

SI Biology - Full Discipline Demo

Invertebrates: Arthropoda, Mollusca, and Echinodermata -

Digital Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Biology - Full Discipline Demo
Course	SI Biology - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Categorize each phrase as belonging to phylum Mollusca, Arthropoda, or Echinodermata.

⌘ Sea stars, sand dollars, sea cucumbers	⌘ Mantle	
⌘ Soft body surrounded by a shell	⌘ Segmented body	⌘ Jointed appendages
⌘ Squid, snails, bivalves	⌘ Water vascular system	⌘ Calcareous endoskeleton
⌘ Insects, crustaceans, arachnids		
Mollusca	Arthropoda	Echinodermata
1	2	3

Correct answers:

- 1 Soft body surrounded by a shell Squid, snails, bivalves Mantle
- 2 Segmented body Jointed appendages Insects, crustaceans, arachnids
- 3 Sea stars, sand dollars, sea cucumbers Water vascular system
Calcareous endoskeleton

Match each term with the best description.

⌘ Umbo	Body cavity derived from mesoderm	1
⌘ Hemolymph	Organism in which the anus develops from the blastopore	2
⌘ Ampulla	Blood-like fluid bathing the internal organs	3
⌘ Coelom	Raised area of bivalve shell nearest the hinge	4
⌘ Deuterostome	Pouch-like structure that pumps water into tube feet	5

Correct answers:

1 Coelom 2 Deuterostome 3 Hemolymph 4 Umbo 5 Ampulla

Exploration

The insects of phylum ____ are the most numerous terrestrial animals on Earth.

- ☒ Arthropoda ✓
- ☐ Mollusca
- ☐ Echinodermata
- ☐ Annelida

Coelomate organisms are classified as protostomes or deuterostomes based on the development of the blastopore.

- ☒ True ✓
- ☐ False

The ____ extends from the anterior end of the clam to provide mobility.

- ☐ incurrent siphon
- ☐ palps
- ☐ umbo
- ☒ foot

✓

____ surround the mouth of the grasshopper and function to taste and feel potential food sources.

- ☐ Spiracles
- ☒ Palps
- ☐ Malpighian tubules
- ☐ Gastric caeca

✓

During feeding, the ____ is everted from the mouth of the sea star.

- ☐ calcareous endoskeleton
- ☒ cardiac stomach
- ☐ ampullae
- ☐ pyloric stomach

✓

Exercise 1

What are the functions of the mantle in the clam? Reference the structures labeled in Photos 1-2 in your explanation.

The epidermis of the mantle secretes calcium carbonate to form a protective shell, which becomes the valves of the clam as labeled in Photo 1. The mantle also creates a body cavity where respiration occurs. In clams, the mantle cavity houses the visceral mass, gills, and palps that were labeled in Photo 2.

Describe the three functions of the gills in the clam. Reference structures labeled in Photo 2 in your explanation.

The gills function for respiration, food collection, and water movement within the mantle cavity. The cells of the gills contain cilia that beat to create suction to draw water into mantle cavity through the incurrent siphon. Food is filtered from incurrent water and trapped by mucus that is also secreted by the cells of the gills. The mucus is then passed to the palps, two flaps of tissue that lie to either side of the mouth, where it enters the digestive system. The gill and palps were labeled in Photo 2.

What are triploblastic organisms? Which structures of the clam correspond to the tissue layers of triploblastic organisms?

Triploblastic animals have tissues derived from three embryonic cell layers: the endoderm, mesoderm, and ectoderm. The clam has a mantle containing an epidermis derived from the ectoderm, the presence of muscles that derived from the mesoderm, and the presence of a digestive system that may have arisen from the endoderm.

