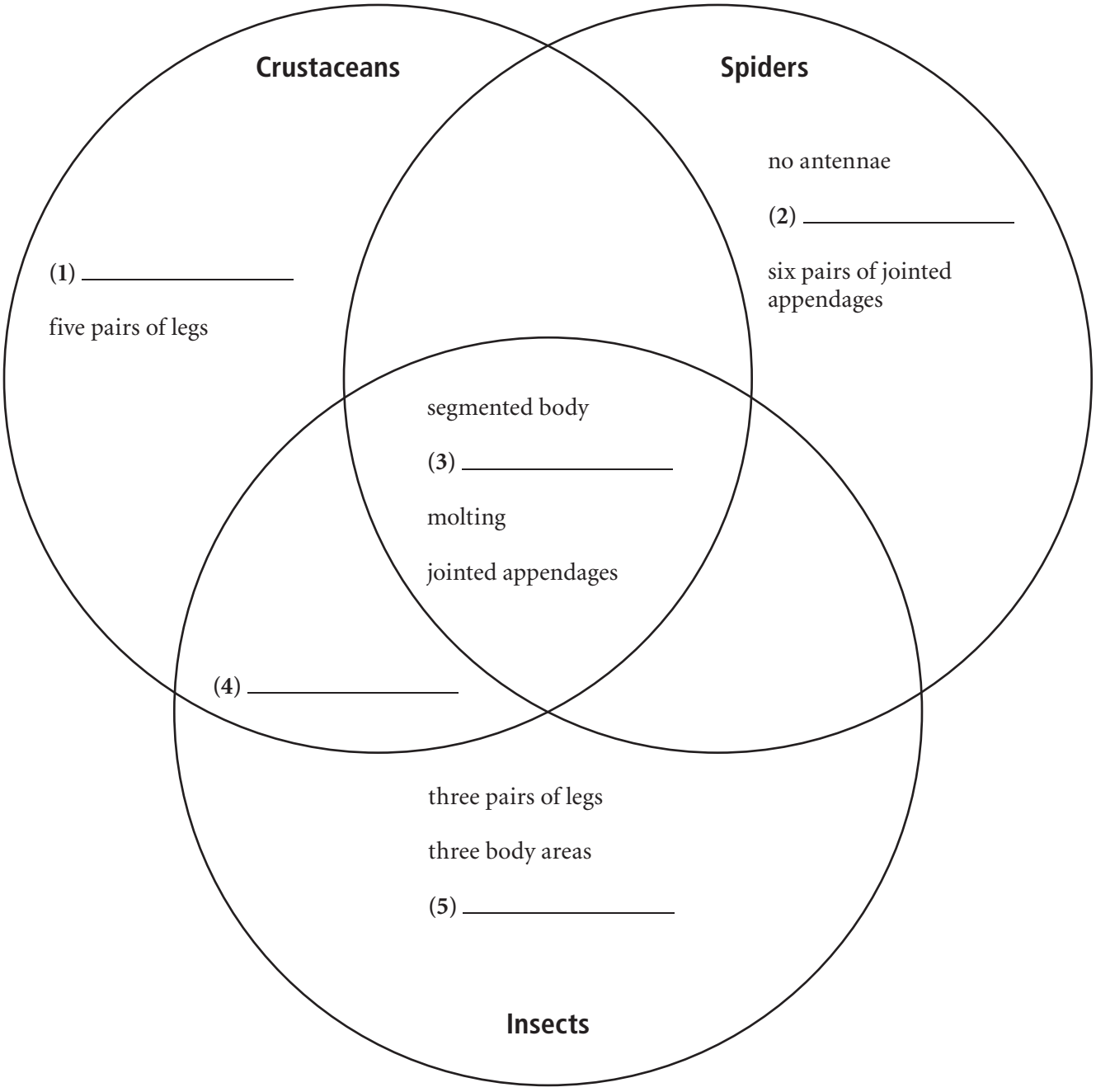
Name _____ Date _____ Class _____

Concept **Mapping**

CHAPTER 26

Characteristics of Arthropods

Complete the Venn diagram about the characteristics of the different groups of arthropods. These terms may be used more than once: antennae, can have wings, exoskeleton, swimmerets, two body sections.



Name _____ Date _____ Class _____

Study Guide

CHAPTER 26

Section 1: Arthropod Characteristics

In your textbook, read about arthropod features.

Use each of the terms below only once to complete the passage.

Arthropoda	**copepods**	**exoskeletons**	**grow**	**habitats**
molt	**mouthparts**	**organ systems**	**two**	**variety**

(1) _____ belong to the phylum called **(2)** _____ . Arthropods can be identified by **(3)** _____ main structural features: segmentation and **(4)** _____ . Arthropods' **(5)** _____ allow them to consume a wide variety of food. In order to **(6)** _____ , arthropods must **(7)** _____ . Arthropods have complex **(8)** _____ that have allowed them to live in all kinds of **(9)** _____ and to increase in **(10)** _____ and number.

In your textbook, read about the body structure of arthropods.

Complete the table by filling in the missing information.

Feature	Function
Tracheal tubes, book lungs, spiracles	**11.**
Heart, vessels, body tissue	**12.**
Brood chambers, copepod brood sacs, abdominal appendages	**13.**
Malpighian tubules	**14.**
Mandibles, feathery strainers, digestive enzymes	**15.**
Compound eyes, three to eight simple eyes	**16.**
Tympanum	**17.**
Pheromones	**18.**

Name _____ Date _____ Class _____

Study Guide

CHAPTER 26

Section 2: Arthropod Diversity

In your textbook, read about arthropod diversity.

If the statement is true, write true. *If the statement is false, replace the italicized word or phrase to make it true.*

1. *Arthropods* include ants, pill bugs, and spiders.

_____

2. Crayfish, lobsters, and crabs have *six* pairs of legs.

_____

3. Sow bugs and pills bugs are terrestrial *crustaceans* that live in damp places.

_____

4. *Mites* are an ancient group of marine animals that are related to arachnids.

_____

5. Scorpions are in the same class as *spiders.*

_____

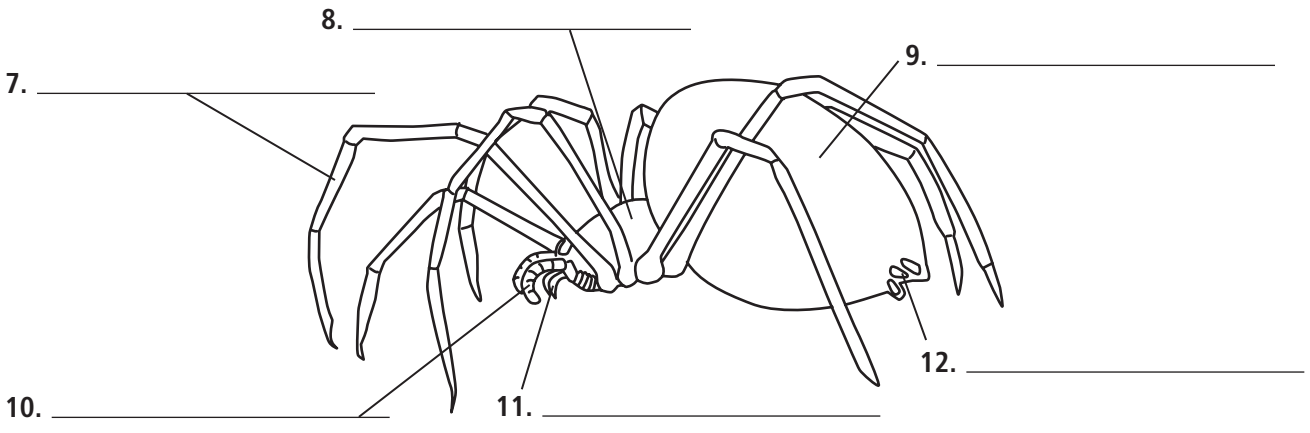
6. *Ticks* are parasites that feed on blood.

