مراجعة نهائية للفصل وفق منهج انسباير

التواصل الاجتماعي بحسب الصف السابع					
صفحة المناهج الإماراتية على فيسبوك					
المواد على تلغرام	التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات	

المزيد من الملفات بحسب الصف السابع والمادة علوم في الفصل الأول	
1	حل نموذج اختبار تجريبي وفق الهيكل الوزاري منهج انسباير القسم الكتابي
2	نموذج اختبار تجريبي وفق الهيكل الوزاري منهج انسباير القسم الكتابي
3	أوراق عمل مراجعة هيكل العلوم بريدج مع الحل
4	حل مراجعة الأسئلة المقالية (الكتابية) وفق الهيكل الوزاري منهج بريدج
5	مراجعة الأسئلة المقالية (الكتابية) وفق الهيكل الوزاري منهج بريدج

GRADE 7 - GENERAL

EoT 1 SCIENCE REVISION

Identify the parts of an ecosystem.
Define ecosystem.

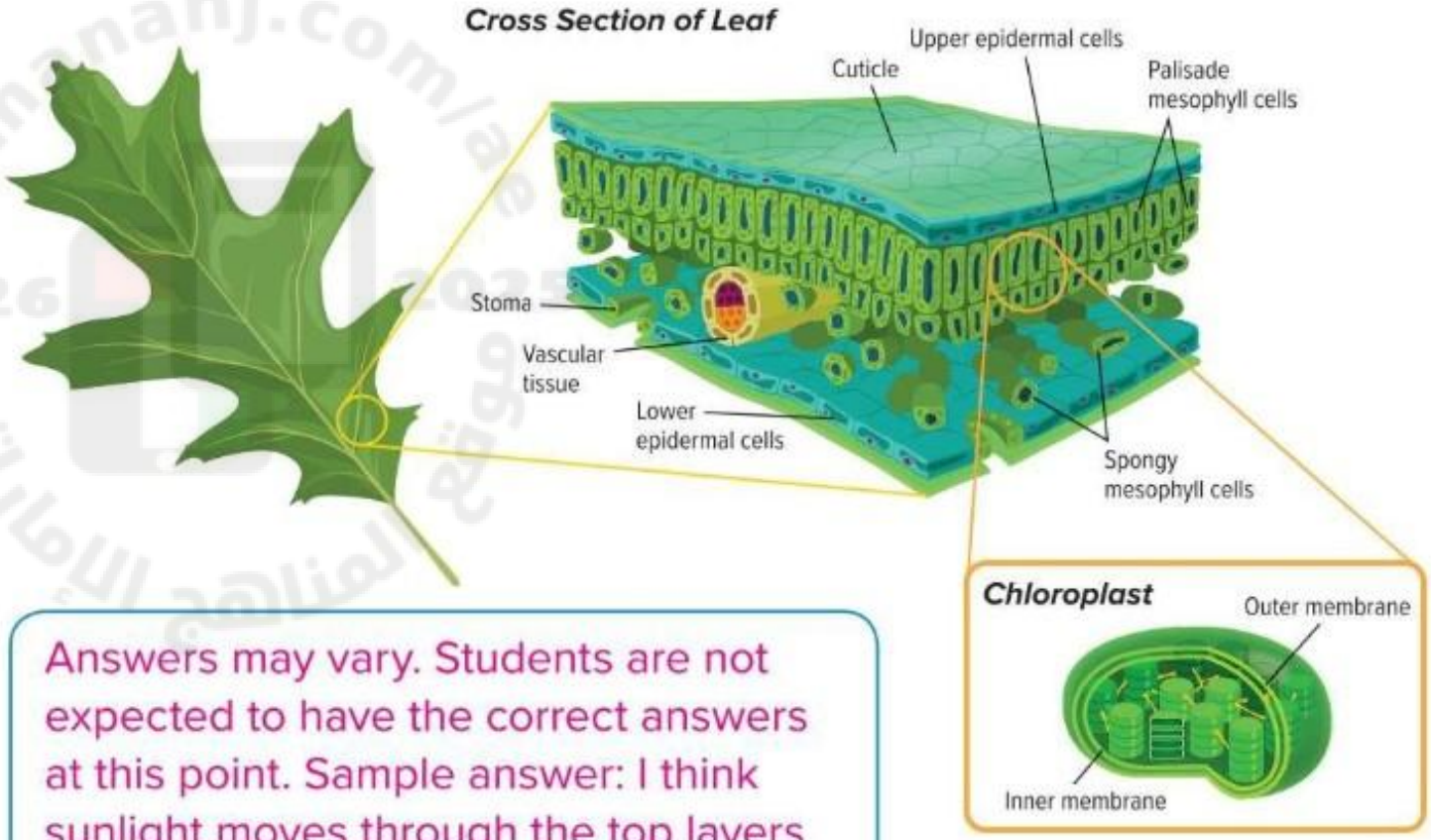
Plants and other photosynthetic organisms absorb carbon dioxide and produce oxygen, making them a necessary part of any ecosystem. An **ecosystem** is all the living and nonliving things in a given area. During the process of photosynthesis, trees absorb carbon dioxide and transfer carbon into their limbs and roots. What is the effect of carbon storage on forest ecosystems?

Explain the process of chemical reactions such as photosynthesis and/or cellular respiration.

INVESTIGATION

Plant Structure

Examine the leaf cross section below. How do you think sunlight is absorbed by a leaf? How are other materials necessary for survival, such as carbon dioxide, oxygen, water, and other nutrients, moved through a leaf? Record your ideas below the cross section.

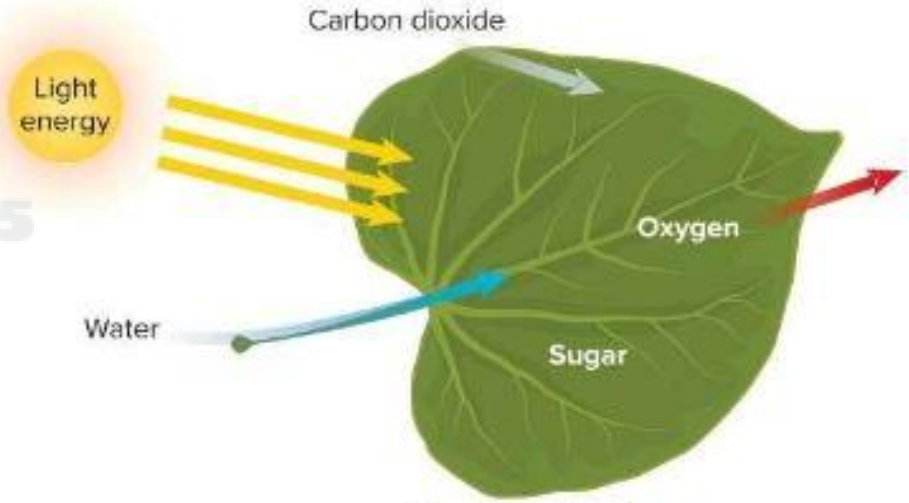


Answers may vary. Students are not expected to have the correct answers at this point. Sample answer: I think sunlight moves through the top layers to the layers below. I think the vascular tissue moves materials through the leaf.

Explain the process of chemical reactions such as photosynthesis and/or cellular respiration.

Capturing Light Energy In the first step of photosynthesis, plants capture the energy in light. This occurs in chloroplasts, which contain plant pigments. Pigments are chemicals that can absorb and reflect light. Most plants appear green because chlorophyll reflects green light and absorbs other colors of light. During photosynthesis, water molecules are split apart. This releases oxygen into the atmosphere.

Making Sugars Sugars are made in the second step of photosynthesis, which can occur without light. In chloroplasts, carbon dioxide from the air is converted into sugars by using the energy stored and trapped by chlorophyll. Carbon dioxide combines with hydrogen atoms from the splitting of water molecules and forms sugar molecules. Plants can use this sugar as an immediate energy source or can store it for later use. Potatoes and carrots are examples of structures where sugar is stored.



Photosynthesis

Carbon dioxide + Water → Sugar + Oxygen

Light energy

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

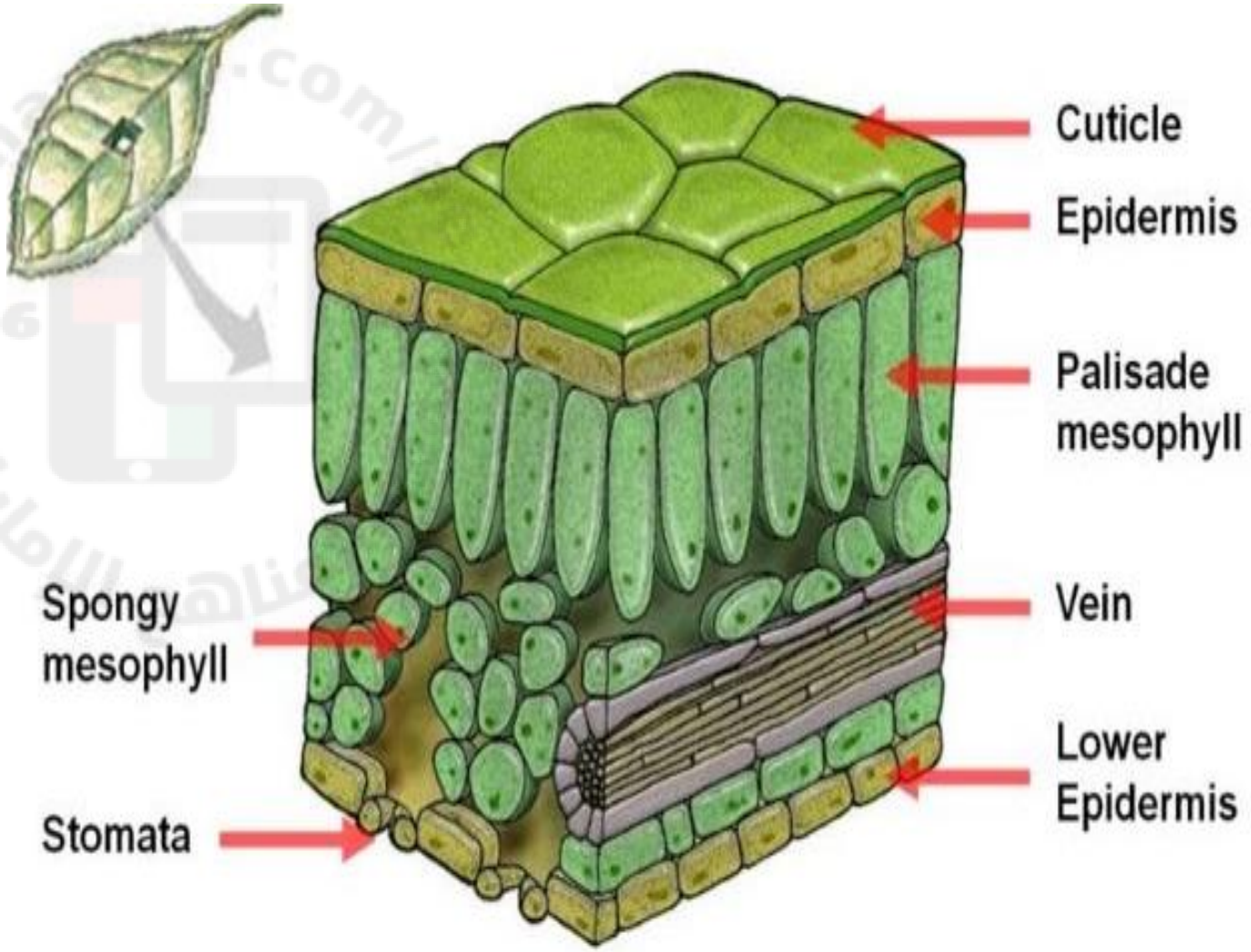
Photosynthesis

PHYSICAL SCIENCE Connection Photosynthesis, like most chemical reactions, requires an input of energy. In this case light energy is absorbed by chlorophyll. When the light energy is absorbed, it is used to split water molecules. This results in oxygen, which is released from the leaves of the plant, and hydrogen, which is used to make glucose. In the chemical reaction for photosynthesis, the reactants carbon dioxide (CO_2) and water (H_2O) use energy from light to form the products glucose ($C_6H_{12}O_6$) and oxygen (O_2).

Where does photosynthesis happen?

• Carbon dioxide, water vapor, and oxygen pass through stomata.

•Both spongy mesophyll and palisade mesophyll cells contain chloroplast, and photosynthesis occurs in these cells.