Photo 1: External Anatomy of the Clam
(SAMPLE ANSWER BELOW)

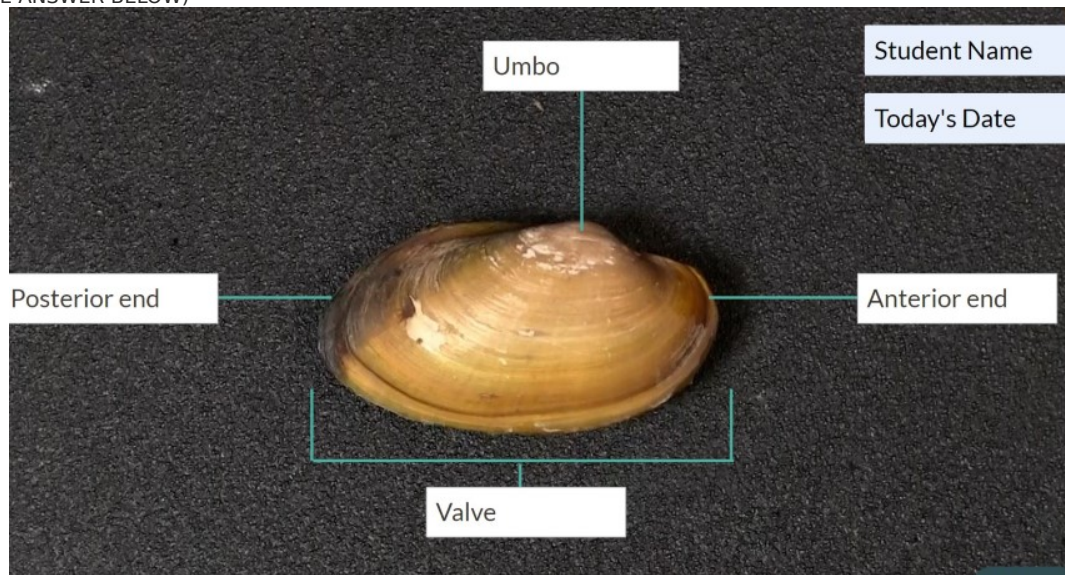
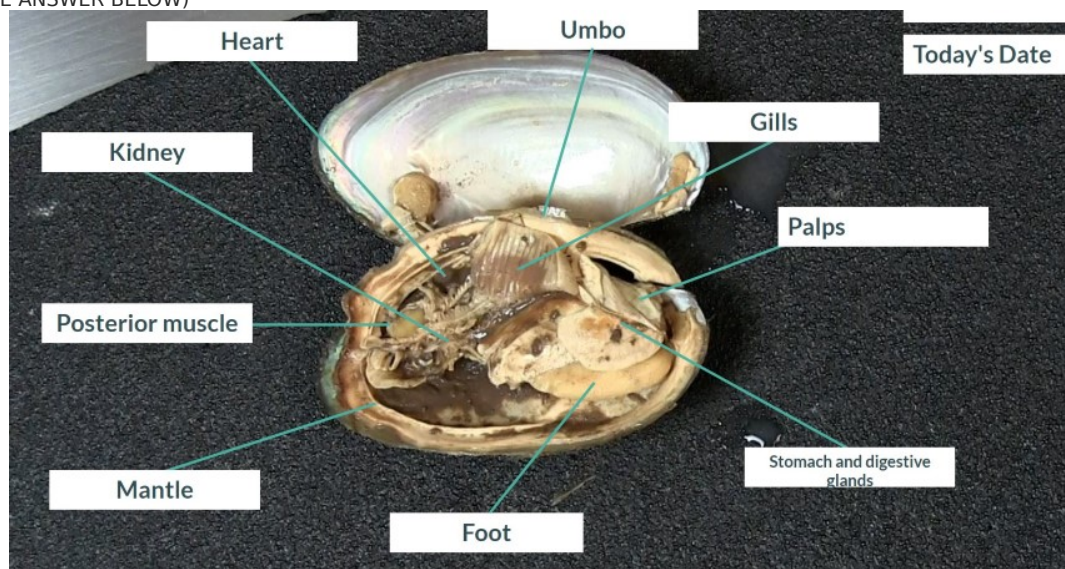


Photo 2: Internal Anatomy of the Clam
(SAMPLE ANSWER BELOW)



Exercise 2

Describe the functions of the digestive organs of the grasshopper. Reference Photo 4 in your explanation.