_____

In your textbook, read about spiders and their relatives.

Label the diagram. Use these choices:

abdomen	**appendages used for locomotion**	**cephalothorax**
chelicerae	**pedipalps**	**spinnerets**



Name _____ Date _____ Class _____

Study Guide

CHAPTER 26

Section 3: Insects and Their Relatives

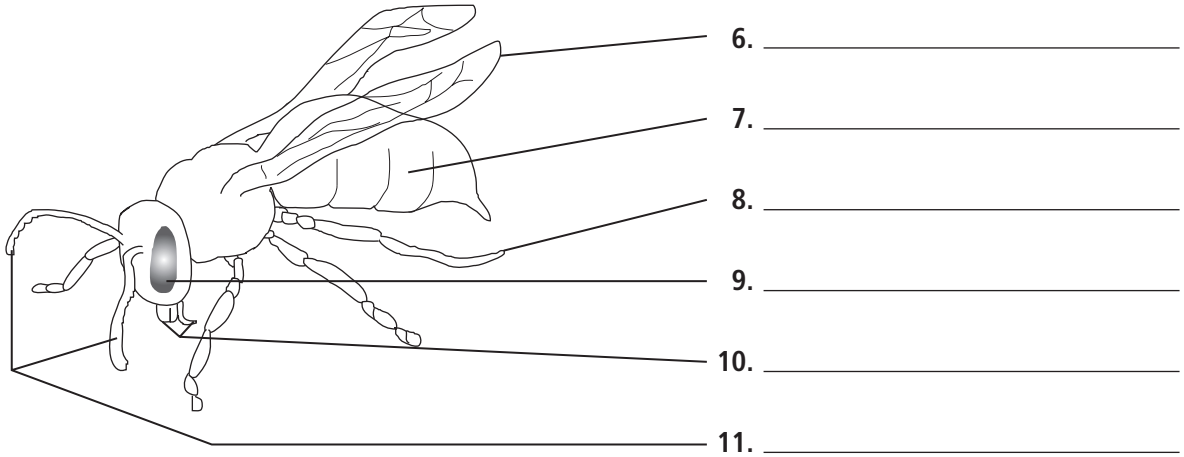
In your textbook, read about insects and their relatives.

Match the definition in Column A with the term in Column B.

	Column A	Column B
_____	**1.** immature form of insects that looks like a small adult	**A.** metamorphosis
_____	**2.** specialized chemical receptors for taste and smell	**B.** pupa
_____	**3.** nonfeeding stage of metamorphosis	**C.** nymph
_____	**4.** a group of individuals in a society that perform a certain task	**D.** caste
_____	**5.** a series of major changes from larval form to adult form	**E.** chemoreceptors

Label the diagram of the honeybee. Use these choices:

abdomen **antennae** **compound eye** **legs** **mandibles** **wings**



In the space at the left, write the letter of the term or phrase that best answers each question.

_____ **12.** Which is **not** a major insect body segment?
A. abdomen **C.** legs
B. head **D.** thorax

_____ **13.** Which body parts are adapted to dig, collect pollen, and skate over water?
A. eyes **C.** mouthparts
B. legs **D.** wings

_____ **14.** Which does **not** describe both centipedes and millipedes?
A. long, segmented bodies **C.** poison claws
B. many legs **D.** preference for moist habitat

In your textbook, read about metamorphosis.

Complete the table by checking the correct column(s) for each description.

Description	Complete Metamorphosis	Incomplete Metamorphosis
15. Insect begins life as a fertilized egg.		
16. Larva hatches from an egg.		
17. Nymph repeatedly molts and increases in size.		
18. Nymph hatches from egg.		
19. Pupa undergoes changes while encased in cocoon.		
20. Adults and young usually eat the same food.		
21. Adults are the only sexually mature form.		

In your textbook, read about the evolution of arthropods.

Complete the table by filling in the missing information.

Early Arthropods	Description	Habitat
Trilobites	**22.**	land
Tardigrades	**23.**	**24.**

Nombre _____ Fecha _____ Curso _____

Guía de estudio

CAPÍTULO 26

Sección 1: Las características de los artrópodos

En tu libro de texto, lee acerca de las características de los artrópodos.

Usa los siguientes términos sólo una vez para completar el párrafo.

artrópodos	**copépodos**	**crecer**	**dos**	**exoesqueletos**
hábitats	**mudar la piel**	**partes de la boca**	**sistemas de órganos**	**variedad**

Los **(1)** _____ pertenecen al filo llamado **(2)** _____ . Los artrópodos pueden identificarse por **(3)** _____ características estructurales principales: la segmentación y los **(4)** _____ . Las **(5)** _____ de los artrópodos les permiten consumir una variedad de alimentos. Para poder **(6)** _____ , los artrópodos deben **(7)** _____ . Los artrópodos cuentan con **(8)** _____ complejos que les han permitido vivir en todo tipo de **(9)** _____ y aumentar su **(10)** _____ y número.

En tu libro de texto, lee acerca de la estructura corporal de los artrópodos.

Completa la tabla con la información faltante.

Característica	Función
Tubos traqueales, pulmones de libro, espiráculos	**11.**
Corazón, vasos sanguíneos, tejido corporal	**12.**
Cámaras para empollar, sacos de los copépodos para empollar, apéndices abdominales	**13.**
Túbulos de Malpigio	**14.**
Mandíbulas, coladores plumosos, enzimas digestivas	**15.**
Ojos compuestos, entre tres y ocho ojos simples	**16.**
Tímpano	**17.**
Feromonas	**18.**

Nombre _____ Fecha _____ Curso _____

Guía de estudio

CAPÍTULO 26

Sección 2: La diversidad de los artrópodos

En tu libro de texto, lee acerca de la diversidad de los artrópodos.

Si la afirmación es verdadera, escribe «verdadero». Si la afirmación es falsa, substituye el término o la frase en cursiva para volverla verdadera.

1. Entre los *artrópodos* se cuentan las hormigas, las cochinillas de humedad y las arañas.

_____

2. El cangrejo de río, la langosta y el cangrejo de mar tienen *seis* pares de patas.

_____

3. Los isópodos y las cochinillas de humedad son *crustáceos* terrestres que viven en lugares húmedos.

_____

4. Los *acáridos* son un grupo antiguo de animales marinos que están relacionados con los arácnidos.

_____

5. Los escorpiones pertenecen a la misma clase de las *arañas.*

_____

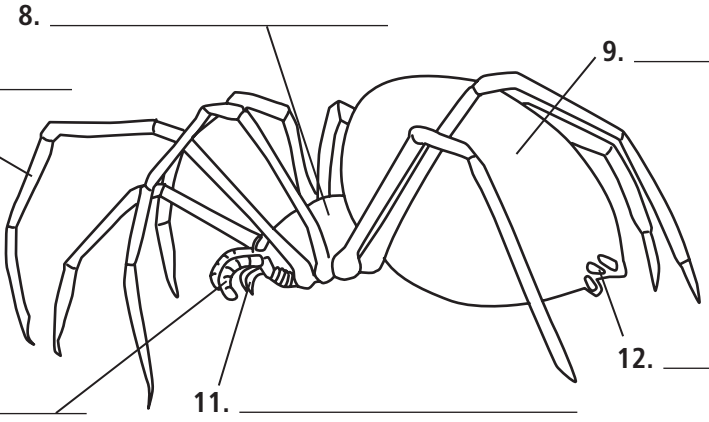
6. Las *garrapatas* son parásitos que se alimentan de la sangre.

_____

En tu libro de texto, lee acerca de las arañas y sus parientes.