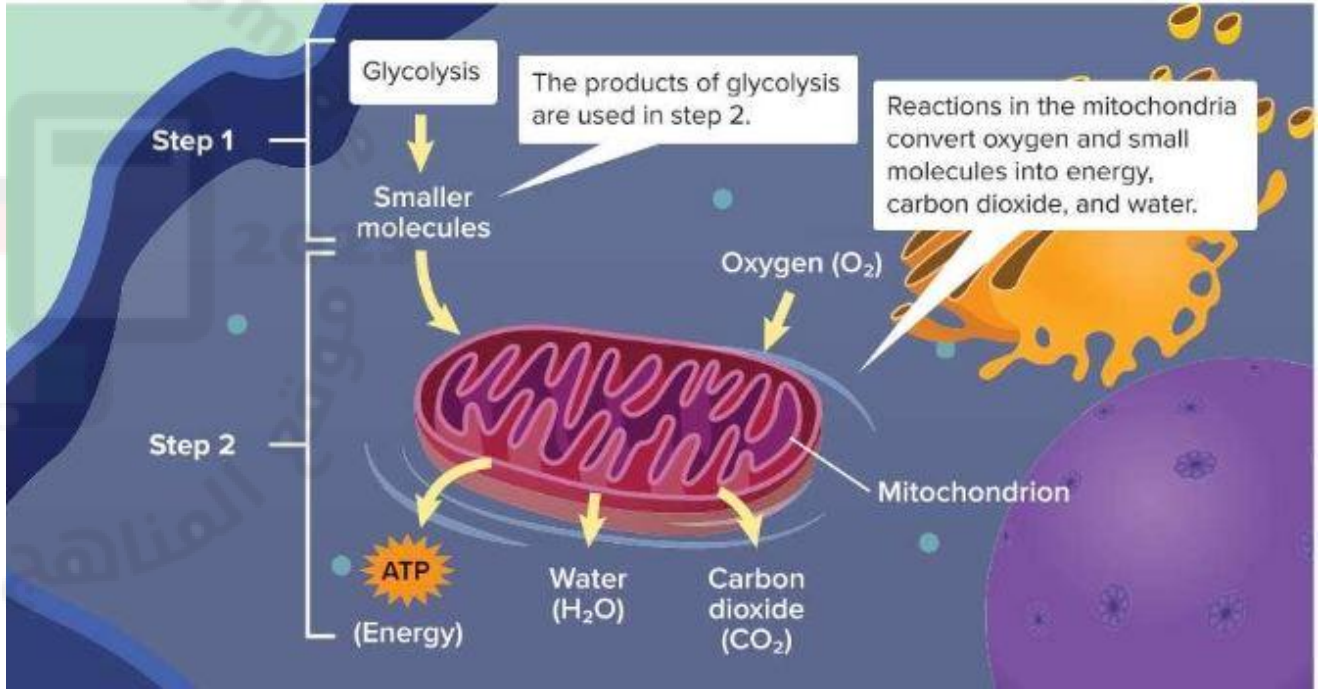
CELLULAR RESPIRATION

Cellular Respiration The bromthymol blue changed color due to the presence of carbon dioxide in your exhalations. Where did the carbon come from? It is a waste product from a process that releases energy from molecules. **Cellular respiration** is a series of chemical reactions that convert the energy in food molecules into a usable form of energy called ATP. Cellular respiration occurs in two parts of a cell—the cytoplasm and the mitochondria.

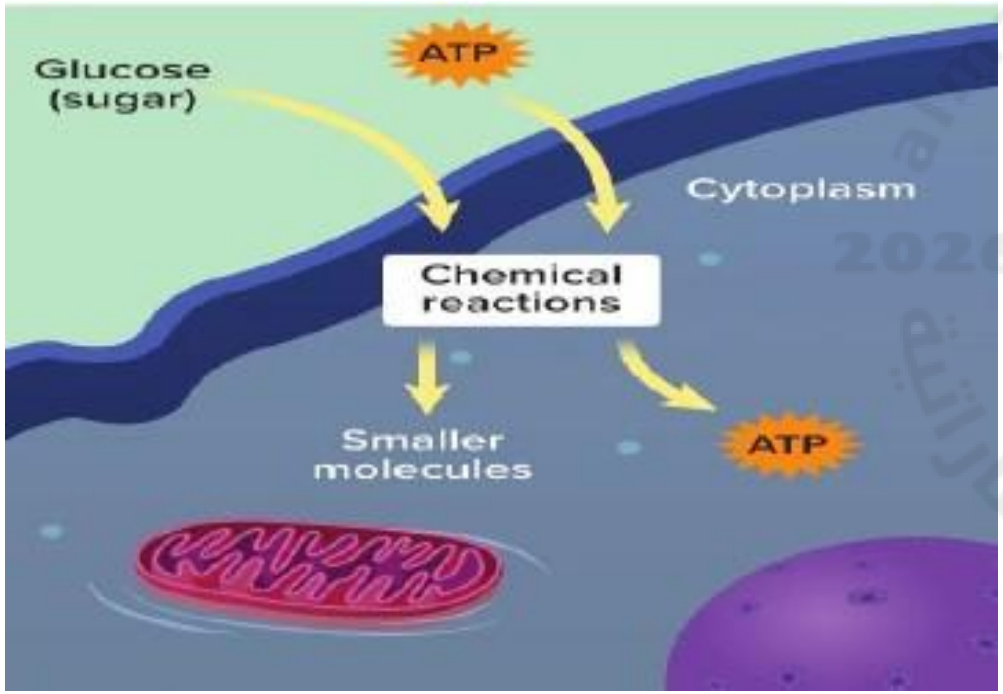
Where does cellular respiration happen?

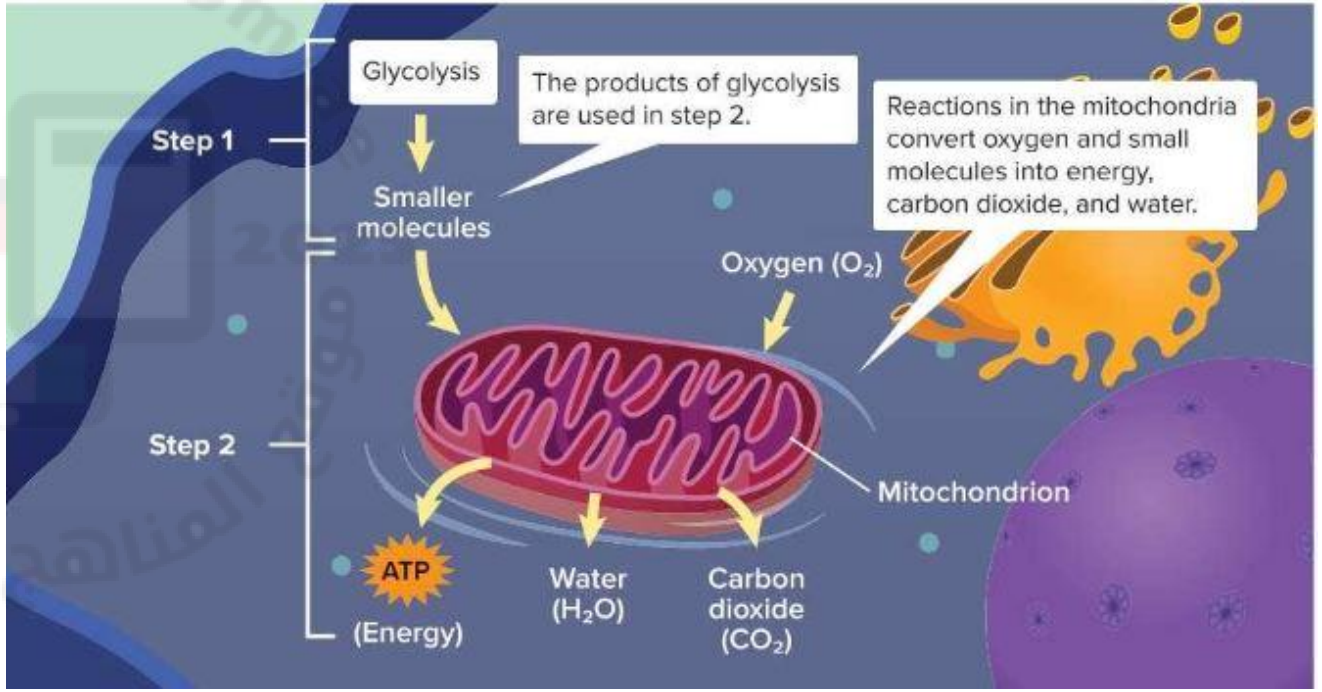
The first step of cellular respiration, called glycolysis, occurs in the cytoplasm of all cells. **Glycolysis** is a process by which glucose, a sugar, is broken down into smaller molecules. Glycolysis produces some ATP, an energy storage molecule. This process also uses energy from other ATP molecules.

The second step of cellular respiration occurs in the mitochondria of eukaryotic cells. This step requires oxygen. The smaller molecules made from glucose during glycolysis are broken down. Large amounts of ATP—usable energy—are produced. Cells use ATP to power all cellular processes. Two waste products—water and carbon dioxide (CO_2)—are given off during this step. The CO_2 released by cells as a waste product is used by plants and some unicellular organisms during photosynthesis.



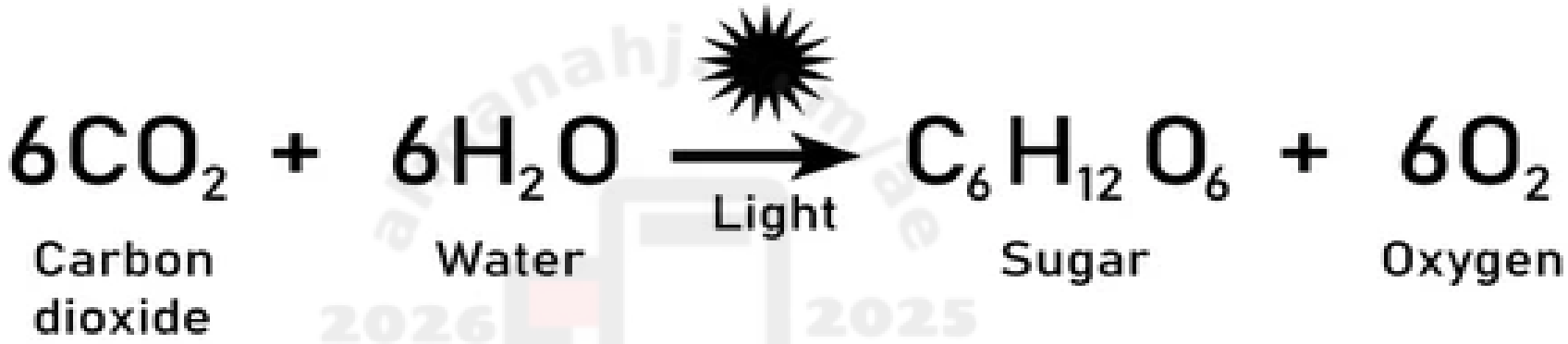
Where does cellular respiration happen?





