

SCIENCE CONTENT TOPICS: L.c.1, L.c.2

SCIENCE PRACTICES: SP.1.a, SP.1.b, SP.1.c, SP.3.b, SP.3.d, SP.7.a

## 1 Review the Skill

A **diagram** uses visual elements to show how things relate to one another. Often, a diagram can show relationships more simply than text can explain them. Some diagrams show the parts of something and how those parts interact. Some diagrams show an order of events. Other diagrams show how things are alike and different. When you **interpret diagrams**, you use their visual elements to understand relationships between ideas, objects, or events.

## 2 Refine the Skill

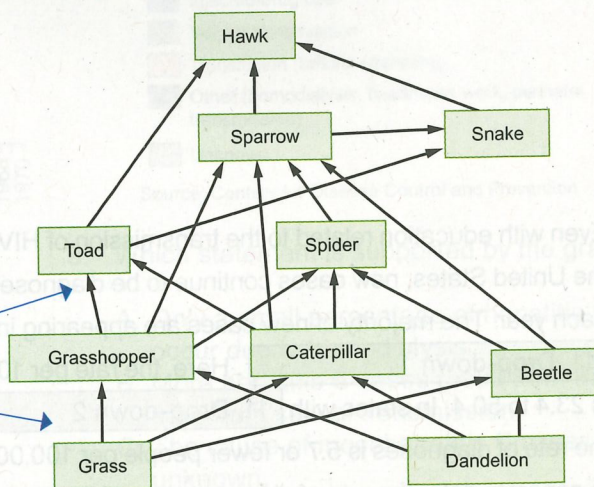
By refining the skill of interpreting diagrams, you will improve your study and test-taking abilities, especially as they relate to the GED® Science Test. Study the information and diagram below. Then answer the questions that follow.

### FEEDING RELATIONSHIPS IN ECOSYSTEMS

Like a food chain, a food web shows feeding relationships in an ecosystem. However, a food web shows more than a single set of feeding relationships. It shows the feeding relationships among many organisms in an ecosystem. The diagram shows a food web for a grassland ecosystem.

**a** Diagrams can show simple or more complex relationships. To interpret a diagram that shows complex relationships, look carefully at parts of the diagram and at the diagram as a whole.

**b** Look at the relationships of the elements in the diagram. The arrows show the direction in which food moves from organism to organism. Also, each organism is connected by several arrows to other organisms.



1. Based on the information in the diagram, what do sparrows eat?

- A. grass
- B. dandelions and grasshoppers
- C. grasshoppers, caterpillars, spiders, and beetles
- D. hawks and snakes

2. Which statement describes feeding relationships in the grassland ecosystem represented by the diagram?

- A. Snakes have fewer food sources than spiders have.
- B. Each animal eats only one other kind of animal or plant.
- C. Hawks eat both plants and animals.
- D. Most living things in a grassland eat insects.

### USING LOGIC

Diagrams represent something real. As you interpret a diagram, consider what you already know. If your interpretation disagrees with what you know, you may be misinterpreting the diagram.

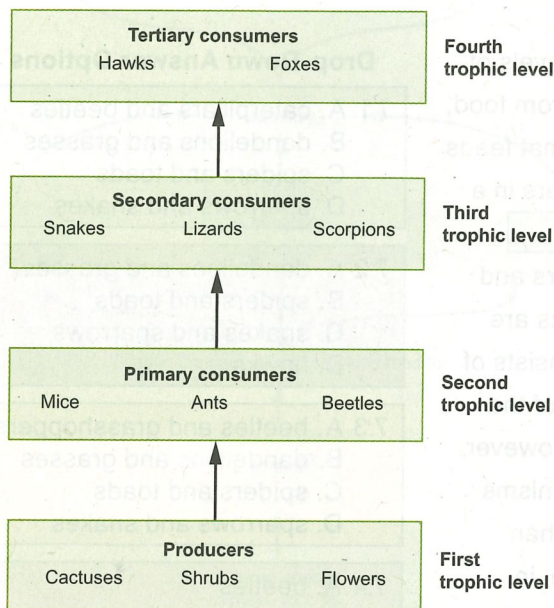


### 3 Master the Skill

**DIRECTIONS:** Study the information and diagram, read each question, and choose the **best** answer.

#### TROPHIC LEVELS

Scientists group living things in an ecosystem based on sources of energy. The groups are called trophic levels. Producers make up the first trophic level. Producers obtain energy by making their own food from nonliving materials. Plants are producers in most land-based ecosystems. Primary consumers make up the second trophic level. They get energy by eating producers. Secondary consumers, which make up the third trophic level, eat primary consumers. The grouping continues through the top level of feeding relationships in the ecosystem. The diagram shows examples of trophic levels in a desert ecosystem.