Identifica el diagrama. Usa estas opciones:

abdomen	**apéndices para locomoción**	**cefalotórax**
hileras	**pedipalpos**	**quelicera**



Nombre _____ Fecha _____ Curso _____

Guía de estudio

CAPÍTULO 26

Sección 3: Los insectos y sus parientes

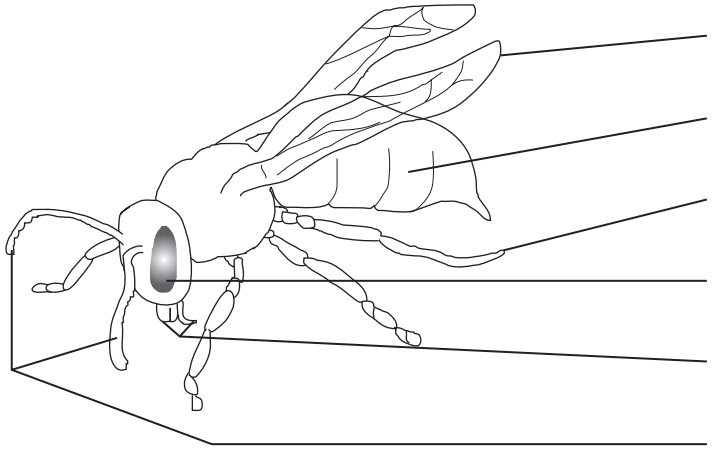
En tu libro de texto, lee acerca de los insectos y sus parientes.

Relaciona la definición en la columna A con el término de la columna B.

	Columna A	Columna B
_____	**1.** forma inmadura de los insectos que parece un adulto pequeño	**A.** metamorfosis
_____	**2.** receptores químicos especializados para el gusto y el olfato	**B.** crisálida
_____	**3.** etapa no alimenticia de la metamorfosis	**C.** ninfa
_____	**4.** un grupo de individuos en una sociedad que realiza una tarea en particular	**D.** casta
		E. quimoreceptores
_____	**5.** una serie de cambios importantes desde la forma de larva hasta la forma adulta	

Identifica el diagrama de una abeja obrera. Usa estas opciones:

abdomen **alas** **antenas** **mandíbulas** **ojo compuesto** **patas**



6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

En el espacio a la izquierda, escribe la letra del término o la frase que mejor responde a cada pregunta.

_____ **12.** ¿Cuál **no** es un segmento importante del cuerpo de un insecto?
A. el abdomen **C.** las patas
B. la cabeza **D.** el tórax

_____ **13.** ¿Cuáles partes del cuerpo están adaptadas para excavar, recoger polen y desplazarse sobre el agua?
A. las alas **C.** las partes de la boca
B. los ojos **D.** las patas

_____ **14.** ¿Cuál describe ni a los ciempiés ni a los milpiés?
A. cuerpos largos, segmentados **C.** muchas patas
B. garras venenosas **D.** preferencia por hábitat húmedo

En tu libro de texto, lee acerca de la metamorfosis.

Completa la tabla marcando la(s) columna(s) correcta(s) para cada descripción.

Descripción	Metamorfosis completa	Metamorfosis incompleta
15. El insecto empieza la vida como huevo fertilizado.		
16. La larva sale de un huevo.		
17. La ninfa muda de piel repetidamente y aumenta de tamaño.		
18. La ninfa sale de un huevo.		
19. La crisálida pasa por cambios mientras está en el capullo.		
20. Los adultos y los jóvenes por lo general comen la misma comida.		
21. Los adultos son la única forma sexualmente madura.		

En tu libro de texto, lee acerca de la evolución de los artrópodos.

Completa la tabla con la información faltante.

Artrópodos anteriores	Descripción	Hábitat
Trilobitas	**22.**	Terrestre
Tardígrados	**23.**	**24.**

Name _____ Date _____ Class _____

Section **Quick Check**

CHAPTER 26

Section 1: Arthropod Characteristics

After reading the section in your textbook, respond to each statement.

1. **Recall** four features of arthropods.

2 **Review** the circulatory system of most arthropods. **Summarize** its function.

3. **Identify** the organ that is used by many arthropods for hearing. **List** places it might be located.

4. **Analyze** why different species of arthropods have many different types of mouthparts.

5. **Consider** some ways in which having an exoskeleton is a disadvantage. **Describe** how it limits arthropods.

Name _____ Date _____ Class _____

Section **Quick Check**

CHAPTER 26

Section 2: Arthropod Diversity

After reading the section in your textbook, respond to each statement.

1. **List** the three types of legs of a crustacean. **Describe** their functions.

2. **Review** the characteristics of a horseshoe crab.

3. **Classify** an arthropod with no antennae, two body sections, and spinnerets.

4. **Infer** how disease-causing agents spread through the body of a host of a tick. Explain.

5. **Suggest** why different spiders construct specific, but different, kinds of webs.

Name _____ Date _____ Class _____

Section **Quick Check**

CHAPTER 26

Section 3: Insects and Their Relatives

After reading the section in your textbook, respond to each statement.

1. **Recall** the three body parts of an insect.

2. **Describe** the stages of complete metamorphosis.

3. **Compare** and **contrast** centipedes and millipedes.

4. **Generalize** Use what you know about bees to tell how insects work together in societies.

5. **Deduce** why insects that do not care for their young lay many more eggs than insects that do care for their young.

Name _____ Date _____ Class _____

CHAPTER 26
Assessment

Student Recording Sheet

Section 26.1

Vocabulary Review

Write the vocabulary term that best completes each analogy.

1. _____ **2.** _____ **3.** _____

Understand Key Concepts

Select the best answer from the choices given, and fill in the corresponding circle.

4. Ⓐ Ⓑ Ⓒ Ⓓ **5.** Ⓐ Ⓑ Ⓒ Ⓓ **6.** Ⓐ Ⓑ Ⓒ Ⓓ **7.** Ⓐ Ⓑ Ⓒ Ⓓ

Constructed Response

8. Record your answer for question 8 on a separate sheet of paper.

9. _____

_____

Think Critically

10. Careers in Biology _____

_____

11. _____

_____

_____

Section 26.2

Vocabulary Review

Explain the relationship between the vocabulary terms in each pair.

12. _____

_____

_____

13. _____

_____

_____

14. _____

_____

_____

Name _____ Date _____ Class _____

CHAPTER 26

Assessment

Student Recording Sheet

Understand Key Concepts

Select the best answer from the choices given, and fill in the corresponding circle.

15. Ⓐ Ⓑ Ⓒ Ⓓ **17.** Ⓐ Ⓑ Ⓒ Ⓓ **19.** Ⓐ Ⓑ Ⓒ Ⓓ

16. Ⓐ Ⓑ Ⓒ Ⓓ **18.** Ⓐ Ⓑ Ⓒ Ⓓ

Constructed Response

20. _____

_____

_____

_____

21. _____

_____

Think Critically

22. Record your answer for question 22 on a separate sheet of paper.

23. _____

_____

Section 26.3

Vocabulary Review

Choose the vocabulary term that does not belong, and explain why it does not belong.

24. _____

_____

_____

25. _____

_____

_____

26. _____

_____

_____

Name _____ Date _____ Class _____

CHAPTER 26

Assessment Student Recording Sheet

Understand Key Concepts

Select the best answer from the choices given, and fill in the corresponding circle.

27. Ⓐ Ⓑ Ⓒ Ⓓ **28.** Ⓐ Ⓑ Ⓒ Ⓓ **29.** Ⓐ Ⓑ Ⓒ Ⓓ

Constructed Response

30. _____

_____

31. _____

_____

_____

_____

Think Critically

32. _____

_____

33. Record your answer for question 33 on a separate sheet of paper.

Additional Assessment

34. Writing in Biology Record your answer for question 34 on a separate sheet of paper.

Document-Based Questions

35. _____

36. _____

37. _____

_____

Cumulative Review

38. _____

_____

_____

_____

Name _____ Date _____ Class _____

CHAPTER 26

Assessment Student Recording Sheet

Standardized Test Practice

Multiple Choice

Select the best answer from the choices given, and fill in the corresponding circle.

1. Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ
4. Ⓐ Ⓑ Ⓒ Ⓓ
5. Ⓐ Ⓑ Ⓒ Ⓓ
6. Ⓐ Ⓑ Ⓒ Ⓓ
7. Ⓐ Ⓑ Ⓒ Ⓓ
8. Ⓐ Ⓑ Ⓒ Ⓓ
9. Ⓐ Ⓑ Ⓒ Ⓓ

Short Answer

Answer each question with complete sentences.

10. Record your answer for question 10 on a separate sheet of paper.

11. _____

_____

12. Record your answer for question 12 on a separate sheet of paper.

13. _____

_____

14. _____

_____

15. _____

_____

16. _____

_____

Extended Response

Answer each question with complete sentences.

17. _____

_____

18. _____

_____

Essay Question

19. Record your answer for question 19 on a separate sheet of paper.

Table of Contents

Reproducible Pages

Chapter 27 Echinoderms and Invertebrate Chordates

Name _____ Date _____ Class _____

Diagnostic Test

CHAPTER 27
Echinoderms and Invertebrate Chordates

Before reading Chapter 27, predict answers to questions about the chapter content based on what you already know. Circle the letter of the correct answer, and then explain your reasoning.

1. While participating in a tidal pool search during summer camp, Tegene discovers an echinoderm. Which does she find?

A. chiton
B. hermit crab
C. sea urchin
D. sponge

Explain.

_____

_____

_____

2. While snorkeling off a coral reef near the British Virgin Islands, Lance spots a brightly colored sea star on a coral head. He is interested in the behaviors of sea stars, and he reads about them in a coral reef guidebook. Which does he learn?

A. Predatory sea stars lie in wait to capture unsuspecting reef fish.
B. Sea stars are scavengers that clean the ocean bottom of organic debris.
C. Some echinoderms, such as sea stars, can regenerate missing arms.
D. Vertebrate sea stars are classified in the same group as other ocean fish.

Explain.

_____

_____

_____

3. While watching a documentary on vertebrate diversity, Cecilia and her friends learn that all vertebrates belong to the group known as phylum Chordata. Cecilia's friends believe that some invertebrates also belong to this phylum, and they research the topic. What do they learn?

_____

_____

_____

Name _____ Date _____ Class _____

Launch Lab

CHAPTER 27

Why are tube feet important?

Like all echinoderms, the crown-of-thorns sea star has structures called tube feet. In this lab, you will observe tube feet and determine their function.

Procedure

1. Read and complete the lab safety form.
2. Place a **live sea star** in a **petri dish** filled with **water** from a **saltwater aquarium.**
   WARNING: ***Treat the sea star in a humane manner at all times.***
3. Observe the ventral side of the sea star under a **dissecting microscope.** Look for the rows of tube feet that run down the middle of each arm, and draw a diagram of the structures.
4. Gently touch the end of a tube foot with a **glass probe.** Record your observations.
5. Return the sea star and water to the aquarium.

Data and Observations

Analysis

1. **Describe** the structure of the sea star's tube feet.

_____

_____

2. **Infer** Based on your observations, what is the function of an echinoderm's tube feet?

_____

_____

Name _____ Date _____ Class _____

MiniLab

CHAPTER 27

Observe Echinoderm Anatomy

What are the characteristics of echinoderms? Although they come in many shapes and sizes, all echinoderms have some features in common.

Procedure

1. Read and complete the lab safety form.
2. Study preserved specimens of **a sand dollar, a sea cucumber, a sea star,** and **a sea urchin.**
3. Create a data table to record your observations. Complete the table by describing the major features of each specimen.
4. Sketch each specimen. Label any external features you can identify.
5. Clean all equipment and return it to the appropriate place. Wash your hands thoroughly after handling preserved specimens.

Data and Observations

Analysis

1. **Compare** the external features of the echinoderms you studied. Can your observations completely justify why these four organisms are classified in the same phylum? Explain.

2. **Observe and Infer** What features are most important in helping echinoderms avoid being eaten by predators?

Name _____ Date _____ Class _____

BioLab

CHAPTER 27

Internet: How do echinoderms survive without a head, eyes, or a brain?

Background: Echinoderms have evolved unlike any other animals on Earth. Lacking eyes and a brain, they also have no heart, and pump seawater through their bodies rather than blood. Echinoderms can change their endoskeletons from rock hard to nearly liquid within seconds. Some can purposely break off an arm to distract a predator. Sound unusual? Not for echinoderms.

Question: *How do echinoderms survive in the competitive marine environment?*

Materials

internet access
echinoderm reference book
field journal

Procedure

1. Read and complete the lab safety form.
2. Design and construct a data table for recording the species; physical characteristics; food sources/strategies for obtaining food; predators; defense strategies; reproduction and development; and other interesting facts about six animals.
3. Choose one species from each of the six major classes of echinoderms to study. List the species in your data table.
4. Research the species you chose and fill in information in your data table. Observe the echinoderms in their natural habitat by visiting a local zoo or aquarium. If you cannot observe the animals in their natural habitats, obtain information about the echinoderms from a reference book or visit biologygmh.com.
5. Record your observations in your field journal. Transfer the information to your data table.
6. Post your results at biologygmh.com. Use data posted by other students to complete missing portions of your table.

Data and Observations

Analyze and Conclude

1. **Describe** some basic physical characteristics shared by echinoderms.

2. **Compare** sexual and asexual reproductive strategies used by echinoderm species.

3. **Think Critically** Echinoderm larvae and mature echinoderms differ in several important ways. Describe the differences, and infer the advantages they provide.

4. **Interpret Data** What are the major food sources of the echinoderms you studied?

5. **Draw Conclusions** Are echinoderms well-adapted to survive in the marine environment? Justify your answer.

6. **Error Analysis** Describe advantages and disadvantages of obtaining information about echinoderms from the Internet.

Name _____ Date _____ Class _____

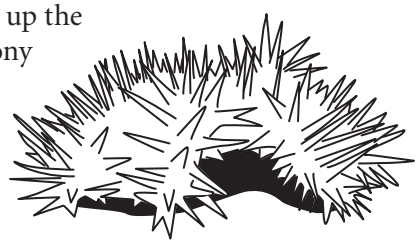
Real-World Biology: **Analysis**

CHAPTER 27

Outbreaks of Crown-of-Thorns Sea Stars

When you think of a sea star, you probably picture a five-armed echinoderm in a tide pool or shallow ocean water. But imagine scuba diving at the Great Barrier Reef just off the shores of Australia. You look down and see an animal that has a diameter of 1 m. You count 21 arms covered with long, venomous spikes. You are looking at a crown-of-thorns sea star. You see many of them, although they are not all so large, and some have fewer arms.

Crown-of-thorns sea stars are a natural part of the Great Barrier Reef ecosystem. They are natural predators of the corals, which are the organisms that make up the living part that covers the reef. Usually, the sea stars eat only part of the colony of corals, and the reef can recover quickly. However, when the population of sea stars greatly increases, the reef is damaged and can take more than ten years to recover. A large increase in the sea star population is known as an outbreak. In this activity, you will explore the reproduction of crown-of-thorns sea stars and three theories about the causes of their outbreaks.



Part A: Increasing Numbers

Crown-of-thorns sea stars have a high reproductive rate. One female produces millions of eggs each year from December to April. Males produce and deposit large amounts of sperm. Because sea stars collect in groups and a large amount of sperm is released, the eggs have a high fertilization rate. Some studies show that more than 70 percent of eggs are fertilized, even if the closest male is 8 m away. **Table 1** describes different stages in the life cycle of a crown-of-thorns sea star. Notice the ages when crown-of-thorns sea stars start eating corals and are able to reproduce.

Table 1

Egg	Larva	Juvenile	6 Months Old	2–3 Years Old
millions produced by each female every year	spends 2–4 weeks drifting in ocean currents	about 1–2 mm across; settles among rocks of reef and is almost invisible	starts to eat corals and grows rapidly	starts breeding; can reproduce for 5–7 years

Analyze and Conclude

Respond to each question.

1. **Summarize** What causes crown-of-thorns sea stars to have a high reproductive rate?

