Key

Class _____ Date _____

3.1 What Is Ecology?

+74 pts

You are Expected to have all corrections made and to have complete sentences!! (Question in your answer)

Lesson Objectives

- Describe the study of ecology.
- Explain how biotic and abiotic factors influence an ecosystem.
- Describe the methods used to study ecology.

Lesson Summary

Studying Our Living Planet **Ecology** is the scientific study of interactions among organisms and between organisms and their environment.

- Earth's organisms live in the **biosphere.** The biosphere consists of the parts of the planet in which all life exists.
- Ecologists may study different levels of ecological organization:
  - Individual organism
  - An assemblage of individuals that belong to the same species and live in the same area is called a **population.**
  - An assemblage of different populations that live together in an area is referred to as a **community.**
  - An **ecosystem** includes all the organisms that live in a particular place, together with their physical environment.
  - A group of ecosystems that have similar climates and organisms is called a **biome.**

Biotic and Abiotic Factors Ecosystems include biotic and abiotic factors.

- A **biotic factor** is any living part of an environment.
- An **abiotic factor** is any nonliving part of an environment.

Ecological Methods Ecologists use three basic methods of research: observation, experimentation, and modeling:

- Observation often leads to questions and hypotheses.
- Experiments can be used to test hypotheses.
- Modeling helps ecologists understand complex processes.

Studying Our Living Planet

1. What is ecology?

(+1) Ecology is the study of the interaction among organisms and between organisms and their environment.

2. What does the biosphere contain?

(+1) The biosphere contains all of the organisms and physical environments of Earth.

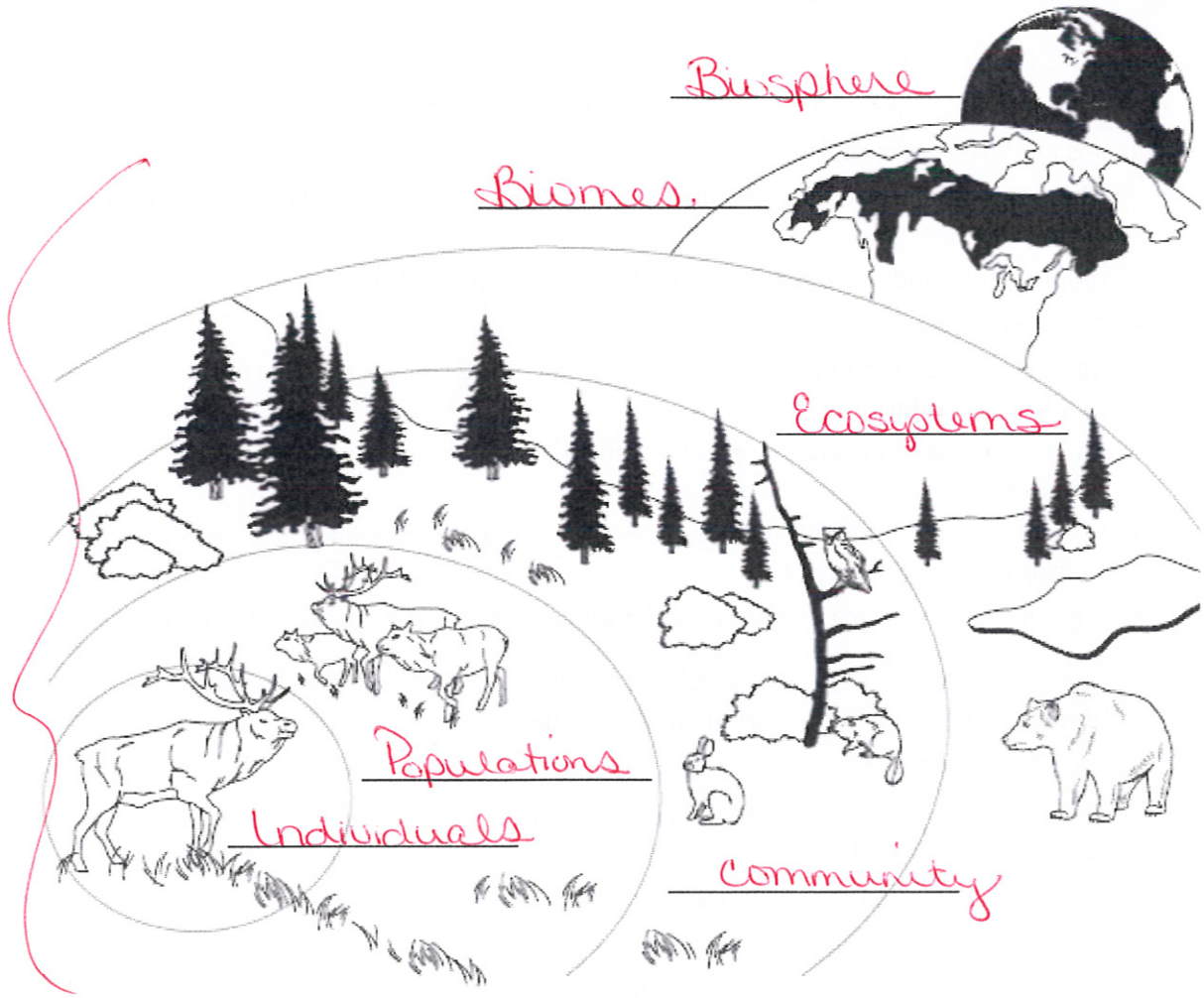
Name _____ Class _____ Date _____

3. How are human economics and ecology linked?

Economics has to do with the running of human "houses" (interactions with money & trade) while ecology has to do with the running of natures "houses" (interactions between energy & nutrients).