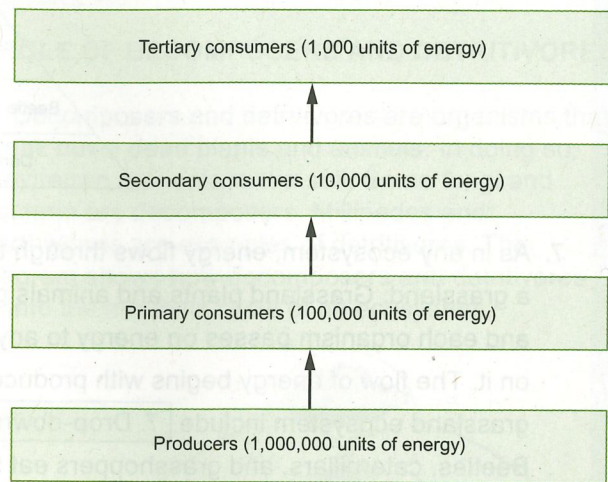


3. Based on the diagram, which statement identifies the trophic level of certain organisms in a desert ecosystem?
  - A. Lizards and snakes are secondary consumers.
  - B. Ants and beetles are in the first trophic level.
  - C. Hawks and foxes are in the third trophic level.
  - D. Flowers and shrubs are sometimes consumers.
4. Which statement describes how certain organisms get food in the desert ecosystem represented by the diagram?
  - A. Plants get food from each other.
  - B. Scorpions eat other animals.
  - C. Ants eat both plants and animals.
  - D. Snakes eat tertiary consumers.

**DIRECTIONS:** Study the information and diagram, read each question, and choose the **best** answer.

#### ENERGY TRANSFER WITHIN AN ECOSYSTEM

On average, an organism stores about 10 percent of the energy it gets from food. The rest of the energy is lost to the surroundings. Therefore, the amount of energy available at one trophic level is smaller than the amount available at the previous trophic level. The diagram shows an example of this energy transfer.



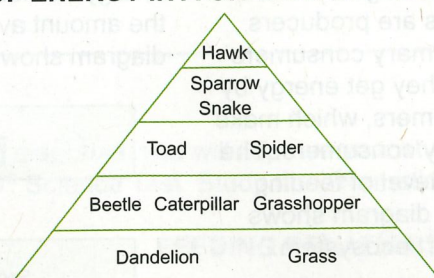
5. How much energy is lost during the energy transfer from primary consumers to secondary consumers in the ecosystem represented by the diagram?
  - A. 900,000 units
  - B. 100,000 units
  - C. 10,000 units
  - D. 90,000 units
6. How does the diagram support the idea that an ecosystem has fewer organisms at the fourth trophic level than at the first trophic level?
  - A. The diagram shows that tertiary consumers are at the fourth trophic level and producers are at the first trophic level.
  - B. The box sizes in the diagram indicate that an ecosystem has fewer organisms at the fourth trophic level than at the first trophic level.
  - C. The diagram shows that less energy is available to support living things at the fourth trophic level than at the first trophic level.
  - D. The shape of the diagram indicates that the number of organisms at the fourth trophic level is less than the number of organisms at the first trophic level.



# ★ Spotlighted Item: DROP-DOWN

**DIRECTIONS:** Study the diagram. Then read the incomplete passage that follows. Use information from the diagram to complete the passage. For each drop-down item, choose the option that **best** completes the sentence.

## FLOW OF ENERGY IN A GRASSLAND ECOSYSTEM



7. As in any ecosystem, energy flows through the trophic levels of a grassland. Grassland plants and animals get energy from food, and each organism passes on energy to any organism that feeds on it. The flow of energy begins with producers. Producers in a grassland ecosystem include **7. Drop-down 1**.