_____

_____

2. **Predict** How long after a large number of eggs hatch might scientists notice a change in a coral reef? Explain.

_____

_____

3. **Calculate** An individual female can produce 60 million eggs each year. If 70 percent of the eggs hatch and 10 percent of the larvae survive each year, how many larvae will the female have produced in 5 years? How many more larvae would there be if 11 percent of the larvae had survived each year?

Part B: Causes of Outbreaks

A large increase in the population of crown-of-thorns sea stars, or an outbreak, causes serious damage to coral reefs. One square meter can contain so many sea stars that they pile on top of one another. During an outbreak, the sea stars can eat almost all the living corals on a reef. The first known outbreak on the Great Barrier Reef occurred in the 1960s. During this time, an increase in tourism and scuba diving made people more aware of the reef. It is possible that earlier outbreaks occurred but were not noticed.

Even after decades of research into the causes of crown-of-thorns outbreaks, the actual cause is not known. The three theories that are supported by scientists are shown in **Table 2.** None of the outbreak theories has been proved.

Table 2

Theory 1	• Natural changes and fluctuations in the environment can increase the survival rate of larvae. • Changes in temperature, salinity, or availability of food (plankton) affect survival of larvae.
Theory 2	• Removal of predators causes an increase in population. • Adult crown-of-thorns sea stars have few predators, which include the giant triton snail and a few fishes. Other reef fishes are predators of juvenile sea stars. • Before laws were passed to protect them, giant triton snails were collected for their shells. Commercial fishing removes some fish from the ecosystem.
Theory 3	• There seems to be a relationship between periods of high amounts of rainfall and the beginning of outbreaks. • A large amount of rain can cause water with low salinity and with large amounts of sediments and nutrients to enter ocean water around the Great Barrier Reef. • Low salinity increases larvae survival. • Large amounts of nutrients increase algae growth, which provides more food for larvae. • The amount of nutrients carried to the ocean by rivers has increased since people developed the land.

Analyze and Conclude

Respond to each question.

1. **Analyze** What stage in the life cycle of crown-of-thorns sea stars is most affected in the three outbreak theories? Give details to support your answer.

2. **Infer** How might people have contributed to outbreaks of crown-of-thorns sea stars?

CAREERS IN BIOLOGY

Marine Science Visit biologygmh.com for information on marine science researchers. What are the responsibilities of a marine science researcher?

Name _____ Date _____ Class _____

Enrichment

CHAPTER 27

Analyze a Problem: Understanding Regeneration

Any description of echinoderms is likely to include some mention of their amazing ability to regenerate lost body parts. While other organisms do have this ability, the echinoderms appear to have become especially talented in replacing lost tails, arms, legs, and even internal organs.

The subject of regeneration has fascinated scientists for centuries. At first, researchers were primarily interested in learning about what happens during regeneration: What body parts can be regenerated? Is there a limit to the types and number of body parts that can be regenerated? What factors affect the way regeneration occurs? More recently, scientists are asking how regeneration occurs: What are the chemical and biological changes that take place in an organism that result in the growth of new body parts?

Research In this activity, you will learn about the contributions of some major figures in biology to present-day understandings of regeneration. The table lists scientists who have made important contributions to the study of regeneration. Choose any one individual and find out more about that person's research on regeneration. What new knowledge did he contribute to the science? Look particularly for any research on echinoderms conducted by this scientist.

The final entry in the table, "Present-day researcher," refers to any scientist that you can identify who is studying regeneration today. Find out what problem that person has chosen to study and what he or she has learned about the mechanism by which regeneration occurs.

Portray Think of an interesting way in which to summarize and display the results of your research. For example, make a poster or put together a bulletin-board display that shows the discoveries made by the scientist you studied. Be sure to include photographs or drawings that illustrate the forms of regeneration about which you learned.

Scientist	Dates
René-Antoine Ferchault de Réaumur	1683–1757
Abraham Trembley	1710–1784
Charles Bonnet	1720–1793
Lazzaro Spallanzani	1729–1799
Thomas Hunt Morgan	1866–1945
Present-day researcher: _____	

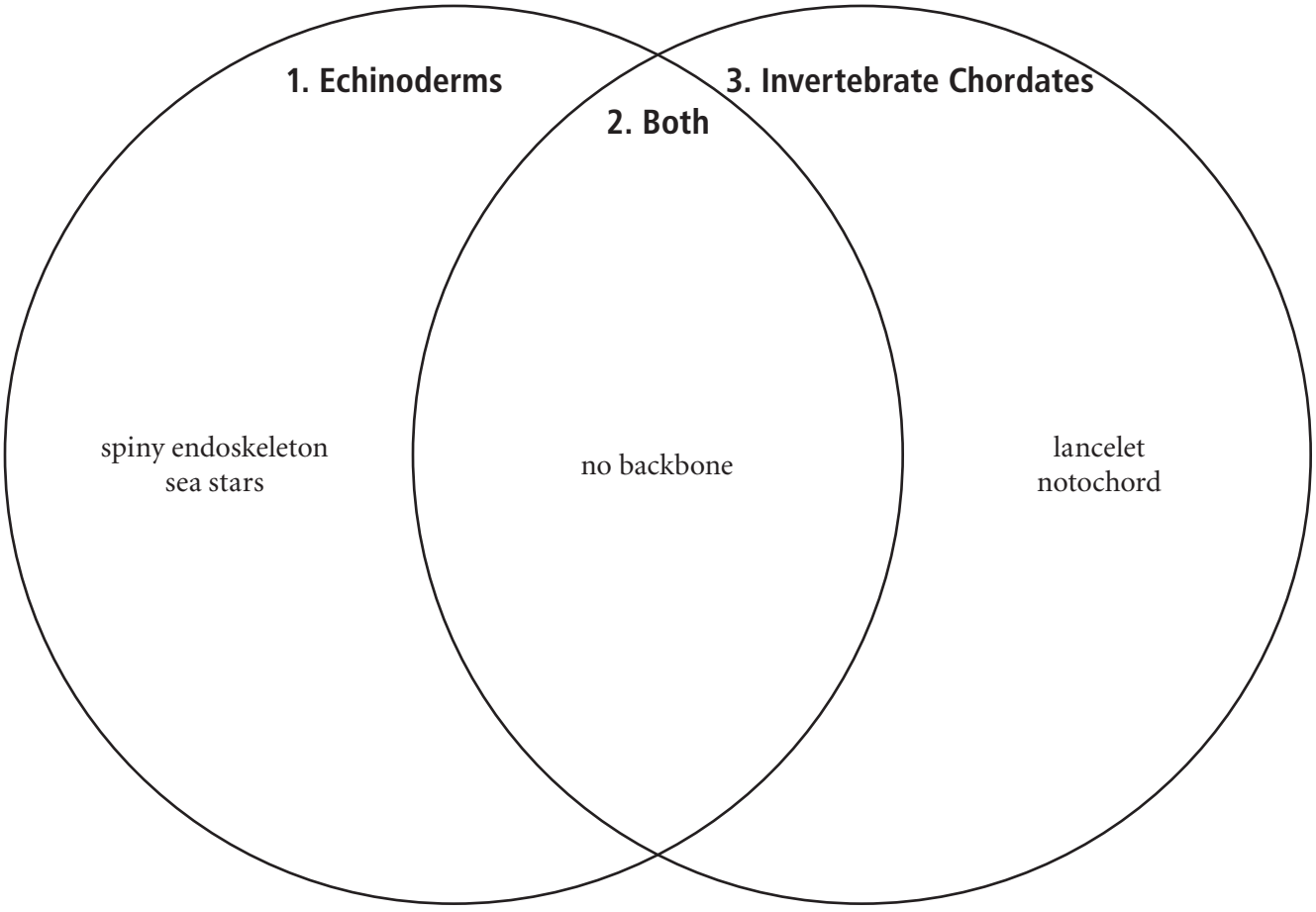
Name _____ Date _____ Class _____

Concept Mapping

CHAPTER 27

Echinoderms and Invertebrate Chordates

Complete the Venn diagram about echinoderms and invertebrate chordates. These terms may be used more than once: deuterostome, dorsal tubular nerve cord, marine animals, pharyngeal pouches, postanal tail, radial symmetry, sea urchins, tube feet, tunicates, water-vascular system.