The digestive system is composed of a large crop where ingested food is stored, gastric ceca located behind the crop function to secrete digestive enzymes and house bacteria that assist in the breakdown of food. The stomach is located in the middle region of the digestive tract and secretes additional enzymes to break down food molecules. The intestines are the site of most nutrient absorption in the grasshopper. Digestive wastes are stored in the rectum before being excreted from the body. Each of these structures were labeled in Photo 4.

What is the function of the Malpighian tubules? Where are they located in the body of the grasshopper? Reference Photo 4 in your explanation.

The Malpighian tubules function as the excretory system of the grasshopper by filtering nitrogen wastes from the surrounding hemolymph fluid. The tubules are attached to the digestive tract between the stomach and the intestine as labeled in Photo 4.

What is a coelomate organism? What is the function of the coelom in the grasshopper?

Coelomate animals have a true body cavity (the coelom), that develops within the mesoderm tissues. The body cavity, termed the **hemocoel** in the grasshopper, houses the internal organs which are bathed in a blood-like fluid called hemolymph.

Photo 3: External Anatomy of the Grasshopper
(SAMPLE ANSWER BELOW)

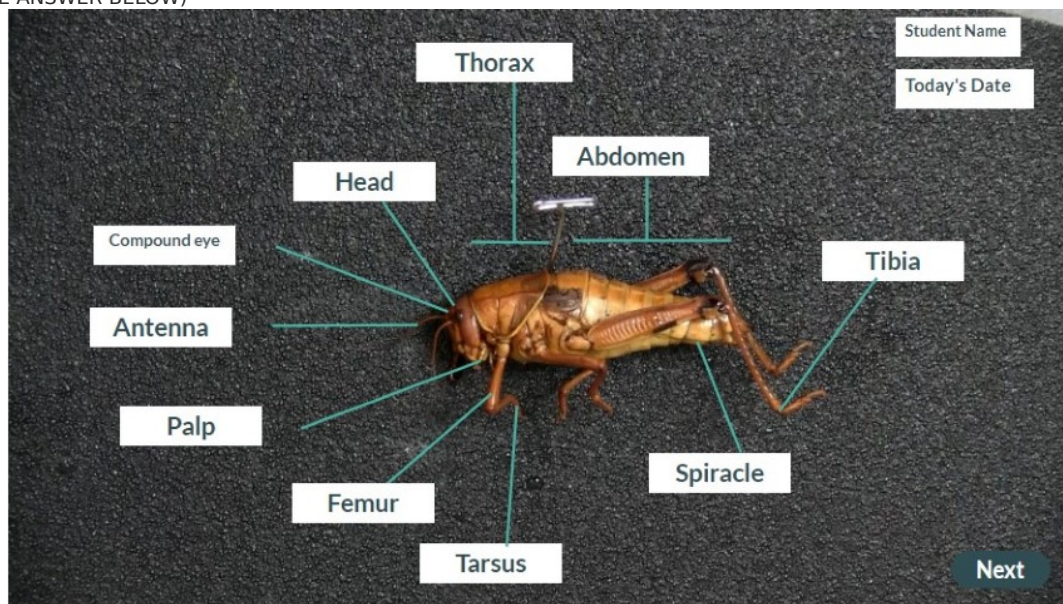
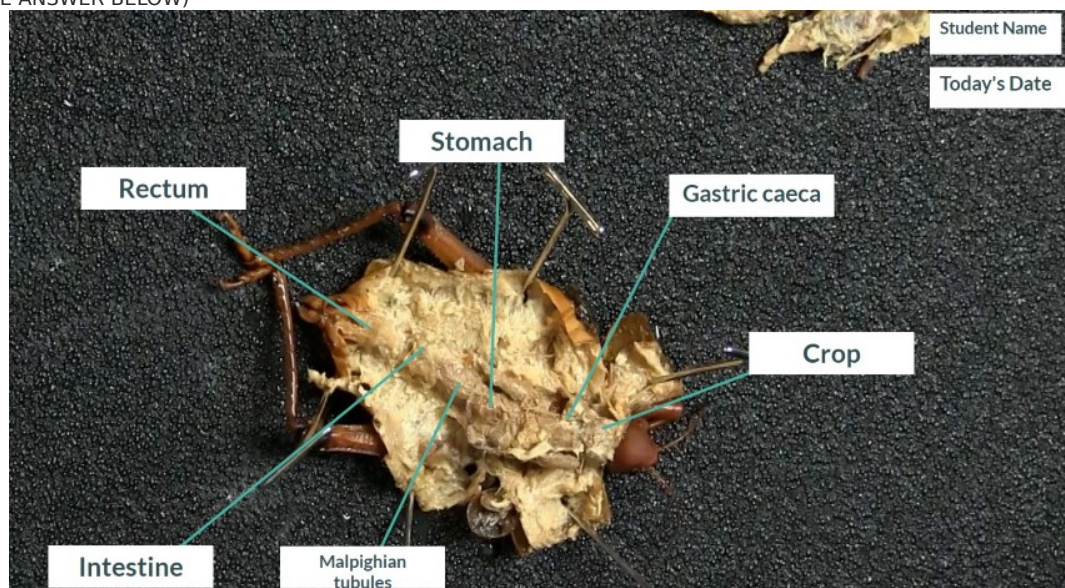