PHOTOSYNTHESIS AND CELLULAR RESPIRATION

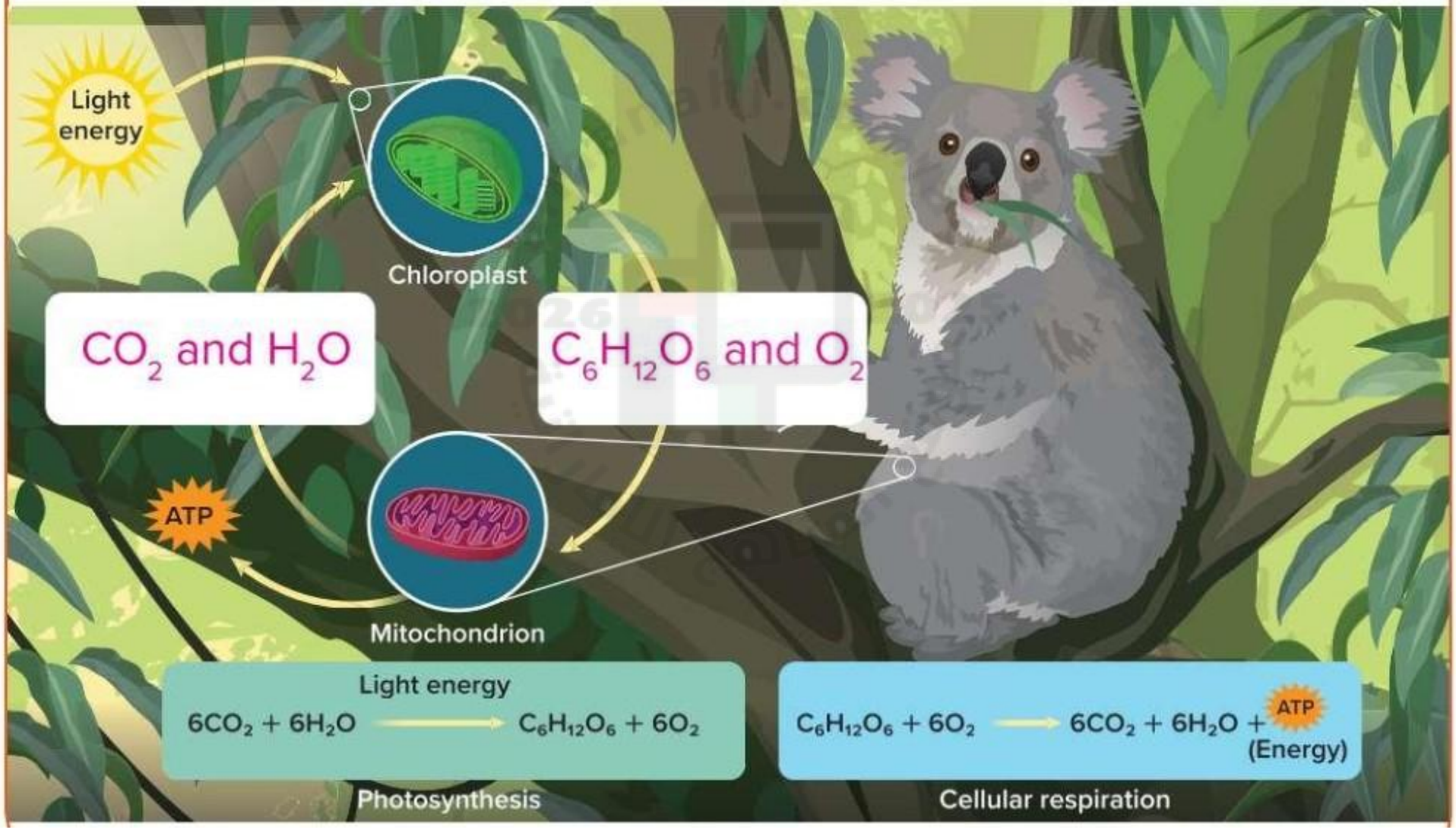
Photosynthesis



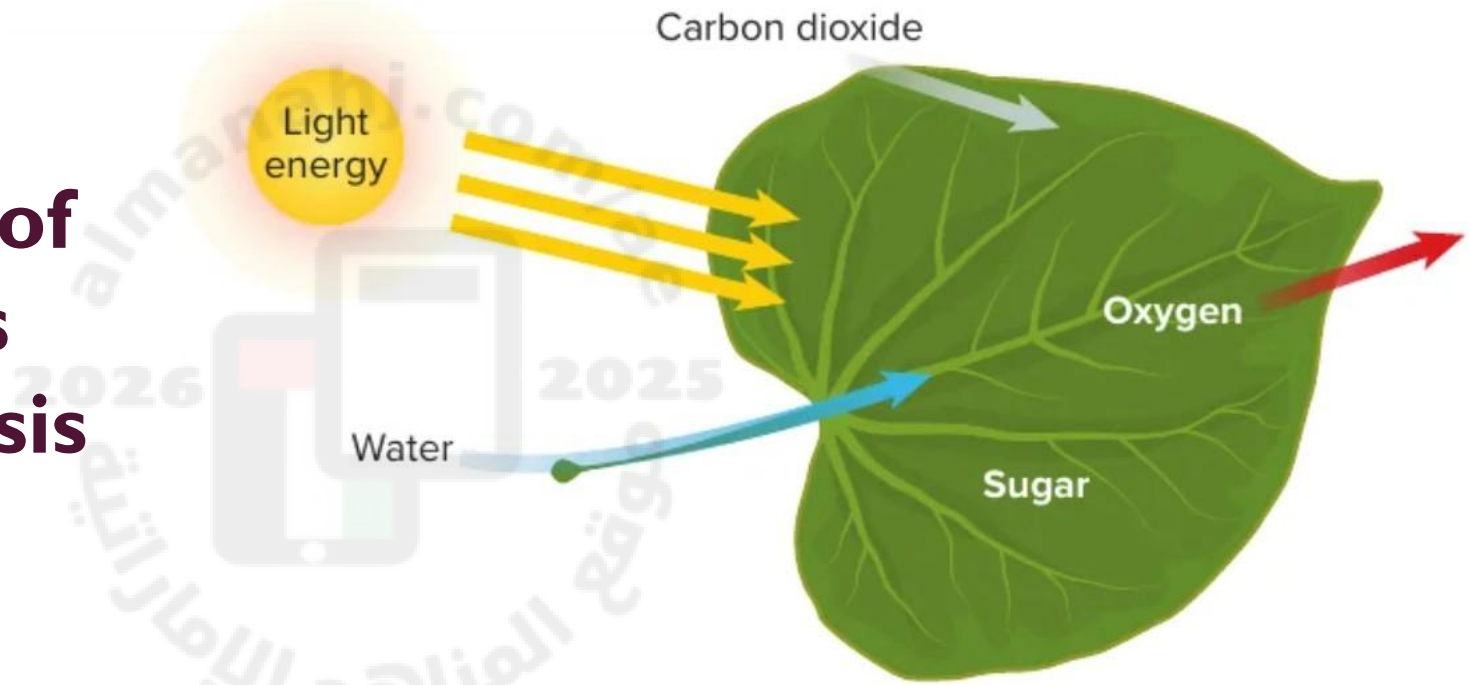
Cellular respiration

THREE-DIMENSIONAL THINKING

Label the image of the **system** below to track the **energy** transfer in photosynthesis and cellular respiration. Identify inputs and outputs of each part of the system.



Explain the process of chemical reactions such as photosynthesis and/or cellular respiration.



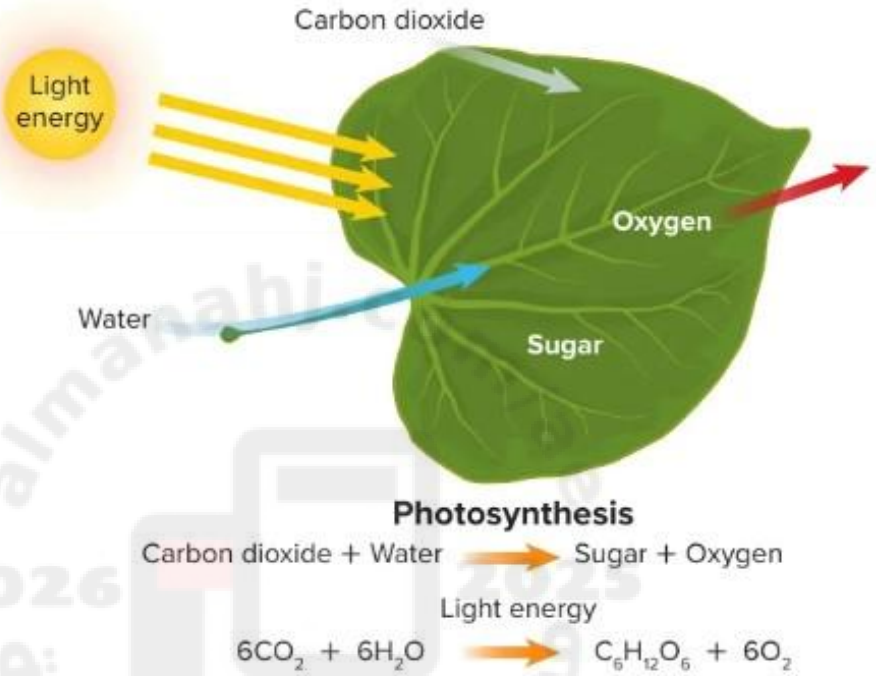
Photosynthesis

Carbon dioxide + Water → Sugar + Oxygen

Light energy

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

Use the model to answer question 2.



2. Which is the best explanation of the change in energy shown in the model?

A New energy is produced by plants during photosynthesis.

B Large amounts of energy are released into the environment during photosynthesis.

C Energy from sunlight is destroyed as it powers photosynthesis

D Energy input from the environment is stored in food molecules during photosynthesis.

3. **EARTH SCIENCE Connection** In recent decades, average global temperatures have increased significantly. Scientists agree that the widespread destruction of the Amazon rain forest contributes to climate change. Which mechanism might be cited to support that hypothesis?

A Deforestation causes water on the ground to reflect sunlight.

B Deforestation reduces the number of plants able to absorb carbon dioxide.

C Photosynthesis produces energy, which gives off heat.

D Plants use up energy during cellular respiration.

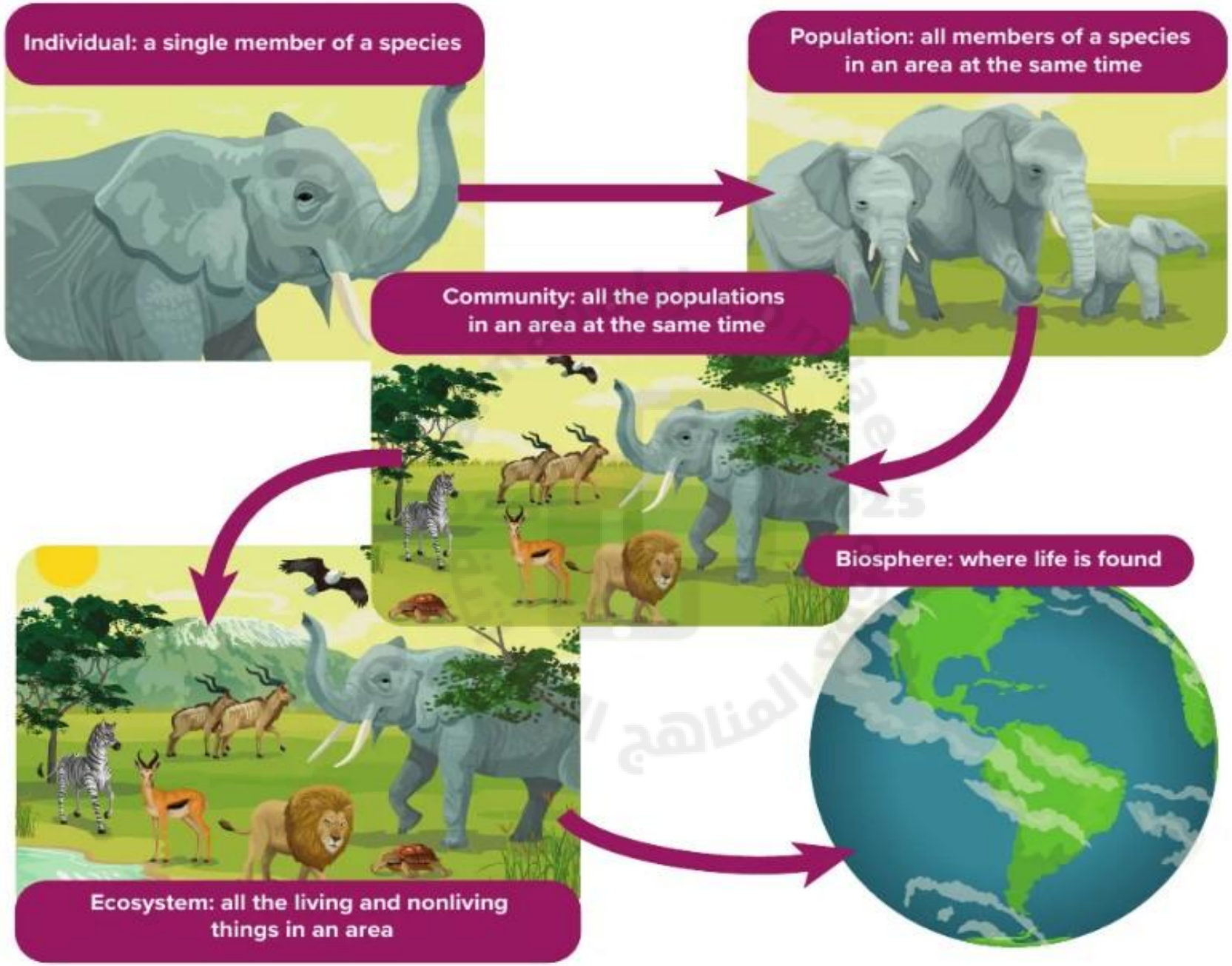
When you observed the animals in the video, you may have noticed the environment around them. What were some of the living and nonliving things you noticed in the video?

Go online f
about reso
ecosystem

In the video, while you noticed the antelope and the lions, you also may have seen grasses growing or birds flying by. The birds, mammals, and grasses are living things. The nonliving parts of the environment included the rocks and the water. Recall that all of the living and nonliving things in an area make up an ecosystem. All of the ecosystems on Earth make up the **biosphere**—the parts of Earth and the surrounding atmosphere where there is life. Examine the image below to see how an area, like the park seen in the video, is organized.

Ecosystems As you can see, an individual elephant is part of an ecosystem. An elephant relies on interactions with other elephants to survive. They move in herds and keep each other safe. All of the elephants in the area make up a population. A **population** is all the organisms of the same species that live in the same area at the same time. A **species** is a group of organisms that have similar traits and are able to produce fertile offspring.

Many species besides elephants live in Etosha National Park. Zebras, tortoises, and lions all call the area their home. Plants that grow in the savanna include shrubs, grasses, and small trees. Together, all these plants, animals, and other organisms make up a community. A **community** is all the populations of different species that live together in the same area at the same time.


Individual: a single member of a species
Population: all members of a species in an area at the same time
Community: all the populations in an area at the same time
Biosphere: where life is found
Ecosystem: all the living and nonliving things in an area

GO ONLINE

Watch the video *Down at the Watering Hole* to see this phenomenon in action.

After watching the video, what did you notice? What are the relationships between the oryx, birds, springboks, and lions?

Sample answer: All of the animals live close together. They all live near, and share the area of water.

What resources do the animals in the video share?

Sample answer: The animals share space, water, grass, sunlight, and fresh air.

COLLECT EVIDENCE as you work through the lesson.

Then return to these pages to record your evidence.

EVIDENCE

A. What evidence have you discovered to explain how the animals of the park in Namibia are organized in their ecosystem?

Different organisms of the same species make populations.

The populations of organisms interact in a community with each other and with the non-living resources of the ecosystem.

MORE EVIDENCE

B. What evidence have you discovered to explain how limiting factors, like water, affect the populations of animals living in the park?