Beetles, caterpillars, and grasshoppers eat the producers and pass on energy to **7. Drop-down 2**. Hawks are at the top of a grassland energy pyramid. Their food consists of

**7. Drop-down 3**. Living things use some of the energy they take in for movement, growth, and repair. However, most of it is lost to the environment. Consequently, organisms at one trophic level have less energy available to them than organisms at the trophic level below theirs. For example, in the grassland ecosystem, more energy is available for use by

**7. Drop-down 4** than by spiders.

## Drop-Down Answer Options

7.1 A. caterpillars and beetles  
B. dandelions and grasses  
C. spiders and toads  
D. sparrows and snakes

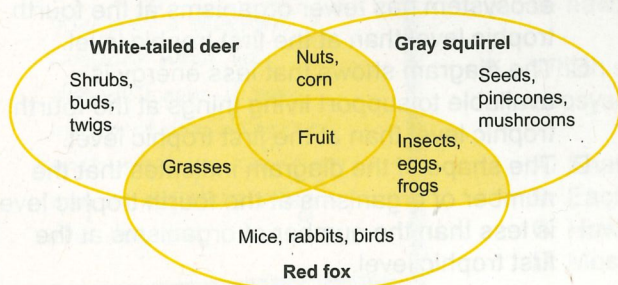
7.2 A. dandelions and grasses  
B. spiders and toads  
C. snakes and sparrows  
D. hawks

7.3 A. beetles and grasshoppers  
B. dandelions and grasses  
C. spiders and toads  
D. sparrows and snakes

7.4 A. beetles  
B. hawks  
C. snakes  
D. toads

**DIRECTIONS:** Study the diagram, read the question, and choose the **best** answer.

## DIETS OF THREE FOREST ANIMALS



8. Which statement describes feeding relationships of animals identified in the diagram?

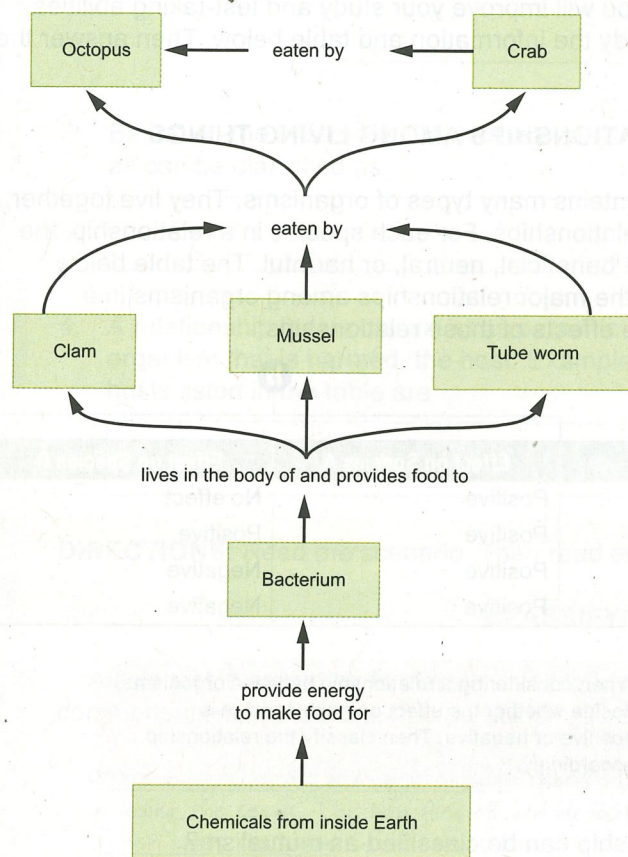
- A. White-tailed deer, gray squirrels, and red foxes are at different trophic levels.
- B. Red foxes eat only mice, rabbits, and birds.
- C. White-tailed deer and gray squirrels both eat nuts and corn.
- D. Gray squirrels and red foxes compete for all the same foods.



**DIRECTIONS:** Study the information and diagram, read each question, and choose the **best** answer.

### DEEP-OCEAN ECOSYSTEM

In the 1970s, scientists traveled to the ocean floor to study the rocks and minerals there. They did not expect to find any life that deep in the ocean. Surprisingly, they discovered an entire ecosystem deep below the ocean's surface. Tiny bacteria form the basis of the ecosystem. These bacteria use chemicals from within Earth to make food. The diagram shows relationships between some living things in the ecosystem the scientists discovered.