Photo 4: Internal Anatomy of the Grasshopper
(SAMPLE ANSWER BELOW)



Exercise 3

What is the water vascular system? Which structures labeled in Photo 7 are part of this system?

The water vascular system consists of a series of canals that transport water throughout the body for the movement of tubed feet, respiration, nutrient transport, and waste elimination. The water vascular system was observed in Photo 7 with the labeled radial canal in the center of each ambulacral groove and the labeled ampullae, pouch-like structures that expand and contract to pump water into the tube feet.

Describe the feeding behavior and digestive system of the sea star. Reference the labeled structures on Photos 5-6 in your answer.

The digestive system consists of two stomachs in the disc connected via pyloric ducts to digestive glands in each of the rays. During feeding, the cardiac stomach is everted from the mouth to secrete enzymes onto the food source. Partially digested food is then ingested and moved to the pyloric stomach before being transported to digestive glands in each ray for further breakdown and absorption. Food wastes are returned to the pyloric stomach where they are excreted through the anus which opens on the dorsal surface of the sea star. The mouth was labeled in Photo 5, whereas all other structures with the exception of the anus were labeled in Photo 6.

Why is the sea star dissected in this exercise classified as a deuterostome? Include the definitions of protostome and deuterostome in your answer.

The sea star is classified as a deuterostome because in the embryo, the blastopore develops into the anus of the adult. In protostomes, the blastopore (the first opening) of the embryo develops into the mouth of the adult. In deuterostomes, the blastopore develops into the anus of the adult. All coelomate invertebrate phyla are protostomes except for Echinodermata, which is the phylum of the sea star.

Photo 5: External Anatomy of the Sea Star
(SAMPLE ANSWER BELOW)