Limiting factors affect the population of organisms living in an area, some organisms may not survive with too few resources so the population size will decrease.

Without limiting factors, populations would keep growing until they reach their biotic potential. With limiting factors, population size is limited to carrying capacity of the ecosystem which is the largest number of individuals a population can support.

REVISED CLAIM

The animals in the park were gathering near water because...

The animals were all gathering near water because they all need water to live. Water is a limiting factor so without it, animals can not survive and population size will decrease.

INVESTIGATION

There's No Place Like Home

Use the space below to list the living and nonliving things in your local ecosystem.

Living Things	Nonliving Things
Answers may vary. Sample answer: Trees, grass, squirrels, rabbits, raccoons, mosquitos, mushrooms	Answers may vary. Sample answer: Rocks, water, sand, sunlight

How do you think the living and nonliving parts of your ecosystem interact?

Answers may vary. Sample answer: Living things like trees and other plants require nonliving things like water and sunlight. Animals in turn need those plants for survival.

Describe the flow of energy among living and nonliving parts of an ecosystem.

Classify producers, consumers, and detritivores by their source of energy.

Producers Living things that make their own food are called **producers.** Producers make their food from materials found in their environments. Most producers are photosynthetic, such as plants. Other producers, including some bacteria, are chemosynthetic. Chemosynthesis is the process during which producers use chemical energy in matter rather than light energy to make food.

Consumers Unlike producers, **consumers** do not produce their own energy-rich food. Instead, they get the energy they need to survive by consuming other organisms. Consumers can be classified by the type of food that they eat. Herbivores feed on only producers. Carnivores eat other animals. Omnivores eat both producers and other consumers.

Describe the flow of energy among living and nonliving parts of an ecosystem.

Classify producers, consumers, and detritivores by their source of energy.

Detritivores Another group of consumers are detritivores (dih TRI tuh vorz). **Detritivores** get their energy by eating the remains of other organisms. Some detritivores, such as bacteria and mushrooms, feed on dead organisms and help break down or decompose them. For this reason, these organisms often are called decomposers. The yeast in the activity above is a decomposer. During decomposition, decomposers produce carbon dioxide that enters the atmosphere. Some of the decayed matter enters the soil or water. In this way, decomposers help recycle nutrients through ecosystems. They also help keep ecosystems clean. Without decomposers, dead organisms would pile up in an ecosystem.

Define herbivore, carnivore, omnivore.

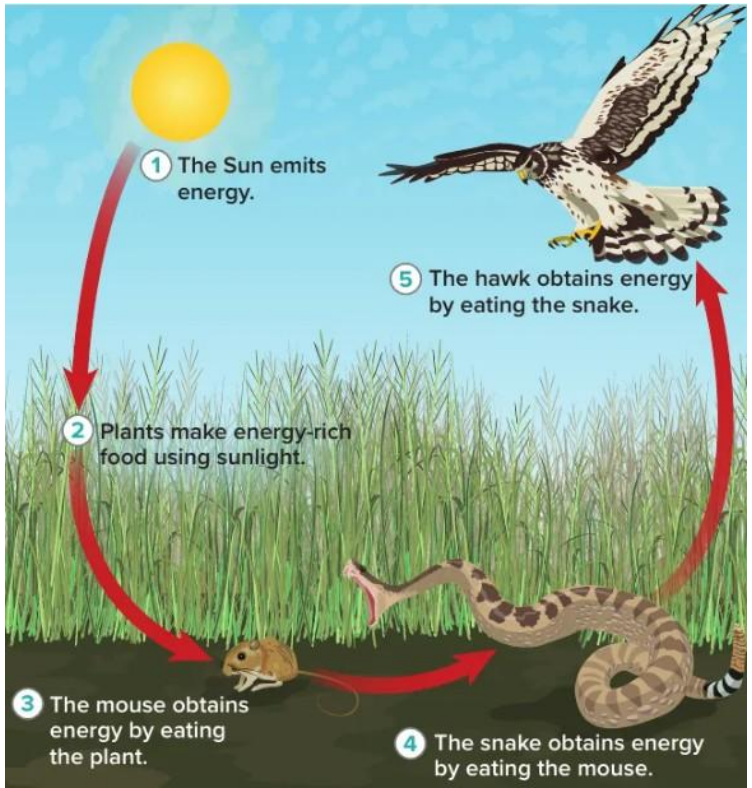
◀ This caterpillar is an herbivore and eats only plants.

This shark is a ▶ carnivore and eats other animals.

◀ These girls are omnivores and eat both producers and other consumers.

What are the differences between a food chain, a food web and a food pyramid?

You just created a food chain. A **food chain,** such as the one shown below, is a simple model that shows how energy moves from the Sun, to a producer, to one or more consumers through feeding relationships. In a food chain, arrows show the transfer of energy. The amount of available energy decreases every time it is transferred from one organism to another. A food chain is helpful when studying certain parts of an ecosystem, but it does not show the whole picture.

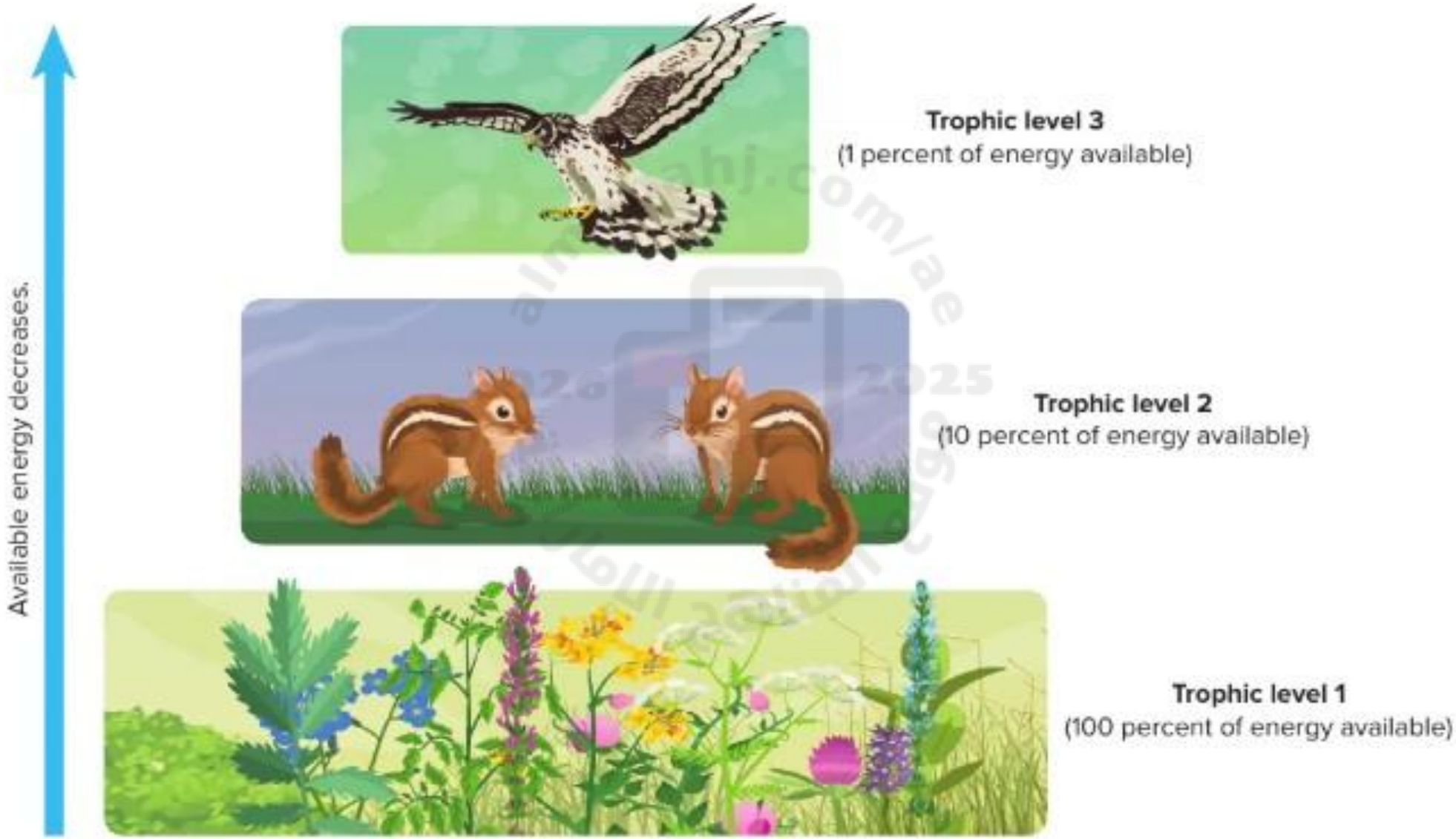


What are the differences between a food chain, a food web and a food pyramid?

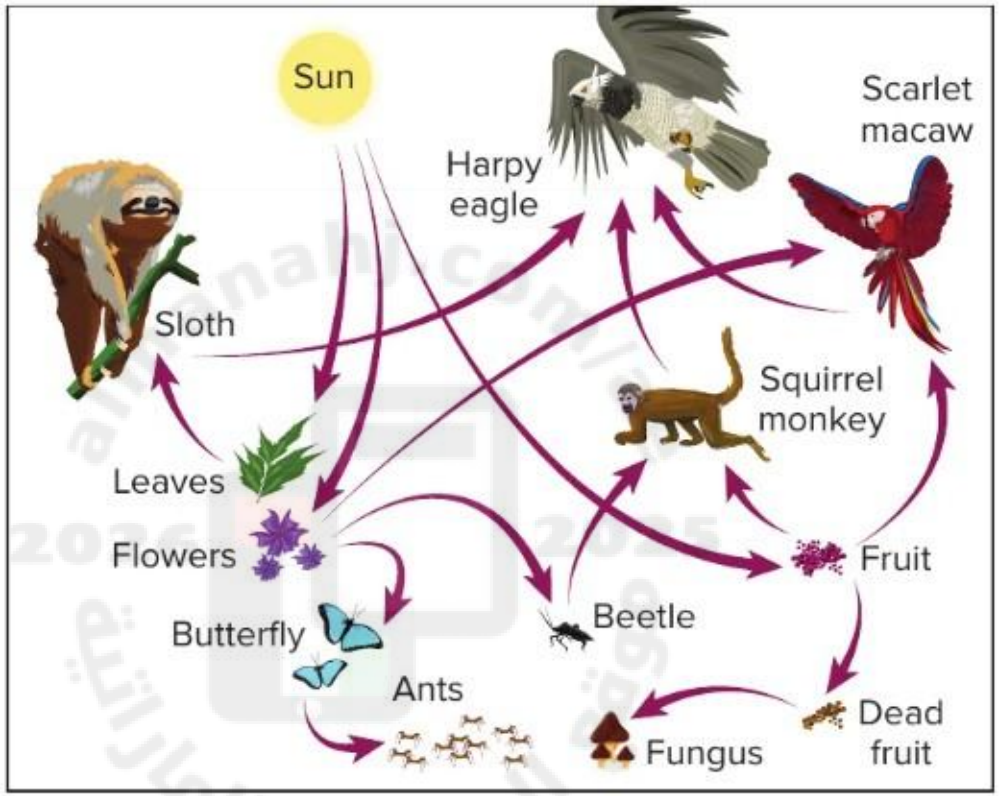
You just created a food web. Scientists use a model of energy transfer called a **food web,** such as the one shown below, to show how food chains in a community are interconnected. You can think of a food web as many overlapping food chains. Like in a food chain, arrows show how energy flows in a food web. Some organisms in the food web might be part of more than one food chain in that web.

Energy Pyramid Food chains and food webs show how energy moves in an ecosystem. However, they do not show how the amount of energy in an ecosystem changes. Scientists use a model called an **energy pyramid,** shown below, to show the amount of energy available in each step of a food chain. The steps of an energy pyramid are also called trophic levels.

Producers make up the trophic level at the bottom of the pyramid. Consumers that eat producers make up the next trophic level. Consumers that eat other consumers make up the highest trophic level. Less energy is available for consumers at each higher trophic level. Only about 10 percent of the energy available at one trophic level transfers on to the next trophic level.


Available energy decreases.
Trophic level 3
(1 percent of energy available)
Trophic level 2
(10 percent of energy available)
Trophic level 1
(100 percent of energy available)

2. Analyze the food web. Which statement is correct?



A The model tracks the transfer of energy as energy flows in this ecosystem.

B The transfer of matter back into the environment occurs only at the detritivore level.

C The model shows the transfer of matter only.

D The decomposers in the model use matter but not energy for their life processes.

3. In an energy pyramid, approximately 10 percent of the energy available in one trophic level is transferred to the next level. Which statement helps explain why this occurs?

A Consumers eat both producers and other consumers.

B Organisms use most of the available energy to fuel their own life processes.

C Predators eat more organisms in their own level than organisms in other levels.