Name _____ Date _____ Class _____

Study Guide

CHAPTER 27

Section 1: Echinoderm Characteristics

In your textbook, read about echinoderm characteristics.

Use each of the terms below only once to complete the passage.

adaptations	**adult**	**classes**	**endoskeletons**
larval	**tube feet**	**water-vascular system**	

Echinoderms are marine animals with spiny (**1**) _____ . Echinoderms also have radial symmetry in the (**2**) _____ stage of life. In the (**3**) _____ stage, echinoderms have features that link them to relatives that evolved after them. Two main features of echinoderms are the (**4**) _____ and the (**5**) _____ . Echinoderms have a variety of (**6**) _____ for feeding and movement. There are six major (**7**) _____ of living echinoderms.

In your textbook, read about the body structure of echinoderms.

Match the definition in Column A with the term in Column B.

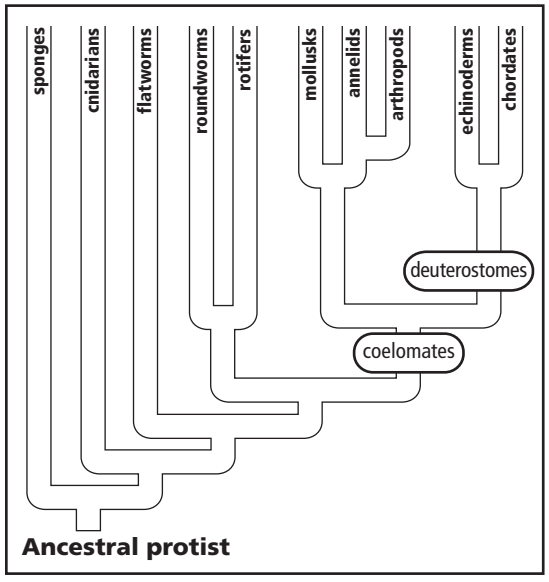
	Column A	Column B
_____	**8.** strainer-like opening to the water-vascular system	**A.** pedicellaria
_____	**9.** structure used for movement and respiration	**B.** water-vascular system
_____	**10.** muscular sac that forces water into the tube feet	**C.** madreporite
_____	**11.** system of fluid-filled, closed tubes that work together for movement and obtaining food	**D.** tube foot
_____	**12.** pincers that aid in catching food	**E.** ampulla

Refer to the evolutionary diagram on the right. Write the name of the group that best completes each statement.

13. Deuterostomes include _____ and _____ .

14. Mollusks, annelids, and arthropods are _____ .

15. The most primitive group after the ancestral protists is the _____ .



In your textbook, read about echinoderm diversity.

Complete the table by checking the correct column(s) for each description.

Description	Asteroidea	Ophiuroidea	Echinoidea	Holothuroidea	Crinoidea
16. Five-armed					
17. Have arms that can break off and regenerate					
18. Cucumber shape					
19. Sessile for some part of life					
20. No suction cups on tube feet					
21. Move using arms					
22. Burrow in rocky areas or sand					
23. Long stalks or feathery, branching arms					
24. Body encased in a test with spines					
25. Leathery outer body					

In your textbook, read about the ecology of echinoderms.

For each statement below, write true *or* false.

_____ **26.** Sea cucumbers are sources of food for people in some Asian countries.

_____ **27.** When the numbers of sea urchins decline in some areas, algae also decreases.

_____ **28.** Sea urchins and sea cucumbers stir up sediment on the ocean floor, which is harmful to the marine ecosystem.

_____ **29.** The crown-of-thorns sea star feeds on coral polyps and can destroy a coral reef.

_____ **30.** Sea otters eat sea urchins. When the numbers of sea otters decline, the numbers of sea urchins increase, and then the sea urchins overgraze kelp forest habitats.

Name _____ Date _____ Class _____

Study Guide

CHAPTER 27

Section 2: Invertebrate Chordates

In your textbook, read about invertebrate chordate features.

In the space at the left, write the letter of the term or phrase that best answers each question.

_____ **1.** Fossil evidence and recent molecular data indicate that humans are more closely related to which animal than to any other invertebrate?
A. amphioxus **C.** sea star
B. crinoid **D.** tunicate

_____ **2.** Which structure do all chordates possess at some point in their development?
A. backbone **C.** gills
B. fins **D.** notochord

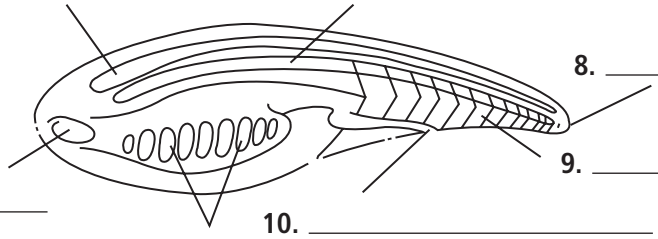
_____ **3.** Which characteristic is most helpful to a free-swimming animal?
A. eye spot **C.** postanal tail
B. leathery skin **D.** thyroid gland

_____ **4.** In chordates, the anterior end of the dorsal tubular nerve cord becomes which structure?
A. brain **C.** muscles
B. digestive organ **D.** spinal cord

_____ **5.** The ancestral thyroid glands were cells that secreted which substance to aid in filter feeding?
A. hormones **C.** mucus
B. iodine **D.** salt

Label the diagram of the lancelet (amphioxus). Use these choices:

anus **dorsal tubular nerve cord** **mouth** **muscle blocks**
notochord **pharyngeal pouches** **postanal tail**



6. _____ **7.** _____ **8.** _____ **9.** _____ **10.** _____ **11.** _____ **12.** _____

For each statement below, write true *or* false.

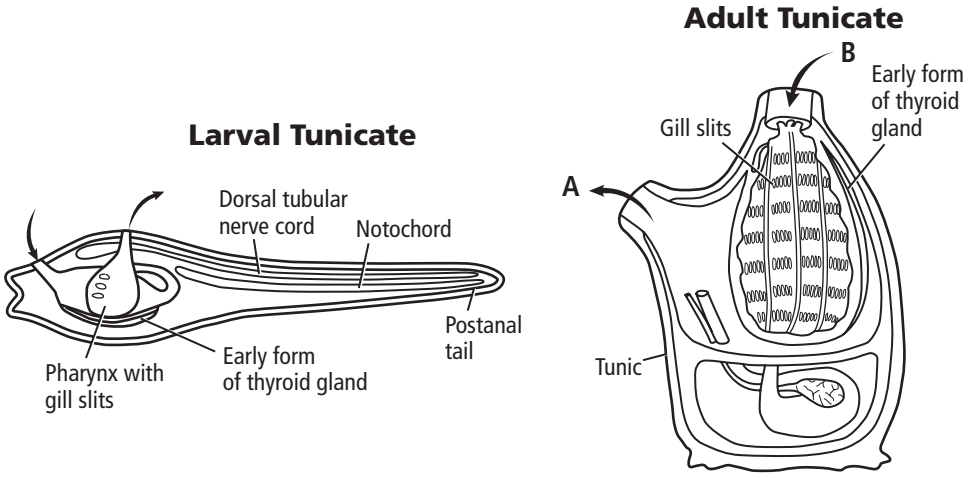
_____ **13.** During your early development, your notochord became your backbone.

_____ **14.** Invertebrate chordates have a backbone.

_____ **15.** In living aquatic chordates, pharyngeal pouches are used for filter feeding.

In your textbook, read about the diversity of invertebrate chordates.

Refer to the diagrams of a larval tunicate and an adult tunicate. Respond to each statement.