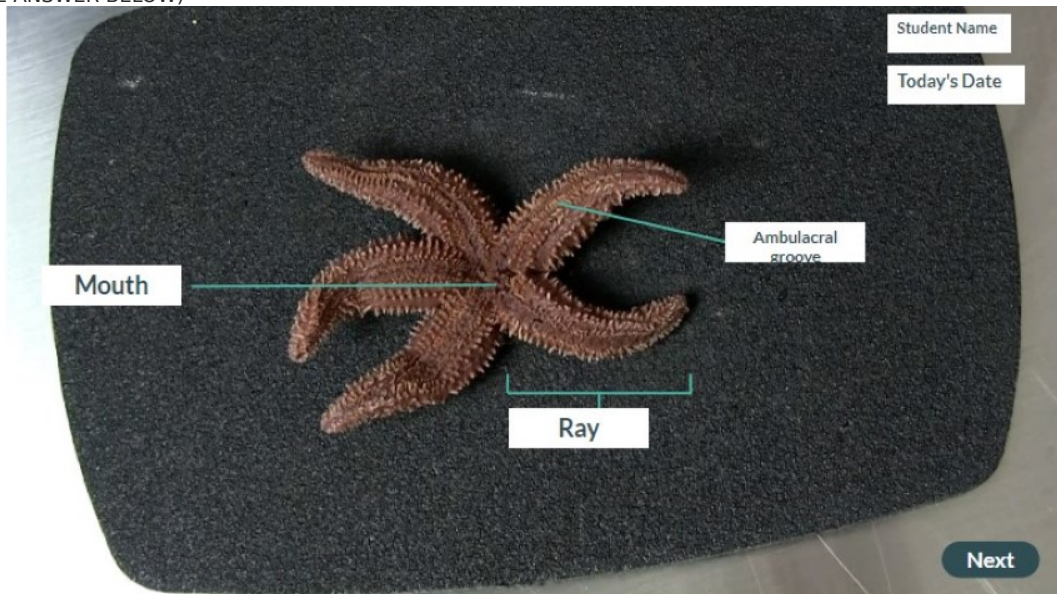


Photo 6: Internal Anatomy of the Sea Star
(SAMPLE ANSWER BELOW)

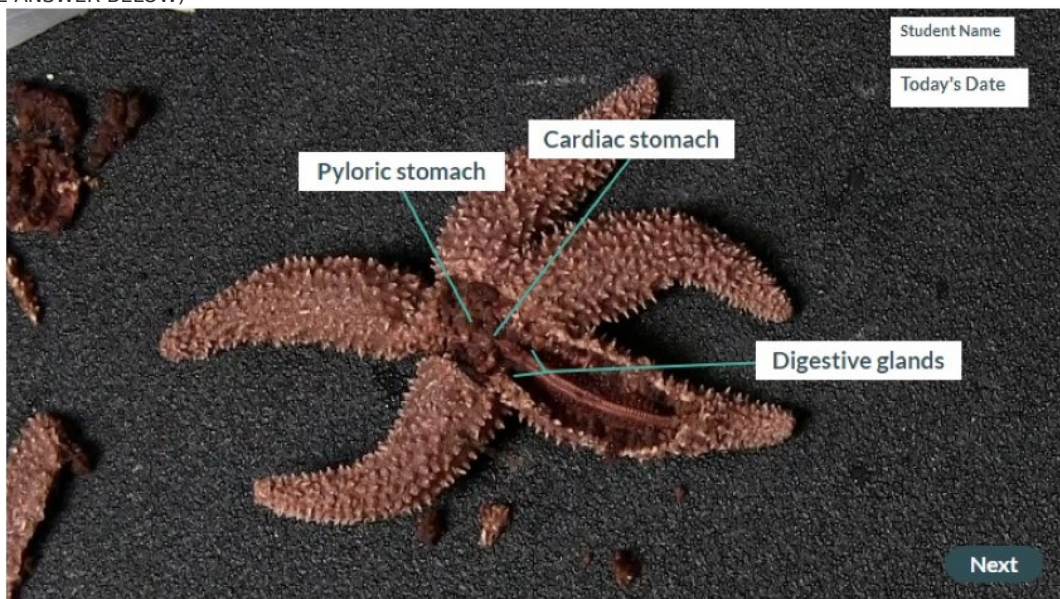
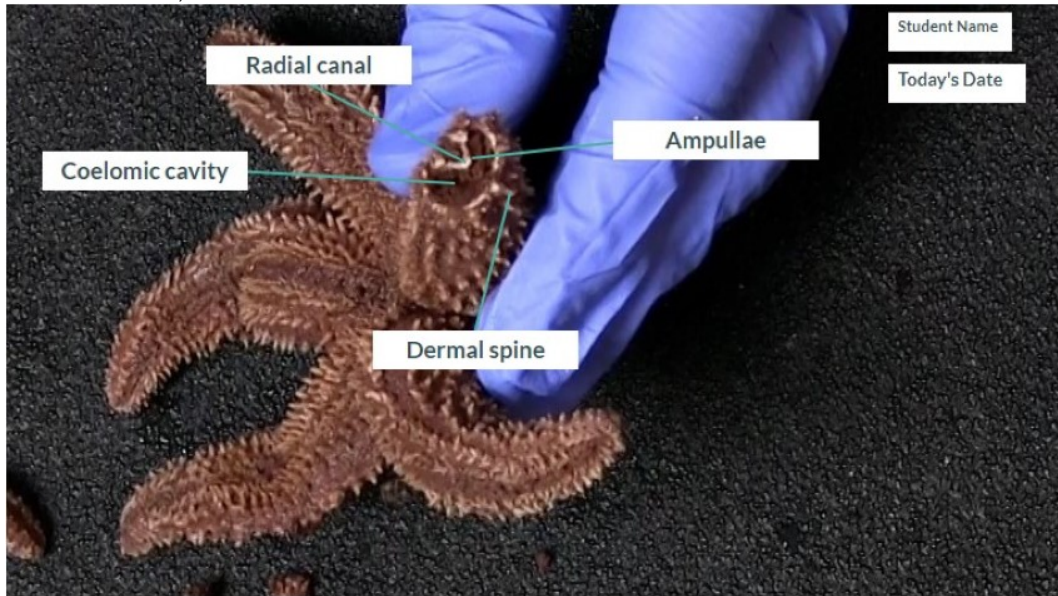