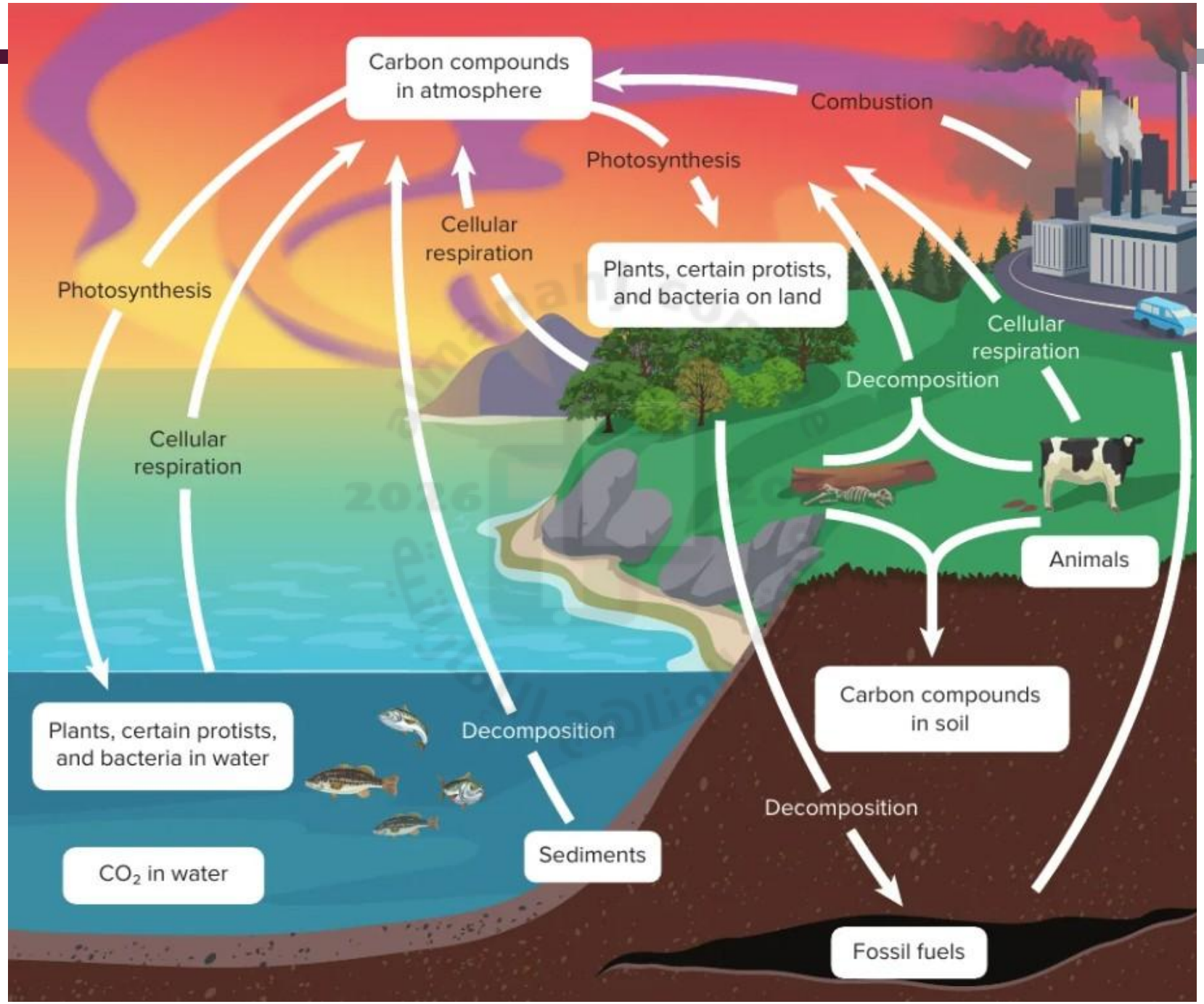
D Producers exist in only the lowest level of the pyramid.

The Carbon Cycle All organisms contain carbon. Some organisms, including humans, get carbon from food. Other organisms, such as plants, get carbon from the atmosphere or bodies of water.

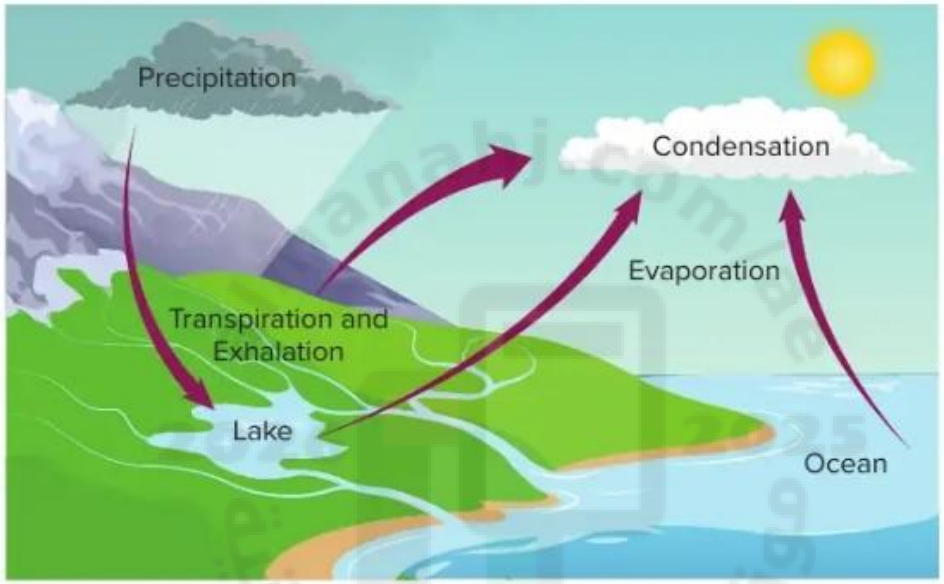
Carbon can enter the environment when organisms die and decompose. This returns carbon compounds to the soil and releases carbon dioxide (CO_2) into the atmosphere for use by other organisms. Carbon is also found in fossil fuels, which formed when decomposing organisms were exposed to pressure, high temperatures, and bacteria over hundreds of millions of years.

Recall that carbon is found in the atmosphere as carbon dioxide. Plants and other photosynthetic organisms take in carbon dioxide and water to produce energy-rich sugars. These sugars are a source of carbon and energy for organisms that eat photosynthetic organisms.

Carbon in Nature In the lab, you observed carbon dioxide in the balloon as a gas. You then observed carbon collect in the liquid as carbon dioxide. In a natural setting you can observe carbon move through systems as well. Tiny ocean organisms called phytoplankton (fi toh PLANK tuhn) take in carbon dioxide gas from the air. In some types of phytoplankton, the carbon dioxide gas is converted to calcium carbonate, which the phytoplankton use to build their skeletons. When phytoplankton die, many of them sink to the bottom of the ocean, where their skeletons become fossilized. Over time, these fossilized skeletons build up and turn into chalk. When this chalk is weathered by rain and waves, it releases carbon dioxide gas into the air. This gas can then be taken in by phytoplankton again.


Carbon compounds in atmosphere
Combustion
Photosynthesis
Cellular respiration
Plants, certain protists, and bacteria on land
Photosynthesis
Cellular respiration
Decomposition
Cellular respiration
Animals
Carbon compounds in soil
Plants, certain protists, and bacteria in water
Decomposition
Decomposition
Sediments
CO_2 in water
Fossil fuels

The Water Cycle Water continually cycles from Earth to its atmosphere and back again. This movement of water is called the water cycle. It involves three main processes: evaporation, condensation, and precipitation. You can see the processes in action in the figure below.

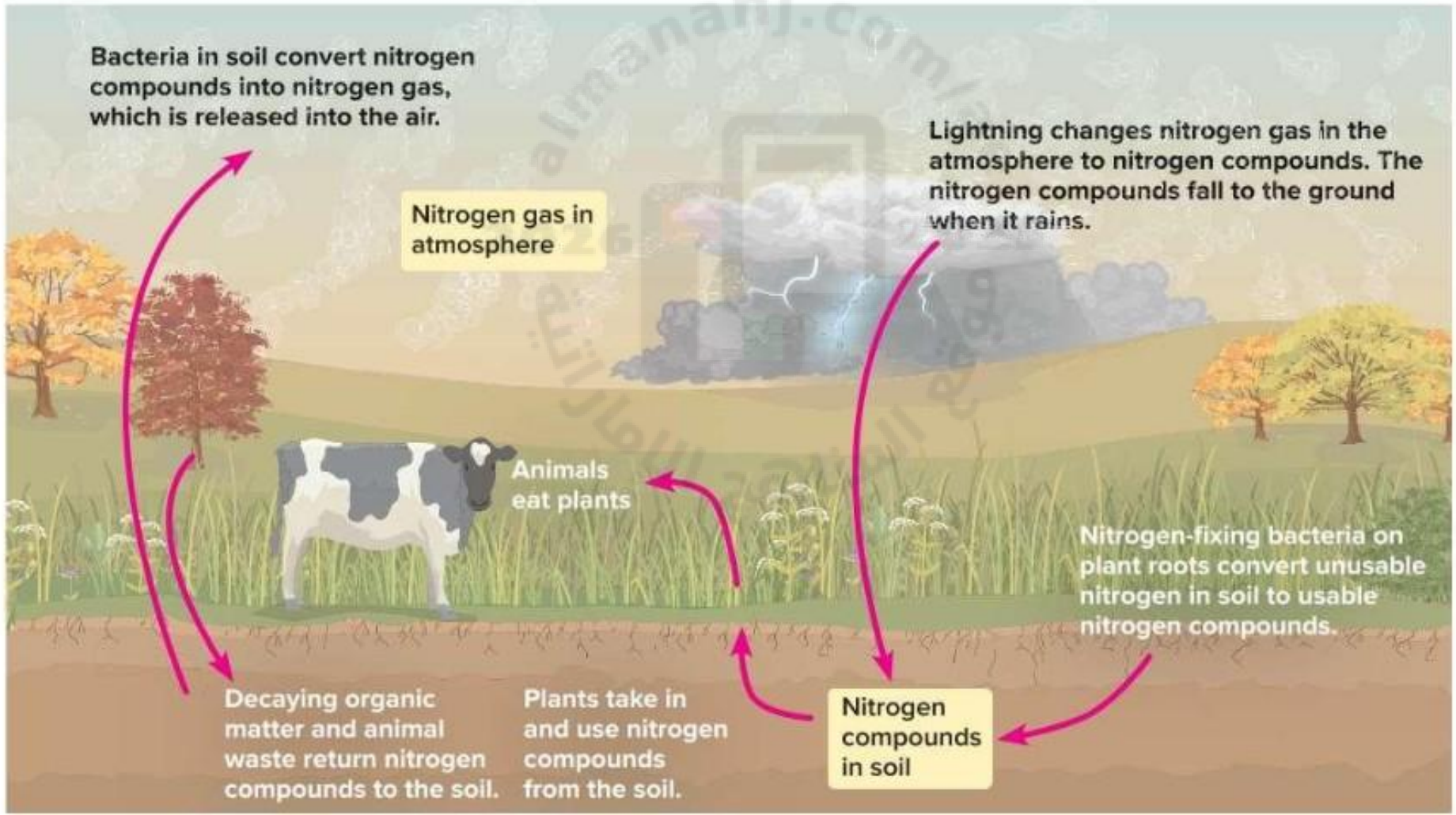


Evaporation is the process during which liquid water changes into a gas called water vapor. This water vapor rises into the atmosphere. Water vapor also enters the atmosphere when animals exhale and through transpiration, which occurs when plants release moisture.

The higher in the atmosphere you are, the cooler the temperature. As water vapor rises, it cools and condensation occurs. **Condensation** is the process during which water vapor changes into liquid water.

Water that falls from clouds to Earth's surface is called **precipitation.** It enters bodies of water or soaks into soil. Precipitation can be rain, snow, sleet, or hail.

The Nitrogen Cycle Just as water is necessary for life on Earth, so is the element nitrogen. It is an essential part of proteins, which all organisms need to stay alive. Nitrogen, like water, cycles between Earth and its atmosphere and back again. Examine the figure and draw arrows to show the path nitrogen takes according to the descriptions.