9. What is the ultimate source of energy for all the living things identified in the diagram?

A. octopuses  
B. bacteria  
C. chemicals from within Earth  
D. sunlight

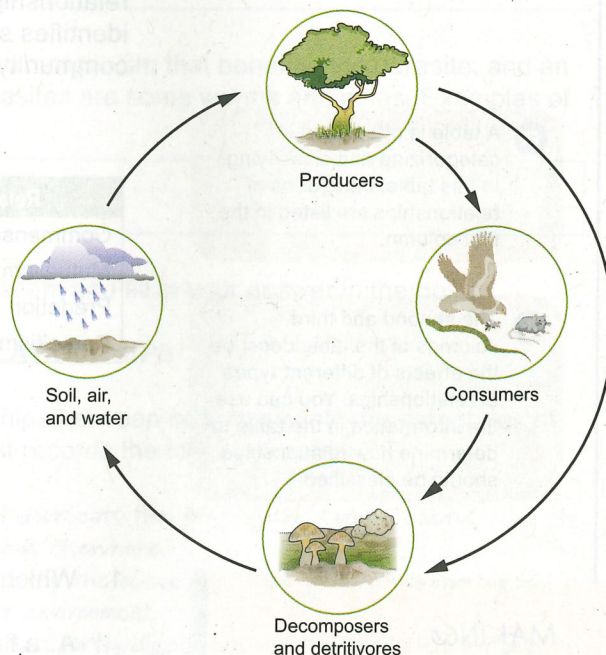
10. A type of large fish also lives in this ecosystem. It eats tube worms, clams, mussels, and crabs. Its position in the food web is **most similar** to that of which animal?

A. crab  
B. mussel  
C. tube worm  
D. octopus

**DIRECTIONS:** Study the information and diagram, read the question, and choose the **best** answer.

### ROLE OF DECOMPOSERS AND DETRITIVORES

Decomposers and detritivores are organisms that break down dead plants and animals. In doing so, they return nutrients to the soil. Some fungi and bacteria are decomposers. Millipedes and earthworms are examples of detritivores. The diagram shows how decomposers and detritivores fit into the nutrients cycle of an ecosystem.



11. Which statement describes the importance of decomposers and detritivores in the nutrients cycle shown in the diagram?

A. Plants use them as food.  
B. Both producers and consumers rely on them in the nutrients cycle.  
C. Dead animal matter cannot exist without them.  
D. Animals that eat plants also eat them.



**1 Learn the Skill**

**Diagrams** show relationships between ideas, objects, or events in a visual way. Diagrams also can show the order in which events occur. When you **interpret diagrams**, you find out how objects or events relate to one another.

**2 Practice the Skill**

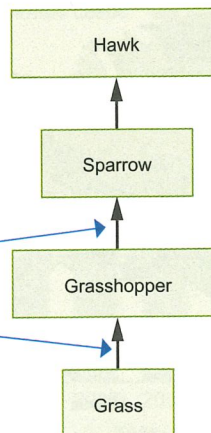
By practicing the skill of interpreting diagrams, you will improve your study and test-taking abilities, especially as they relate to the GED® Science Test. Study the information and diagram below. Then answer the question that follows.

**ECOSYSTEMS**

An ecosystem includes all the living things in an area, along with their nonliving environment. Energy flows through the living parts of an ecosystem. In most ecosystems, the energy originates from the sun. Plants use energy from sunlight and nutrients from air, water, and soil to make food. Animals eat the plants, other animals eat the plant eaters, and so on. Each organism gets energy from its food and passes on energy to any organism that feeds on it. A food chain shows a single path of feeding relationships among certain organisms in an ecosystem. The diagram shows a food chain in a grassland ecosystem.

**a** Diagrams can take many forms. Flowcharts use boxes and arrows to show steps in a process or order of events. Some flowcharts are circles or ovals. They show events that occur in cycles.

**b** The parts of this diagram are arranged in a line, with arrows pointing from one part to the next. The arrows show the direction in which food moves from one organism to the next.



1. Which statement describes a feeding relationship shown in the diagram?

- A. Hawks eat grass.
- B. Grasshoppers eat sparrows.
- C. Sparrows eat grasshoppers.
- D. Hawks eat grasshoppers.