16. Tell which structure in the adult tunicate gave rise to its name. _____

17. State which structure labeled *A* or *B* in the adult tunicate is the excurrent siphon. _____

18. List the structures in the larval tunicate that disappear in the adult.

_____

_____

Complete the table by checking the correct column(s) for each description.

Description	Lancelets	Tunicates
19. Belong to the genus *Branchiostoma*		
20. Often called sea squirts		
21. Are filter feeders		
22. Take in water through the incurrent siphon		
23. Are fishlike, but do not have scales		
24. Have tails only as larvae		
25. One individual produces both eggs and sperm		
26. Burrow into the sand in shallow seas		
27. Retain chordate characteristics throughout life		
28. Have gill slits through which water exits the body		
29. Use a heart and blood vessels for circulation		

Nombre _____ Fecha _____ Curso _____

Guía de estudio

CAPÍTULO 27

Sección 1: Las características de los equinodermos

En tu libro de texto, lee acerca de las características de los equinodermos.

Usa los siguientes términos sólo una vez para completar el párrafo.

adaptaciones	**adulta**	**clases**	**endoesqueletos**
larval	**patas tubulares**	**sistema vascular acuático**	

Los equinodermos son animales marinos con (**1**) _____ espinosos. Los equinodermos también tienen simetría radial en la etapa de vida (**2**) _____ . En la etapa (**3**) _____ , los equinodermos tienen características que los relacionan con parientes que evolucionaron después de ellos. Las dos características principales de los equinodermos son el (**4**) _____ y las (**5**) _____ . Los equinodermos tienen una variedad de (**6**) _____ para alimentación y movimiento. Existen seis (**7**) _____ principales de equinodermos vivientes.

En tu libro de texto, lee acerca de la estructura corporal de los equinodermos.

Relaciona la definición de la columna A con el término de la columna B.

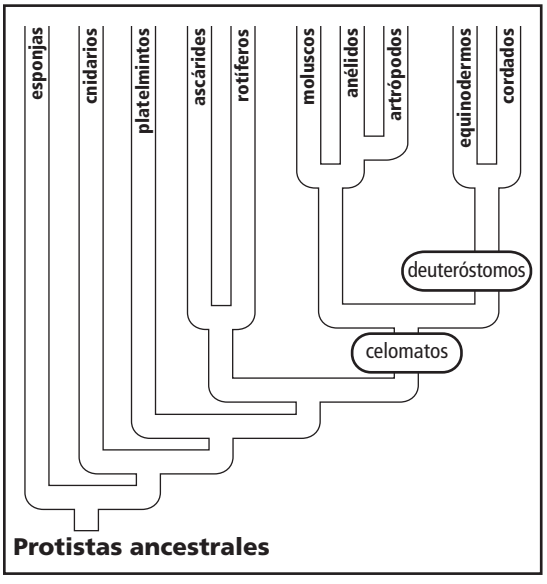
Columna A		Columna B
_____	**8.** abertura tipo colador hacia el sistema vascular acuático	**A.** pedicelarias
_____	**9.** estructura usada para el movimiento y la respiración	**B.** sistema vascular acuático
_____	**10.** saco muscular que lleva el agua hacia las patas tubulares	**C.** madreporita
_____	**11.** sistema de tubos cerrados, llenos de fluido que trabajan en combinación para moverse y obtener comida	**D.** patas tubulares
_____	**12.** pinzas que ayudan a capturar la comida	**E.** ampolla

Consulta el diagrama evolutivo a la derecha. Escribe el nombre del grupo que mejor completa cada afirmación.

13. Los deuteróstomos incluyen los _____ y los _____ .

14. Los moluscos, los anélidos y los artrópodos son _____ .

15. El grupo más primitivo después de los protistas ancestrales es las _____ .



En tu libro de texto, lee acerca de la diversidad de los equinodermos.

Completa la tabla marcando la(s) columna(s) correcta(s) para cada descripción.

Descripción	Asteroidea	Ophiuroidea	Echinoidea	Holothuroidea	Crinoidea
16. Tienen cinco brazos.					
17. Tienen brazos que se pueden partir y regenerar.					
18. Tienen forma de pepino.					
19. Son sesil es en cierta parte de la vida.					
20. No tienen copas de succión en las patas tubulares.					
21. Se mueven con los brazos.					
22. Hacen madriguera en áreas rocosas o en la arena.					
23. Tienen tallos largos o brazos plumosos y ramificados.					
24. Sus cuerpos encapsulados en una testa con espinas.					
25. Sus cuerpos exteriores son coriáceos.					

En tu libro de texto, lee acerca de la ecología de los equinodermos.

Para cada afirmación, escribe «verdadero» o «falso».

_____ **26.** Los pepinos de mar se comen en algunos países asiáticos.

_____ **27.** Cuando el número de erizos de mar disminuye, las algas también disminuyen.

_____ **28.** Los erizos de mar y los pepinos de mar revuelven el sedimento en el fondo del mar, lo cual es perjudicial para el ecosistema marino.

_____ **29.** La estrella de mar "corona de espinas" se alimenta de pólipos de coral y puede destruir un arrecife de corales.

_____ **30.** La nutria marina come erizos de mar. Cuando el número de nutrias marinas disminuye, el número de erizos de mar aumenta, y luego los erizos de mar consumen en exceso en los hábitats boscosos de kelp.

Nombre _____ Fecha _____ Curso _____

Guía de estudio

CAPÍTULO 27
Sección 2: Los cordados invertebrados

En tu libro de texto, lee acerca de las características de los cordados invertebrados.

En el espacio a la izquierda, escribe la letra del término o la frase que mejor responde a cada pregunta.

_____ **1.** ¿La evidencia fósil y los datos moleculares recientes indican que los humanos están más cercanamente relacionados a qué animal que a cualquier otro invertebrado?
A. anfioxo **C.** estrella de mar
B. crinoid **D.** tunicado

_____ **2.** ¿Qué estructura poseen todos los cordados en algún momento de su desarrollo?
A. agallas **C.** columna vertebral
B. aletas **D.** notocordio

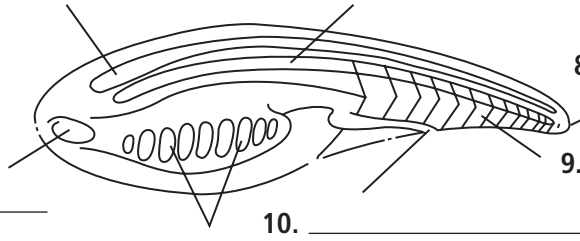
_____ **3.** ¿Qué característica es más útil para un animal de nado libre?
A. cola postanal **B.** mancha ocular
B. glándula tiroidea **D.** piel coriácea

_____ **4.** ¿En los cordados, el extremo anterior del cordón nervioso tubular dorsal se convierte en qué estructura?
A. cerebro **C.** músculos
B. médula espinal **D.** órgano digestivo

_____ **5.** ¿Las glándulas tiroideas ancestrales fueron células que secretaban qué sustancia para ayudar en la alimentación por filtración?
A. hormonas **C.** sal
B. mucosa **D.** yodo

Identifica el diagrama del pez lanceta (anfioxo). Usa estas opciones:

ano	**bloques musculares**	**boca**	**bolsas faríngeas**
cola postanal	**cordón nervioso tubular dorsal**	**notocordio**	



6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

Para cada afirmación, escribe «verdadero» o «falso».