Photo 7: Cross Section of the Sea Star
(SAMPLE ANSWER BELOW)



Competency Review

Invertebrate phylum Mollusca includes ____.

- ☐ earthworms
- ☒ slugs ✓
- ☐ jellyfish
- ☐ crustaceans

Members of phylum Arthropoda are classified as protostomes.

- ☒ True ✓
- ☐ False

Respiration occurs in the ____ of mollusks.

- ☐ hemocoel
- ☐ spiracles
- ☒ mantle cavity ✓
- ☐ water vascular system

Arthropods possess a calcareous endoskeleton.

- ☐ True
 - ☒ False ✓
-

_____ are a characteristic of phylum Echinodermata.

- ☐ Palps
- ☐ Mantles
- ☐ Segmented bodies
- ☒ Tube feet

✓

The _____ must be severed to open the shell of a clam during dissection.

- ☐ visceral mass
- ☒ adductor muscles
- ☐ ampullae
- ☐ gills

✓

The _____ of the jumping leg is indicated in the image of a grasshopper below.



- ☒ femur
- ☐ tibia
- ☐ tarsus
- ☐ ampulla

✓

The digestive glands are located in the ____ of the sea star.

- ☐ central disc
- ☐ mouth
- ☒ rays
- ☐ mantle cavity



The palps of clams, located adjacent to the gills, function to direct food into the mouth.

- ☒ True
- ☐ False



Extension Questions

Cephalopods are a class of aquatic invertebrates possessing complex nervous systems, large eyes, a mouth surrounded by arms lined with sucker discs, and jet-propelled motility. Cephalopods breathe through gills attached to the roof of the mantle cavity and feed by actively capturing other invertebrates and fish. Apply your knowledge of invertebrate phyla and their characteristics to explain why cephalopods belong in the phylum Mollusca, even though they are dissimilar to the clam. (SAMPLE ANSWER BELOW)

Cephalopods belong in the phylum Mollusca because they have a mantle that forms the mantle cavity used for respiration, which is the common characteristic of all mollusks.