**TEST-TAKING TIPS**

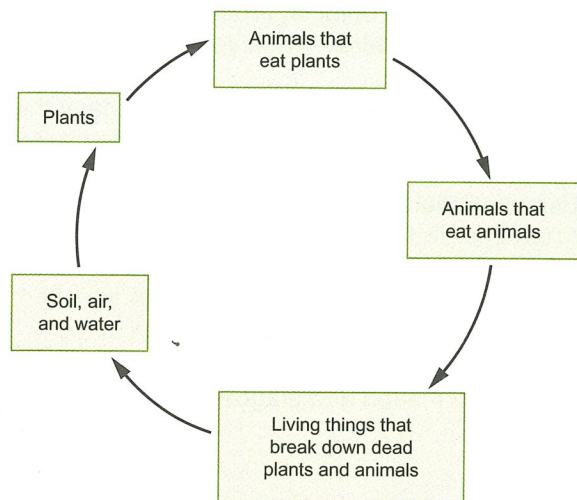
Review the answer choices. How would the diagram have to look for each answer choice to be true? Compare the imagined diagram with the actual diagram to determine the correct answer.



### 3 Apply the Skill

**DIRECTIONS:** Study the diagram and information, read each question, and choose the **best** answer.

#### MOVEMENT OF NUTRIENTS IN AN ECOSYSTEM



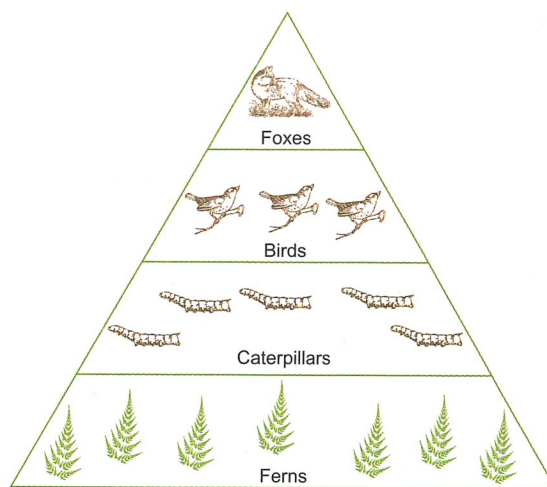
Matter, or the material that makes up everything around us, is continuously recycled in an ecosystem. Organisms get materials they need to live from the environment. They then release waste matter back into the environment. Nutrients are one form of matter that cycles through an ecosystem. The diagram shows the movement of nutrients in a land-based ecosystem.

2. Based on the diagram, which statement describes a flow of nutrients in a land-based ecosystem?
  - A. Most animals obtain nutrients by eating other animals.
  - B. Plants obtain nutrients from soil, air, and water.
  - C. Animals that eat animals are a source of nutrients for animals that eat plants.
  - D. Living things that break down dead plants and animals contribute no nutrients to the ecosystem.
3. What would happen to the movement of nutrients shown in the diagram if all the plants in the ecosystem died?
  - A. Nutrients would continue to cycle through the ecosystem, skipping the missing step.
  - B. Plant-eating animals would start eating other animals.
  - C. The nutrients cycle would end.
  - D. Soil, air, and water supplies would decrease and eventually end.

**DIRECTIONS:** Study the information and diagram, read each question, and choose the **best** answer.

#### MOVEMENT OF ENERGY IN AN ECOSYSTEM

As energy flows through an ecosystem, it is conserved. That is, the amount of energy neither increases nor decreases. Plants get energy by making food. Animals get energy by eating food in the form of plants and other animals. Living things convert the energy stored in food into energy for movement, growth, and repair. A small amount of energy that a living thing takes in is stored in the cells of its body. Most of the energy is lost to the environment as heat, sound, motion, and—in some cases—light. Energy pyramids show how energy flows through ecosystems. The diagram shows an energy pyramid for a forest ecosystem.



4. What is one way in which energy flows through the forest ecosystem represented by the diagram?
  - A. from ferns to caterpillars
  - B. from foxes to ferns
  - C. from birds to ferns
  - D. from birds to caterpillars
5. What idea does the shape of an energy pyramid **most likely** reinforce?
  - A. In general, larger animals in an ecosystem eat smaller animals in the ecosystem.
  - B. Plants use sunlight to obtain energy and form the basis for all food chains in an ecosystem.
  - C. Organisms at higher levels of a food chain live at higher levels in an environment.
  - D. The amount of available energy decreases as energy passes from organism to organism.



**1 Learn the Skill**

When you **categorize**, you choose the criteria for placing organisms, objects, processes, or other items in groups. Such groups are based on shared characteristics or relationships. When you **classify**, you put things into groups that already exist.