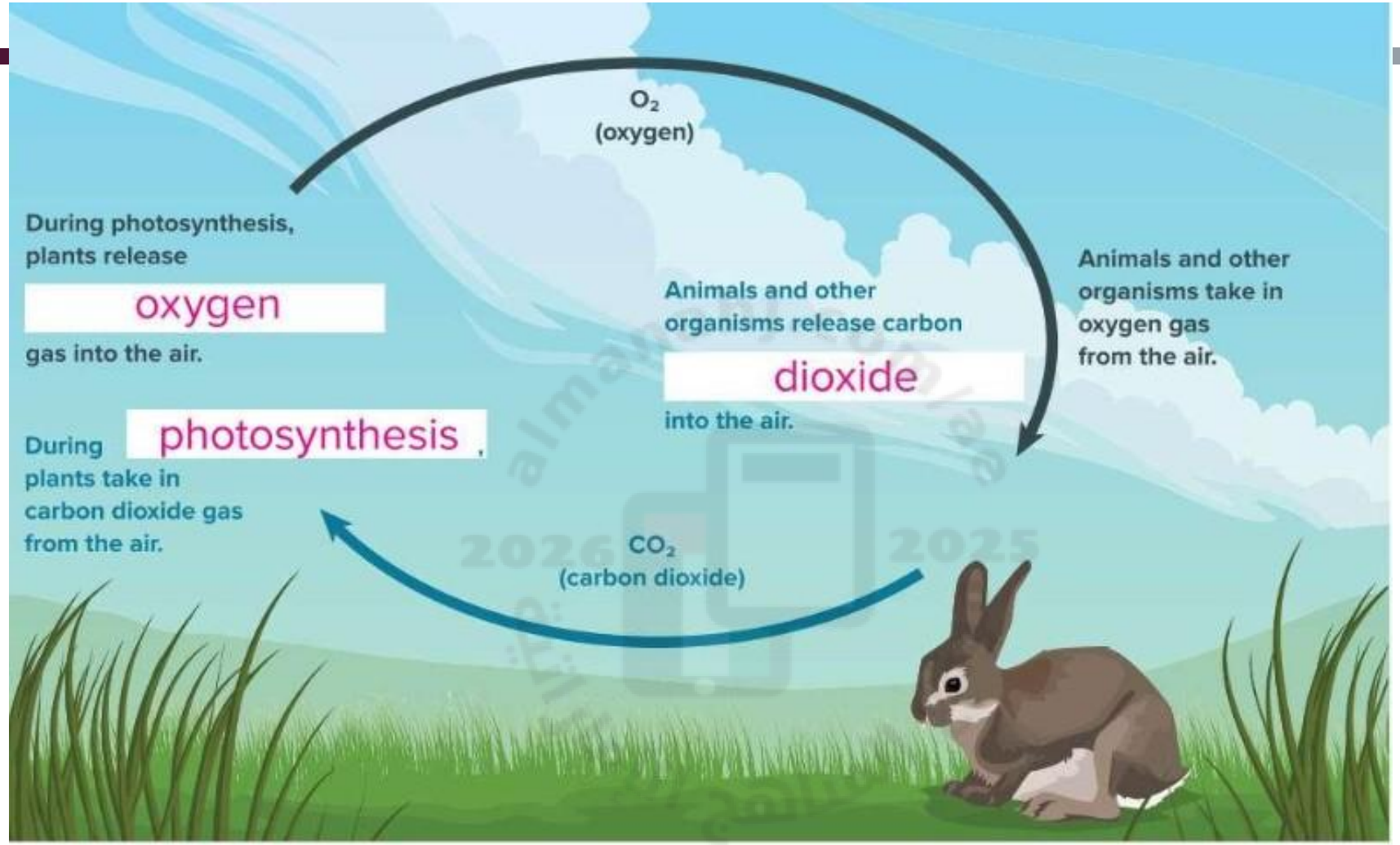


Recall that the atmosphere is mostly nitrogen. However, this nitrogen is in a form that plants and animals cannot use. The process that changes atmospheric nitrogen into nitrogen compounds that are usable by living things is called **nitrogen fixation** (NI truh jun • fihk SAY shun). Plants and some other organisms take in this changed nitrogen from the soil and water. Then, animals take in nitrogen when they eat the plants or other organisms.

As you learned in the previous lesson, decomposers can break down the tissues of dead organisms. When organisms die, nitrogen-fixing bacteria help return the nitrogen in the tissues of dead organisms to the environment. Nitrogen also returns to the environment in the waste products of organisms. Farmers often spread animal wastes, called manure, on their fields during the growing season. The manure provides nitrogen to plants for better growth.

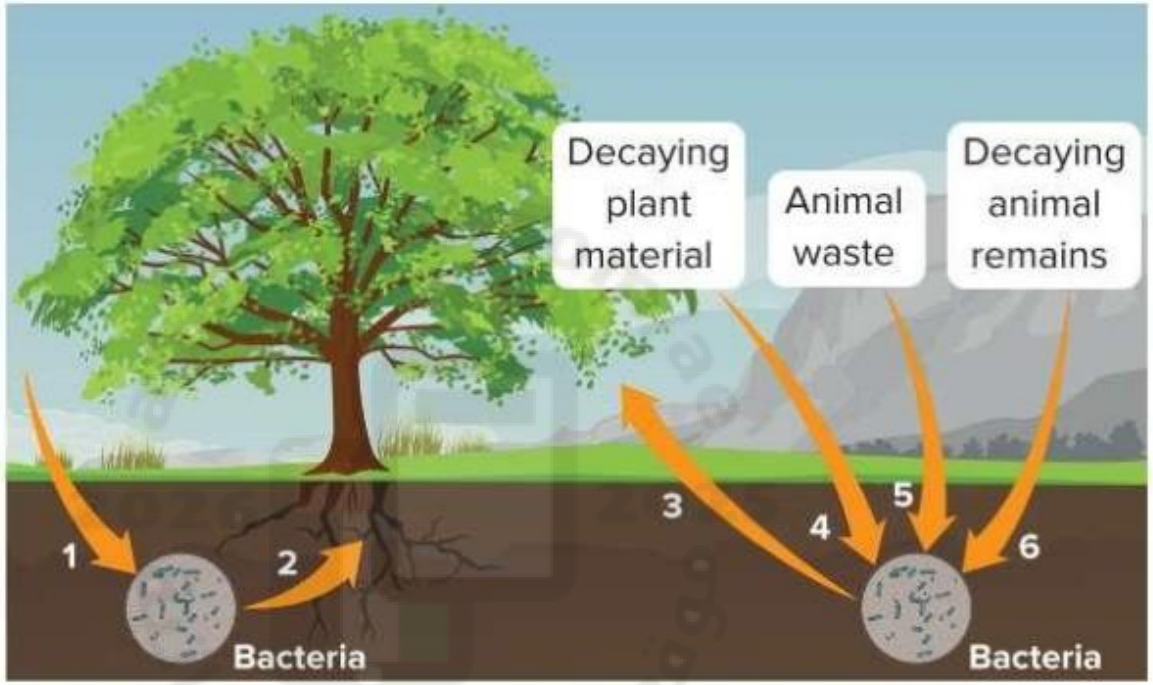
The Oxygen Cycle Oxygen is another element that cycles through ecosystems. Recall that oxygen is necessary for cellular respiration. Oxygen is also part of many substances that are important to life, such as carbon dioxide and water.

Earth's early atmosphere probably did not contain oxygen gas. Oxygen might have entered the atmosphere when certain bacteria evolved that could carry out the process of photosynthesis and make their own food. A by-product of photosynthesis is oxygen. Over time, other photosynthetic organisms evolved and the amount of oxygen in Earth's atmosphere increased. Today, photosynthesis is the primary source of oxygen in Earth's atmosphere. Some scientists estimate that unicellular organisms in water, called phytoplankton, release more than 50 percent of the oxygen in Earth's atmosphere.



Many living things, including humans, take in oxygen and release carbon dioxide. The interaction of the carbon and oxygen cycles is one example of a relationship between different types of matter in ecosystems. As the matter cycles through an ecosystem, both the carbon and the oxygen take different forms and play a role in the other element's cycle.

Keisha and her classmates created a model of the nitrogen cycle. Their diagram is shown below.



2. What is the function of the bacteria shown in the model?

A They prevent the nitrogen from harming the plants.

B They remove the nitrogen from the soil.

C They remove the oxygen from the soil.

D They return the nitrogen to the system.

3. Which of the following is NOT true about systems that cycle matter?

A Living things play a role in the cycling of matter.

B Matter changes form as it cycles.

C Some matter is destroyed as it cycles through the environment.

D Matter is constantly cycling thought the environment.

How do resources affect populations?

FOLDABLES®

Go to the Foldables® library to make a Foldable® that will help you take notes while reading this lesson.

Recall that nonliving things like water and living things like plants are both found within the same ecosystem. The living plants require water for individual growth and for survival of the entire population. Water is a resource and can have a large impact on the plants in the ecosystem. What effect could resources have on the growth of a population?

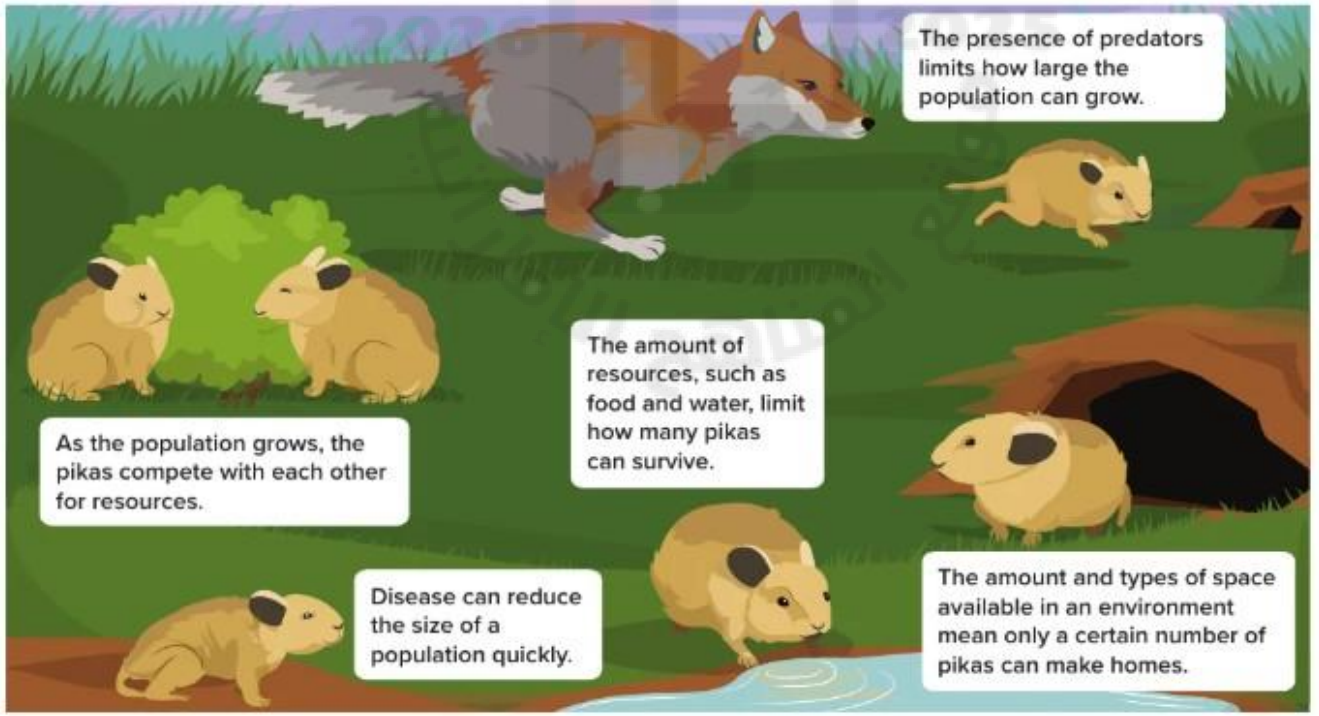
Limiting Factors Environmental factors, such as available water, food, sunlight, and temperature, are possible limiting factors for a population. A **limiting factor** is anything that restricts the size of a population. Populations can increase and decrease in size, but limiting factors might affect the number of individuals an ecosystem can support.

How Limiting Factors Affect Populations As you discovered in the Lab, *Fishy Population Changes*, the amount of space affects a population's size. Space is a limiting factor, just like available water, food, sunlight, and temperature. With too few resources, populations may migrate to new areas or even die out. Other factors that you will learn about may also limit how many individuals survive. Now, examine some limiting factors in a population of pikas.

INVESTIGATION

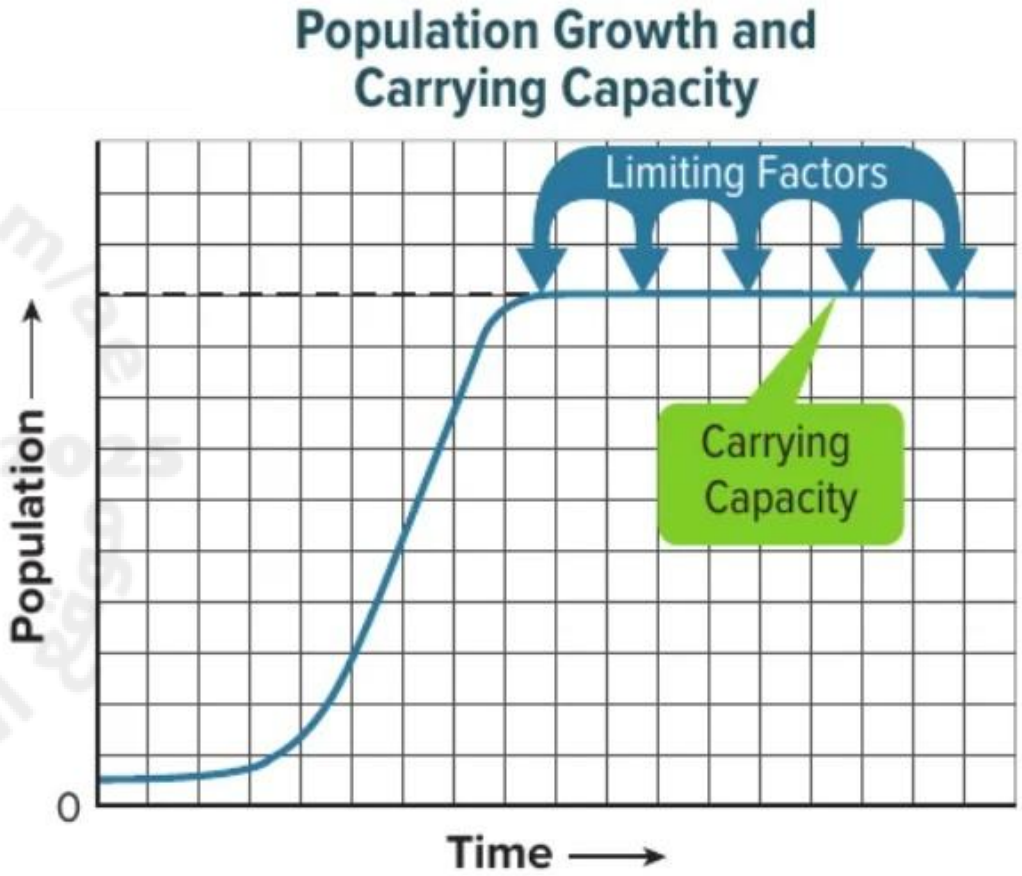
Pika Predicaments

Examine the figure of a population of pikas below. Read about how limiting factors affect their population and answer the following question.