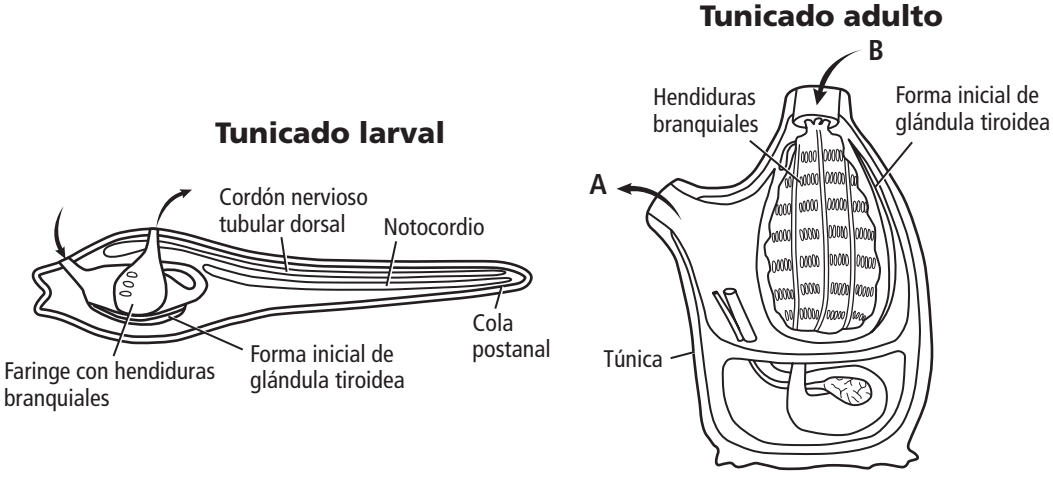
_____ **13.** Durante tu desarrollo inicial, el notocordio se convirtió en tu columna vertebral.

_____ **14.** Los cordados invertebrados tienen columna vertebral.

_____ **15.** En los cordados acuáticos vivientes, las bolsas faríngeas se usan para la alimentación por filtración.

En tu libro de texto, lee acerca de la diversidad de los cordados invertebrados.

Consulta los dibujos de un tunicado larval y un tunicado adulto. Responde a cada afirmación.



16. Indica qué estructura en el tunicado adulto dio lugar a su nombre. _____

17. Establece qué estructura identificada como *A* o *B* en el tunicado adulto es el sifón excurrente. _____

18. Enumera las estructuras en el tunicado larval que desaparecen en el adulto.

_____

_____

Completa la tabla marcando la(s) columna(s) correcta(s) para cada descripción.

Descripción	Pez lanceta	Tunicado
19. Pertenece al género *Branquiostoma.*		
20. A menudo se le llama ascidia.		
21. Se alimenta por filtración.		
22. Absorbe agua a través del sifón incurrente.		
23. Es como un pez, pero no tienen escamas.		
24. Tiene cola únicamente en la forma de larva.		
25. Produce tanto huevos como espermas.		
26. Hace madrigueras en la arena en mares poco profundos.		
27. Retiene las características de los cordados durante toda la vida.		
28. Tiene hendiduras branquiales a través de las cuales el agua sale del cuerpo.		
29. Usa un corazón y vasos sanguíneos para la circulación.		

Name _____ Date _____ Class _____

Section **Quick Check**

CHAPTER 27

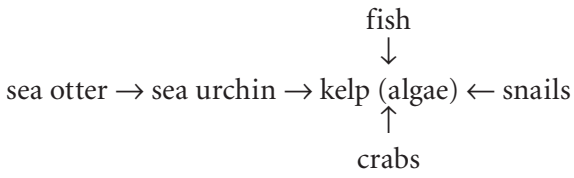
Section 1: Echinoderm Characteristics

After reading the section in your textbook, respond to each statement.

1. **List** the six classes of living echinoderms and the types of animals in each class.

2. **Explain** how radial symmetry is an advantage for adult echinoderms.

3. **Describe** the spiny skin that is a characteristic of echinoderms.



4. **Predict** a likely consequence if the sea otters in the food web shown above were to rapidly decrease in number.

5. **Evaluate** the benefit of the ability to regenerate lost body parts for most echinoderms.

Name _____ Date _____ Class _____

Section **Quick Check**

CHAPTER 27

Section 2: Invertebrate Chordates

After reading the section in your textbook, respond to each question and statement.

1. **Specify** the final structures that arise from embryonic pharyngeal pouches in invertebrates and in vertebrates.

2. **Describe** a notochord and relate its significance to vertebrates.

3. **Explain** what makes the lancelet (amphioxus) unique among invertebrate chordates and an interesting animal for evolutionary scientists to study.

4. **Clarify** the significance of the development of a notochord. What did the notochord enable chordates to do?

5. **Compare** an adult tunicate with a larval tunicate.

Name _____ Date _____ Class _____

CHAPTER 27
Assessment

Student Recording Sheet

Section 27.1

Vocabulary Review

Explain the difference between the vocabulary terms in each pair.

1. _____

2. _____

3. _____

Understand Key Concepts

4. _____

Select the best answer from the choices given, and fill in the corresponding circle.

5. Ⓐ Ⓑ Ⓒ Ⓓ
6. Ⓐ Ⓑ Ⓒ Ⓓ
7. Ⓐ Ⓑ Ⓒ Ⓓ
8. Ⓐ Ⓑ Ⓒ Ⓓ
9. Ⓐ Ⓑ Ⓒ Ⓓ
10. Ⓐ Ⓑ Ⓒ Ⓓ

Constructed Response

11. _____

12. _____

13. _____

14. _____

Think Critically

15. _____

16. _____

Name _____ Date _____ Class _____

CHAPTER 27
Assessment

Student Recording Sheet

Section 27.2

Vocabulary Review

Replace the underlined words with the correct vocabulary terms.

17. _____

18. _____

19. _____

Understand Key Concepts

Select the best answer from the choices given, and fill in the corresponding circle.

20. Ⓐ Ⓑ Ⓒ Ⓓ
21. Ⓐ Ⓑ Ⓒ Ⓓ
22. Ⓐ Ⓑ Ⓒ Ⓓ
23. Ⓐ Ⓑ Ⓒ Ⓓ
24. Ⓐ Ⓑ Ⓒ Ⓓ
25. Ⓐ Ⓑ Ⓒ Ⓓ
26. Ⓐ Ⓑ Ⓒ Ⓓ
27. Ⓐ Ⓑ Ⓒ Ⓓ
28. Ⓐ Ⓑ Ⓒ Ⓓ

Constructed Response

29. _____

_____

30. _____

_____

31. _____

_____

_____

32. _____

_____

_____

Think Critically

33. _____

_____

_____

34. Record your answer for question 34 on a separate sheet of paper.

Name _____ Date _____ Class _____

CHAPTER 27
Assessment

Student Recording Sheet

Additional Assessment

35. Writing in Biology Record your answer for question 35 on a separate sheet of paper.

Document-Based Questions

36. _____

37. _____

_____

38. _____

_____

Cumulative Review

39. _____

_____

_____

_____

40. _____

_____

_____

_____

_____

_____

41. Record your answer for question 41 on a separate sheet of paper.

42. _____

_____

_____

_____

_____

43. _____

_____

_____

_____

_____

Name _____ Date _____ Class _____

CHAPTER 27
Assessment

Student Recording Sheet

Standardized Test Practice

Multiple Choice

Select the best answer from the choices given, and fill in the corresponding circle.

1. Ⓐ Ⓑ Ⓒ Ⓓ
2. Ⓐ Ⓑ Ⓒ Ⓓ
3. Ⓐ Ⓑ Ⓒ Ⓓ
4. Ⓐ Ⓑ Ⓒ Ⓓ
5. Ⓐ Ⓑ Ⓒ Ⓓ
6. Ⓐ Ⓑ Ⓒ Ⓓ
7. Ⓐ Ⓑ Ⓒ Ⓓ
8. Ⓐ Ⓑ Ⓒ Ⓓ
9. Ⓐ Ⓑ Ⓒ Ⓓ

Short Answer

Answer each question with complete sentences.

10. _____

_____

11. _____

_____

12. Record your answer for question 12 on a separate sheet of paper.

13. Record your answer for question 13 on a separate sheet of paper.

14. _____

_____

15. _____

_____

Extended Response

Answer each question with complete sentences.

16. Record your answer for question 16 on a separate sheet of paper.

17. _____

_____

18. _____

_____

19. _____

_____

Essay Question

20. Record your answer for question 20 on a separate sheet of paper.