Presentations of scientific material often involve categorization and classification because many things in science are organized in groups. In life science, for example, cells are categorized and classified according to their functions. Living things in an ecosystem are categorized and classified by roles they play in the ecosystem. Ecosystems are categorized and classified based on their physical traits.

**2 Practice the Skill**

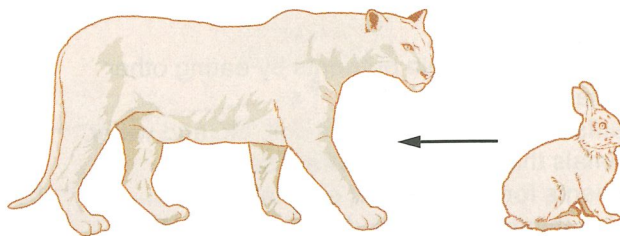
By practicing the skill of categorizing and classifying, you will improve your study and test-taking abilities, especially as they relate to the GED® Science Test. Study the information and diagram below. Then answer the question that follows.

**PREDATOR-PREY RELATIONSHIPS**

**a** The passage and diagram give information about one type of relationship between organisms—the predator-prey relationship. Relationships can be organized in categories. Predator-prey is a category.

**b** Once categories have been created, you can classify something specific, such as a specific relationship, into the appropriate category. The question asks you to classify.

**a** All organisms have relationships with other organisms. These relationships are known as symbiotic relationships. One such relationship is that of predator and prey. This relationship is called a predator-prey relationship, or predation. A predator is an organism that kills and eats another organism. Its prey is the organism it eats. The arrow in the diagram shows that the rabbit is eaten by the cougar. The rabbit is prey, and the cougar is a predator. Predators and prey live together in the same environment, and their numbers affect each other.



1. Based on the information, which relationship between organisms **most likely** can be classified as a predator-prey relationship?

A. bear-fish  
B. goat-pig  
C. bee-flower  
D. barnacle-whale

**TEST-TAKING TIPS**

Organisms, objects, and processes often can be categorized and classified in more than one way. Look for the best fit when categorizing and classifying on a test.



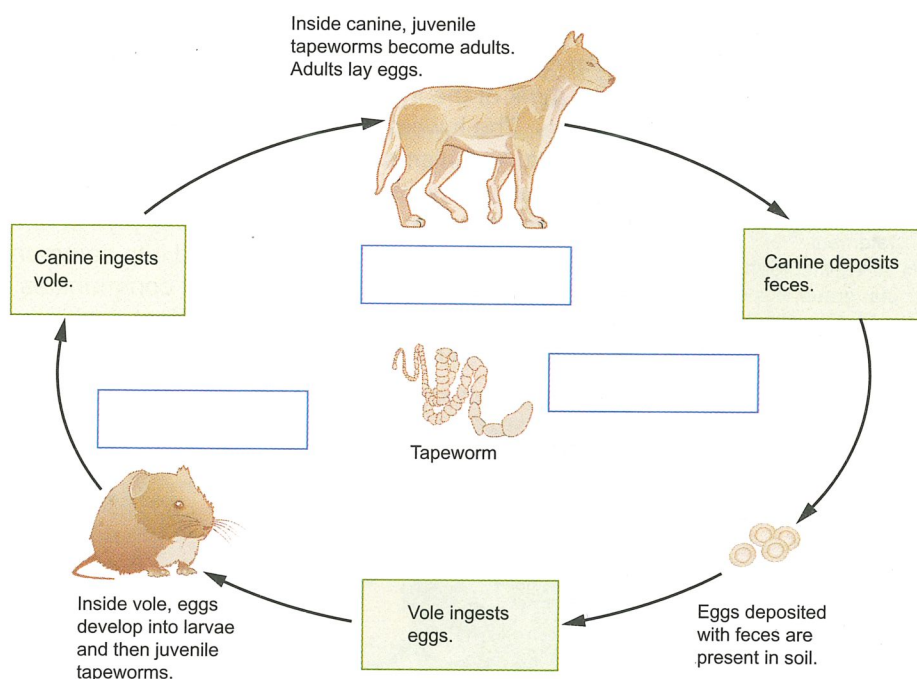
# ★ Spotlighted Item: **FILL-IN-THE-BLANK**

**DIRECTIONS:** Read the passage. Then read the item, and fill in your responses in the boxes.

## PARASITISM

Symbiosis is a situation in which two organisms from different species live close together. There are different types of symbiotic relationships. One type is parasitism. In a parasitic relationship, one organism, the parasite, benefits from and harms another organism, the host. For example, a tapeworm lives in the intestines of an animal, getting food by eating the animal's partly digested food. The animal then is unable to obtain all the nutrients available in the food it ingests.