Without limiting factors, populations would keep growing until they reached their biotic potential. **Biotic potential** is the potential growth of a population if it could grow in perfect conditions with no limiting factors.

Almost no population reaches its biotic potential. Instead, it reaches its carrying capacity. **Carrying capacity** is the largest number of individuals of one species that an ecosystem can support over time. For example, in the *Fishy Population Changes* lab, the pond could only support 16 fish before it reached its carrying capacity. The limiting factors of an area determine the area's carrying capacity, as shown in the graph.



Overpopulation Sometimes a population becomes too large for its ecosystem to support. **Overpopulation** is when a population's size grows so large that it causes damage to the environment.

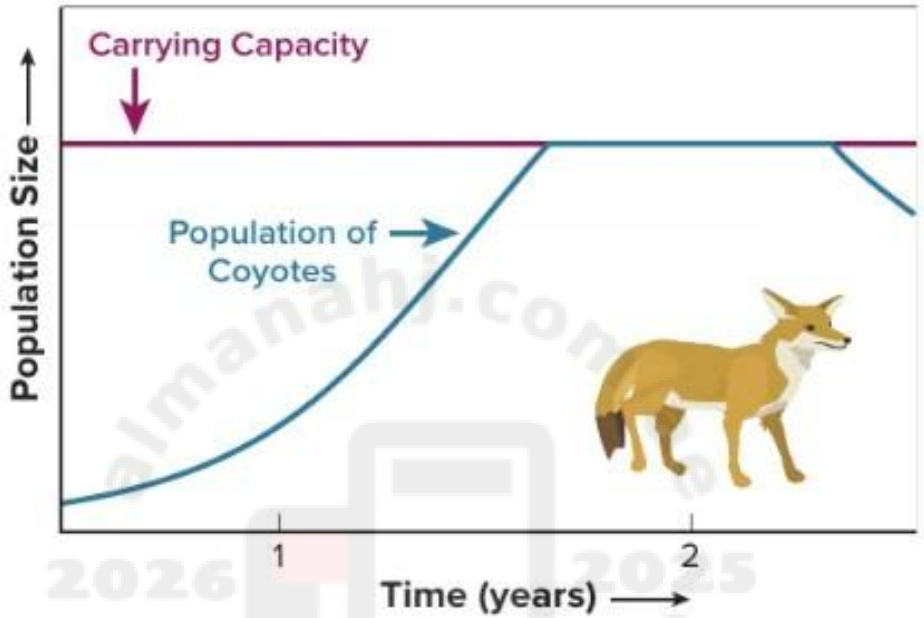
Overpopulation can cause problems for organisms. For example, a population of birds eats spiders. An overpopulation of birds causes the size of the spider population in that community to decrease. Populations of other animals that eat spiders also decrease when the number of spiders decreases.

Population Size Decrease Population size can increase, but it also can decrease. For example, a population of field mice might decrease in size in the winter because there is less food. Natural disasters such as floods, fires, or volcanic eruptions also affect population size. Sometimes, a population's size can decrease to such an extent that it may threaten the entire species. Examine the table to learn about what happens to species that see large decreases in population size.

Extinction If populations continue to decrease in numbers, they disappear. An extinct species is a species that has died out and no individuals are left. Extinctions can be caused by predation, natural disasters, or damage to the environment. For example, New Zealand was once home to a large, flightless bird called the giant moa. Humans first settled these islands about 700 years ago. They hunted the moa for food. As the size of the human population increased, the size of the moa population decreased. Within 200 years, all the giant moas had been killed and the species became extinct.

Endangered Species Mountain gorillas are an example of a species that is endangered. An endangered species is a species whose population is at risk of extinction. There are currently over 16,000 species that are categorized as endangered. Species that are considered critically endangered face an even higher risk of extinction.

Threatened Species California sea otters almost became extinct in the early 1900s due to overhunting. In 1977, California sea otters were classified as a threatened species—a species at risk, but not yet endangered. Laws were passed to protect the otters and by 2016 there were about 3,200 sea otters. Worldwide, approximately 7,000 species are classified as threatened.



2. A population of coyotes lives in a habitat with plentiful food and no predators. Analyze the graph and interpret what is happening to their population size at the one year mark.

A The population size is increasing.

B The population size is decreasing.

C The population size is remaining the same.

D The population size cannot be inferred from the graph.

3. Which of the following explains what happened to the coyote population size when it reached its carrying capacity, and why?

A The population size continued to increase because the ecosystem had not changed.

B The population size stopped increasing because it had reached the largest number of coyotes that the ecosystem could support.

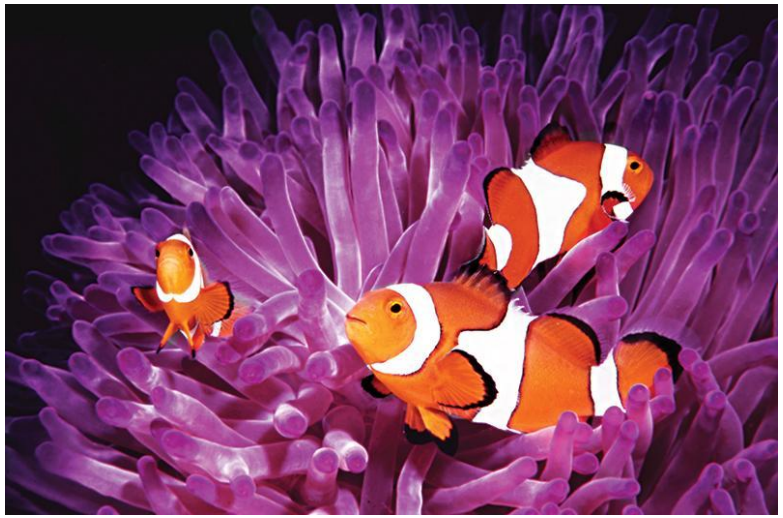
C The population size became zero because the ecosystem could no longer support the coyote population.

D The population size can no longer be inferred from the graph once carrying capacity is reached.

Symbiosis Barbel fish and hippos have a unique relationship. The fish follow and groom the hippos to eat. The hippos have parasites removed and their mouths cleaned by the fish. Both rely on the interaction to stay healthy and survive. This relationship is a type of symbiosis. **Symbiosis** is a close, long-term relationship between two species that usually involves an exchange of food or energy.

As you read earlier, organisms in communities can have many different types of relationships. Symbiotic relationships occur when two organisms live in direct contact and form a relationship. Some species have such close relationships that they are almost always found living together

Mutualism A symbiotic relationship in which both partners benefit is called **mutualism.** Clownfish and sea anemones live in tropical coral reef communities. The clownfish receives protection from the anemone as the anemone will sting predators of the clownfish. The anemone in turn receives energy from the waste produced by the clownfish. The barbel fish and hippos you learned about earlier also share a mutualistic relationship.



Another example

Bee and flower

+ 0

Commensalism A symbiotic relationship that benefits one species but does not harm or benefit the other is **commensalism**. Plants called epiphytes (EH puh fites) grow on the trunks of trees and other objects. The roots of an epiphyte anchor it to the object. The plant's nutrients are absorbed from the air. Epiphytes benefit from attaching to tree trunks by getting more living space and sunlight. The trees are neither helped nor harmed by the plants.

Another example

Remora fish and shark

+ -

Parasitism A symbiotic relationship that benefits one species and harms the other is **parasitism**. The species that benefits is the parasite. The species that is harmed is the host. The larvae of the hunting wasp is a parasite. The female wasp, shown in the photo on the left, stings a spider to paralyze it. Then she lays eggs in its body. When the eggs hatch into larvae, they eat the paralyzed spider.

Another example

Human and mosquito

Cooperative Relationships The leafcutter ants in the *Assorted Associations* investigation work together in cooperative relationships for their survival. Together they carry leaves to their nest to be used to grow fungus for food and building. Cooperative relationships can be found in many different populations across the world. For example, elephants cooperate with each other to raise young and watch for predators. Squirrel monkeys benefit in a similar way by living in groups. They cooperate as they hunt for food and watch for danger.

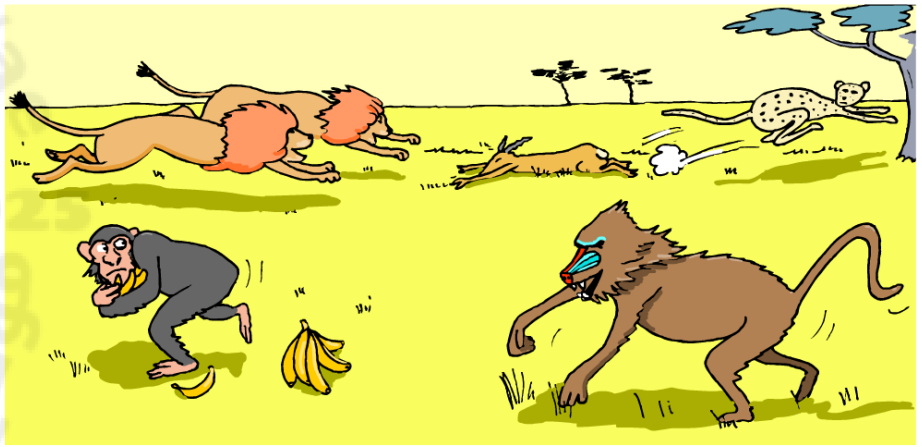
Elephants protecting baby elephants

Predator-Prey Relationships The osprey catching a fish is an example of a predator-prey relationship. A predator-prey relationship is one in which one organism, the predator, eats another, the prey. Predators help prevent prey populations from growing too large for the carrying capacity of the ecosystem. Predators often capture weak or injured individuals of a prey population. When the weak members of a population are removed, there are more resources available for the remaining members. This helps keep the prey population healthy.

Bear hunting and feeding on the fish

Competitive Relationships Organisms that share the same habitat often compete for resources. This is known as a competitive relationship. Competition describes interactions between two or more organisms that need the same resource at the same time. For example, trees compete for sunlight, and the shade from tall trees can slow the growth of younger trees. Wolves compete with ravens for meat from the animals that wolves kill, as shown in the previous photo.

Lions competing for deer



Monkeys competing for bananas

Ecological Succession The change in the pond you just observed is an example of ecological succession. **Ecological succession** is the process of one ecological community gradually changing into another. Ecological succession occurs in a series of steps. These steps can usually be predicted. For example, small plants usually grow first. Larger plants, such as trees, usually grow last. The final stage of ecological succession in a land ecosystem is a **climax community**—a stable community that no longer goes through major ecological changes.

Primary Succession Ecological succession in new areas of land with little or no soil or vegetation, such as on a lava flow, a sand dune, or exposed rock, is primary succession. Take a look at how an ecosystem changes after a volcanic eruption.

During a volcanic eruption, molten lava flows over the ground and into the water. After the eruption is over, the lava cools and hardens into bare rock.

Lichen spores carried on the wind settle on the rock. They break down the rock which builds up soil. Lichens add nutrients to the soil as they die and decay.

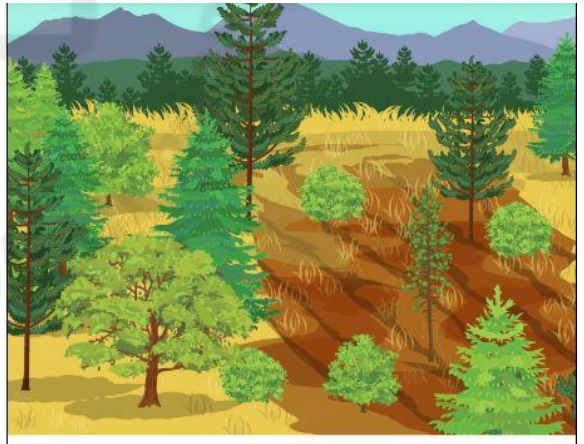
Airborne spores from mosses and ferns settle onto the thin soil and add to the soil when they die. The soil gradually becomes thick enough to hold water. Insects and other small organisms move into the area.

After many years the soil is deep and has enough nutrients for grasses, wildflowers, shrubs, and trees. The new ecosystem provides habitats for many animals. Eventually, a climax community develops.

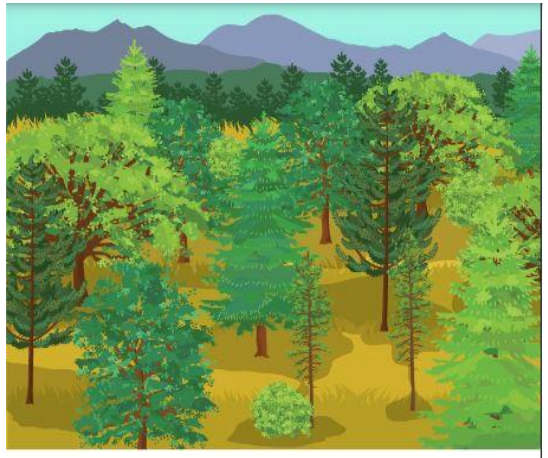
Secondary Succession In areas where existing ecosystems have been disturbed or destroyed, secondary succession can occur. One example is forestland in New England that early colonists cleared hundreds of years ago. Some of the cleared land was not planted with crops. This land gradually grew back to a climax forest community of beech and maple trees.

Settlers in New England cleared many acres of forest to create cropland. In places where people stopped planting crops, the forest began to grow back.

Seeds of grasses, wildflowers, and other plants quickly began to sprout and grow. Young shrubs and trees also started growing. These plants provided habitats for insects and other small animals, such as mice.



White pines and poplars were the first trees in the area to grow to their full height. They provided shade and protection to slower growing trees, such as beech and maple.



Eventually, a climax community of beech and maple trees developed. As older trees die, new beech and maple seedlings grow and replace them.

Like land ecosystems, freshwater ecosystems change over time in a natural and predictable process. This process is called aquatic succession. Observe how freshwater ecosystems change over time.

After a devastating forest fire, small green sprouts begin to appear on the forest floor.

2. What is happening in the image?

A The forest is undergoing primary succession.

B The forest is undergoing secondary succession.

C The green sprouts will not grow into full plants and the forest will not recover.

D The forest is suffering from eutrophication.

3. How might a lake suffering from eutrophication affect a population of fish?

A The population will grow because of the extra nutrients.

B The population will suffer due to decreases in oxygen and habitat loss.

C The fish population will not be affected.

D The size of the population will waver.

INVESTIGATION

Change in Communities

Examine the two images below. One is labeled *A* and the other is labeled *B*. Imagine community *A* changes and becomes like community *B*.

1. How long do you think it would take community *A* to become like community *B*?

Students should infer that the process takes time.

2. Summarize the changes you think would happen as the community changed from *A* to *B*.

Sample answer: Trees and plants grew along the edges of the pond. Animals like ducks and frogs then came to live in the pond.

THREE-DIMENSIONAL THINKING

Construct an explanation of how **changes,** such as the buildup of soil, could affect populations of organisms in a lake ecosystem.

Sample answer: If soil were to build up at the bottom of a lake, it may crowd out species that live within the lake. Some populations will leave while others may die out.

Read a Scientific Text

Eutrophication Like sediment, decaying organisms fall to the bottom of a pond, a lake, or a wetland, adding nutrients to the water. Runoff from fertilizers used in farming adds even more nutrients to water systems. **Eutrophication** is the process of a body of water becoming nutrient rich. Read about how nutrient pollution and eutrophication can affect an ecosystem.

Canopy Fogging Scientists use canopy fogging to collect data about the biodiversity of insects. It is often used in forests. A low dose of insecticide is sprayed up into the top of a tree or trees. The insecticide kills the insects, causing them to fall from the trees. When the insects fall, they are collected in a large screen, a large sheet, or several large funnels. To learn more about biodiversity, scientists study the insects, identify them, and count them.

Transect Sampling Scientists use a transect line to complete transect sampling. A transect line can be a rope, string, or measuring tape that is marked at set intervals, such as every meter or every 2 meters. The transect line is placed in or on the habitat surface and, at every interval, the number of species and individuals are recorded. Transect lines can be used in both terrestrial and aquatic habitats, such as the one in the photo to the right.

Mist Netting Fine mesh nets, called mist nets, are used to humanely capture animals in ecosystems. In terrestrial ecosystems, netting is often used to collect data on the biodiversity of bats and birds, as in the photo to the right. A large net is stretched across an area, and when a bat or bird flies into the net, it is removed and examined by scientists. In aquatic ecosystems, fish, shellfish, and other organisms may be captured. After organisms are captured, they are identified, counted, and often tagged and released.

Aerial Photos Photos of the ground taken from above, usually from an airplane, are called aerial photos. Aerial photos can be used to count and track species of whales and herds of migrating animals on land, such as moose and caribou. Aerial photos can also be used to assess the biodiversity of trees in temperate forests, but a limitation of the photos is that you can't see the forest floor. The photo to the right is an aerial photo showing walrus cows resting on sea ice.

Surveys An effective way for scientists to learn more about the biodiversity of certain groups of organisms, particularly birds, is by surveying. By analyzing data collected by expert bird watchers, field technicians, and scientists, a big picture of the biodiversity of bird species in an area can be seen. Surveys are usually conducted by people going through a habitat on foot or in a boat and, in the case of birds, using binoculars and a spotting scope to identify and count the number of birds in each species.

Quadrat Sampling A quadrat is a known square area that is marked using a pre-made square of plastic or stakes and string. Quadrats can range in size from 1 m^2 to 20 m^2 and can be used in both aquatic and terrestrial ecosystems. The size of the quadrat used depends on the type of habitat and organisms surveyed. Scientists set down the quadrat and count the number of species and the number of individuals of each species. This is repeated many times throughout the habitat so that the most accurate calculation of biodiversity can be made.

INVESTIGATION

Collect That Data

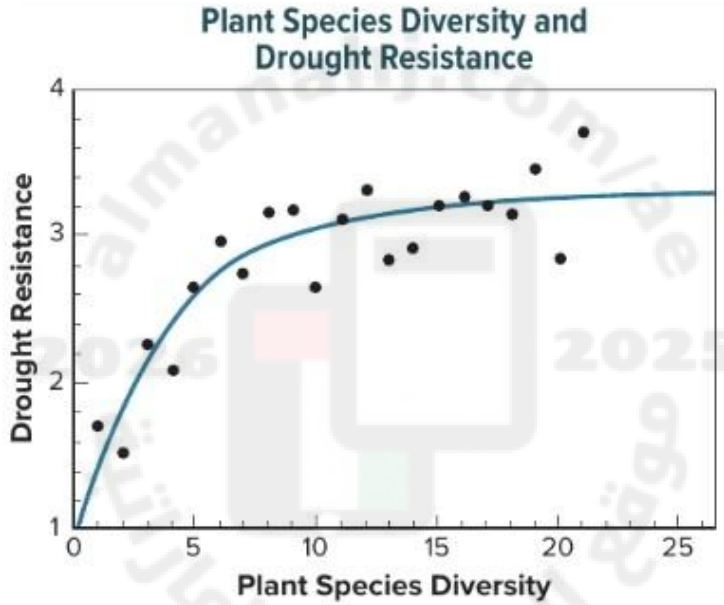
Explore some of the different ways that people collect data on the biodiversity of an area.

GO ONLINE Watch the videos *Grey-Faced Sengi* and *Counting Species in California.*

Record your observations about the different ways people collect data on biodiversity. What different methods and technologies did they use?

Sample answer: In one video the scientists used a camera trap to discover a new species. In the other video, they used cameras on poles to collect data on bats, large nets to collect data on fish, and climbing equipment to collect data on organisms at the tops of trees.

The graph below shows more data from the second experiment described in the Investigation *Plant Productivity.* During the course of the experiment, the region experienced an extended drought. The researchers tracked the relationship between plant species diversity and the ecosystem's resilience to the drought. Values closer to one on the vertical axis imply less resilience to the drought.



2. What conclusion can be made by analyzing the data from the graph?

A As plant biodiversity increases, resistance to drought decreases.

B As plant biodiversity increases, resistance to drought increases.

C Ecosystems with lower biodiversity are better able to respond to changes.

D Ecosystems with higher biodiversity are less able to respond to changes.

3. What would happen to the biodiversity index of an ecosystem if a change in the ecosystem caused the number of species to stay the same and the total number of individuals to increase?

A The biodiversity index would increase.

B The biodiversity index would decrease.

C The biodiversity index would stay the same.

D The biodiversity index would increase, and then decrease.

How does biodiversity differ between ecosystems?

What is a biome?

A ***Biome*** is a geographic area on Earth that contains ecosystems with similar biotic and abiotic features

**The *abiotic factors* in each major land biome determine which organisms can live in that ecosystem

How does biodiversity differ between ecosystems?

Land biomes

1. Deserts
2. Grasslands
3. Tropical rain forest
4. Temperate rain forest
5. Temperate deciduous forest
6. Taiga
7. Tundra

Aquatic ecosystems

1. Streams and rivers
2. Ponds and lakes
3. Wetlands
4. Estuaries
5. Open oceans
6. Intertidal zones
7. Coral reefs

Land

Desert

- Very little rain → Rare
- Earth's driest ecosystems
- Forms almost 1/3 of Earth
- Animals and plants have to adapt to hot and dry environment

Grassland

- Grasses are dominant
  - ➢Ex. of grass: Wild oats & buffalo grass
- Rich in invertebrates, birds & mammals
- Grasses &herbs → food and habitat

Forests

Tropical rain forest

- Grow near equator
- Heavy annual rainfall
- Warm and moist
- High biodiversity
  - ➢ Mostly insects
  - ➢ Parrots, Toucans & Snakes

Temperate rain forest

- Near the equator in Temperate regions (between tropics and polar circles)
- Temperate→ Mild climates and distinct seasons
- Moist ecosystems (mostly in coastal areas) & less warm
- Less biodiversity(because of seasonal changes)

Temperate deciduous forest

- Grow in temperate regions (Most common in US)
- More variation in winter & summer
- Mostly deciduous tress (lose their leaves in the fall)

Ice

Taiga*Boreal forest*

- Consists mostly of cone-bearing green trees
- Exist only in Northern hemisphere
- Colder temperatures → Fewer reptiles & amphibians
- Diversity:
  - Fewer mammals and birds

Tundra

- Cold, dry and treeless
- Most are in the south of the north pole (bottom of north pole)
- Frozen ground → difficult to grow deep rooted plants
- Diversity:
  - Diverse mammals
  - Rare reptiles and amphibians

INVESTIGATION

Benefits of Healthy Ecosystems

ENVIRONMENTAL Connection Observe the ecosystem in the image to the right. With a partner, brainstorm the benefits that humans receive from that ecosystem in the space below.

Answers may vary. Students should be encouraged to speculate. Sample answer: Humans receive food, such as corn, from the ecosystem. People also make money from the sale of food. Humans also use the water in this ecosystem, and breathe the air. Humans also receive benefits by enjoying activities in the ecosystems, such as biking and boating. They also benefit from the trees in this ecosystem because they provide oxygen.

Threats to Biodiversity You just explored how one type of pollution—air pollution—moves through an environment. **Pollution** is the contamination of the environment with substances that are harmful to life. You observed another threat to biodiversity at the beginning of this lesson—an invasive species. An **invasive species** is an organism that is introduced into an ecosystem, either by accident or on purpose, that spreads on its own and outcompetes native species for resources, such as space, food, light, and nutrients. Read about other threats to biodiversity in the table below.

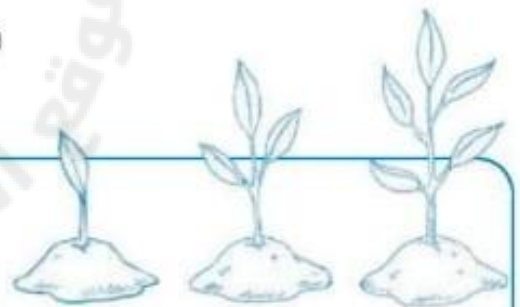
Threat to Biodiversity	Description	Example
Habitat Destruction	**Habitat destruction** involves cutting down forests, draining wetlands, or generally changing a habitat so much that it is no longer usable by the organisms that live there. The photo to the right shows a wetland being drained.	

Overexploitation	**Overexploitation** is the overuse of animal and plant species by humans for purposes including food, medicine, or clothing.	
Climate Change	**Climate change** refers to changes in climate patterns over time. Recently there has been an increase in Earth's average surface temperature both on land and in oceans, referred to as global warming.	

1. With your group, define the problem and brainstorm different solutions to your assigned scenario in the space below. After you have some ideas written down, research solutions to your scenario using print and digital sources and record them below. Try to come up with as many solutions as possible.

Answers may vary. Sample answer: getting species on endangered species list, setting up designated "protected areas," monitoring/ setting up rules and regulations for tourists, SCUBA divers, snorkelers, boaters, etc., guidelines for fishing, guidelines for pollution

2. What are some different considerations to keep in mind when evaluating these solutions? Record your ideas below.



Answers may vary. Sample answer: effectiveness, cost, time, number of people it will take to complete

3. Decide on your four best solutions and fill in the table

Solution	Benefits	Constraints	Ranking and Reasoning (lowest number = most important/do first)
Example: designating endangered/ threatened species	animals offered protection by the federal government	long process	2
education for divers	gets people involved in helping	difficult to regulate	4
zone management	able to control pollution, development	cost of regulating is high	1
reintroducing species	makes ecosystems genetically diverse	doesn't always work	3