2. Based on the passage, label each organism to classify it as a parasite or a host.



**DIRECTIONS:** Read the passage. Then read the question, and fill in your answer in the box.

## HARMLESS SYMBIOTIC RELATIONSHIPS

Several types of symbiotic relationships exist. Commensalism is a relationship in which one organism benefits and the other does not benefit but is not harmed. For example, certain orchids use the branches of large trees in tropical forests as places to grow and live. The trees receive no benefit, but the orchids do not harm the trees. Another type of symbiotic relationship is mutualism. In a mutualistic relationship, both organisms benefit, and neither is harmed.

3. What are the categories of symbiotic relationships discussed in the passage?



SCIENCE CONTENT TOPIC: L.c.4  
SCIENCE PRACTICES: SP.1.a, SP.1.b, SP.1.c, SP.3.a, SP.3.b, SP.6.c

## 1 Review the Skill

When you **categorize**, you identify groups you can use to organize things such as organisms, objects, or processes. Each category should be based on relationships between the things you want to organize or on features those things share. When you **classify**, you place specific things into categories that already exist.

Scientists use categorization and classification to organize aspects of the natural world. By categorizing and classifying, scientists and others who study science improve their understanding of relationships among objects, processes, systems, and so on.

## 2 Refine the Skill

By refining the skill of categorizing and classifying, you will improve your study and test-taking abilities, especially as they relate to the GED® Science Test. Study the information and table below. Then answer the questions that follow.

### RELATIONSHIPS AMONG LIVING THINGS

A community contains many types of organisms. They live together, forming different relationships. For each species in a relationship, the relationship can be beneficial, neutral, or harmful. The table below identifies some of the major relationships among organisms in a community and the effects of those relationships.

**a** A table is often used in categorizing and classifying. In this table, categories of relationships are listed in the first column.

**b** The second and third columns of the table describe the effects of different types of relationships. You can use the information in the table to determine how relationships should be classified.

Relationship	Effect on Species A	Effect on Species B
Commensalism	Positive	No effect
Mutualism	Positive	Positive
Predation	Positive	Negative
Parasitism	Positive	Negative

**c** When considering a relationship between organisms, decide whether the effect on each species is positive or negative. Then classify the relationship accordingly.

### MAKING ASSUMPTIONS

The table does not describe each type of relationship. It only tells the effects. From your own experience, though, you may know examples of how each type of relationship works.

1. Which relationship can be classified as mutualism?

- A. a flea living on a dog
- B. a mosquito biting a human
- C. a bee getting nectar from a flower and transferring pollen
- D. a bat capturing a moth in flight to eat

2. An animal unknowingly carries a burdock weed's seeds in its fur and then scatters the seeds as it moves from place to place. Which type of relationship do the burdock weed and the animal have?

- A. commensalism
- B. mutualism
- C. predation
- D. parasitism



★ Spotlighted Item: **FILL-IN-THE-BLANK**

**DIRECTIONS:** Study the table. Then complete each statement by filling in the box.

**TWO CATEGORIES OF SYMBIOTIC RELATIONSHIPS**

Type of Relationship	Examples
Parasite-host	Tapeworms-humans Barber's pole worms-sheep Anchor worms-fish Bird mites-pigeons
Predator-prey	Sea otters-fish Salamanders-frog tadpoles Great horned owls-raccoons Cheetahs-wildebeests

3. Based on the information in the table, a sea otter, a salamander, a great horned owl, and a cheetah all can be classified as

4. A relationship that is classified as parasitic involves an organism that benefits, the parasite, and an organism that is harmed, the host. Examples of parasites are some worms and mites. Examples of hosts listed in the table are

**DIRECTIONS:** Read the scenario. Then read each question, and fill in your answer in the box.

**CLASSIFYING RELATIONSHIPS**

A scientist is preparing to classify symbiotic relationships between organisms into the categories of commensalism, mutualism, and parasitism. The scientist records the following notes:

White-winged doves and saguaro cacti The white-winged dove eats the fruit of the saguaro cactus, including the seeds. The bird flies off and deposits the seeds elsewhere.

Spider crabs and algae Spider crabs that live on the bottom of the ocean floor have greenish brown algae living on their backs, making the crabs blend in with their environment.

Bacteria and humans Bacteria living in the intestines of humans partly digest and use the food that humans are unable to digest. Once the food is partially digested, humans are able to continue the digestion process.

5. Into which category will the scientist place all three relationships?

6. Why do the examples the scientist noted all fit in this category?

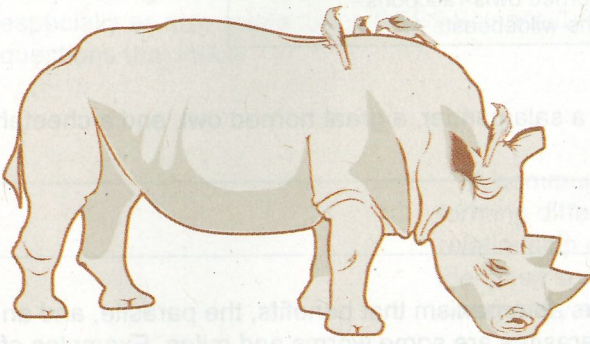


## ★ Spotlighted Item: **FILL-IN-THE-BLANK**

**DIRECTIONS:** Read the passage, and study the illustration. Then complete each statement by filling in the box.

### **RHINOCEROSSES AND OXPECKER BIRDS**

Organisms can have different relationships with one another. One type of relationship is mutualism. In a mutualistic relationship, both organisms benefit. The illustration shows an example of a mutualistic relationship between a rhinoceros and oxpeckers. In this relationship, the oxpeckers eat insects off the rhinoceros. The birds get food, and the rhinoceros gets rid of biting insects.



7. If the oxpeckers harmed the rhinoceroses by eating insects off their bodies, the relationship would be classified as

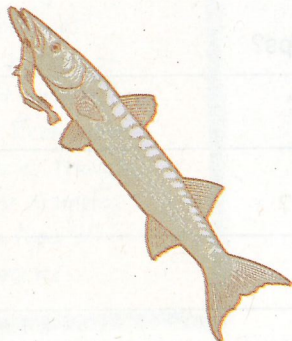
8. The relationship between the oxpeckers and the insects fits into the

 category.

**DIRECTIONS:** Read the passage, and study the illustration. Then read each item, and fill in your response in the box.

### **BARRACUDA AND CLEANING FISH**

Tiny organisms live on the exteriors of barracuda. Barracuda are a species of fish considered to be predators. However, barracuda modify their behavior to meet different needs. At times, a barracuda positions itself in an unusual posture with its head up to signal to smaller cleaning fish that it will not eat them. When the cleaning fish see this sign, they know it is safe to approach the barracuda. The cleaning fish then eat the tiny organisms that live on the barracuda.



9. Classify the relationship between the barracuda and the cleaning fish.

10. Classify the relationship between the organisms that live on a barracuda and the barracuda.

11. How would the relationship between a barracuda and cleaning fish be classified when the barracuda is not in a heads-up posture?



**DIRECTIONS:** Study the table. Then read each question, and fill in your answer in the box.

### MUTUALISM AND COMMENSALISM

Mutualism (Both Organisms Benefit)	Commensalism (One Organism Benefits; Other Is Not Affected)
Honeybees-flowers	Orchids-tall trees
Leaf-cutting ants-fungi	Barnacles-humpback whales
Clown fish-sea anemones	Redwood sorrel plants-redwood trees
Humans-pets	Pearl fish-sea cucumbers

12. What characteristic must a relationship have to be classified as commensalism?

13. Suppose that the barnacles on a humpback whale are so numerous that they cause infection. What category could be added to the chart to fit this relationship?

14. Eagles eat fish. What category could be added to classify this relationship?

**DIRECTIONS:** Read the passage. Then read each question, and fill in your answer in the box.

### ALLIGATOR HOLES

Some scientists consider alligator holes to be an example of mutualism. Using their feet and snouts, alligators clear mud and muck from the limestone bedrock to form holes they can use for shelter. The holes may be quite large, even the size of a small backyard pool. The holes are important to wetland ecosystems because they retain water during dry times of the year, and many animals drink from them. However, because so many animals use the holes for water, the holes also are good places for certain other animals to find food.

15. What type of relationship exists between the animals that come to an alligator hole seeking food and the animals that come there for water?

16. In what category besides mutualism might scientists classify the relationship between alligators and the animals that use their holes, and why would scientists choose this category?