(+1)

Use the diagram to answer Questions 4–5



(+1)

4. Label each level of organization on the diagram.

5. Explain the relationship between ecosystems and biomes.

A group of ecosystems that share similar climates and organisms are what make up biomes.

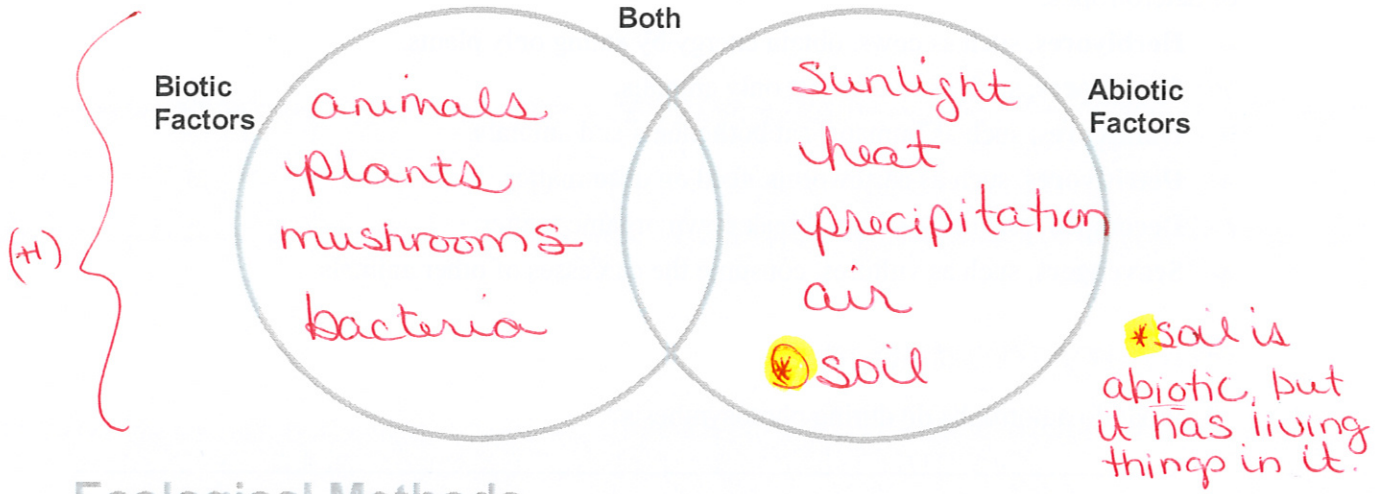
(+1)

Name _____ Class _____ Date _____

Biotic and Abiotic Factors

6. Use the terms in the box to fill in the Venn diagram. List parts of the environment that consist of biotic factors, abiotic factors, and some components that are a mixture of both.

air	**heat**	**precipitation**
animals	**mushrooms**	**soil**
bacteria	**plants**	**sunlight**



Ecological Methods

7. Why might an ecologist set up an artificial environment in a laboratory?

(+1) Artificial environments may be necessary so no harm is done to the actual environment or for time.

8. Why are many ecological phenomena difficult to study?

(+1) Ecological phenomena happen over long period of time and over large areas.

9. Why do ecologists make models?

(+1) Models help ecologists gain insight and understand complex phenomena.

3.2 Energy, Producers, and Consumers

Lesson Objectives

- Define primary producers.
- Describe how consumers obtain energy and nutrients.

Lesson Summary

Primary Producers Sunlight is the main energy source for life on Earth. Organisms that can capture energy from sunlight or chemicals and use that energy to produce food are called **autotrophs**, or **primary producers**.

- The process in which autotrophs capture light energy and use it to convert carbon dioxide and water into oxygen and sugars is called **photosynthesis**.
- The process in which autotrophs use chemical energy to produce carbohydrates is called **chemosynthesis**.

Consumers Organisms that rely on other organisms for their energy and food are called **heterotrophs**. Heterotrophs are also referred to as consumers. There are many different types of heterotrophs:

- **Herbivores**, such as cows, obtain energy by eating only plants.
- **Carnivores**, such as snakes, eat only animals.
- **Omnivores**, such as humans, eat both plants and animals.
- **Detritivores**, such as earthworms, feed on dead matter.
- **Decomposers**, such as fungi, break down organic matter.
- **Scavengers**, such as vultures, consume the carcasses of other animals.

Primary Producers

1. What do autotrophs do during photosynthesis?

(+1) Autotrophs use light energy to convert CO_2 and H_2O into carbohydrates.

2. Can some organisms survive without energy from the sun? Explain your answer.

(chemo-trophs) Organisms that live in environments where sunlight does not reach (like the bottom of the ocean) have evolved the ability to use chemicals instead of light to make food. (+1)

3. Can organisms create their own energy? Explain your answer.

(+1) Energy cannot be created or destroyed so no, organisms cannot create energy. Instead they transfer energy and harness energy.

Consumers

4. Complete the table about types of heterotrophs.

Types of Heterotrophs		
Type	**Definition**	**Examples**
(+1) Herbivore	Heterotrophs that eat only plants	cows, rabbits
(+1) Carnivore	Heterotroph that eats animals	snakes, lions, dogs, cats

(+1)	Omnivore	Heterotrophs that eat both plants & animals.	humans, bears, pigs
(+1)	Detritivore	Heterotroph that feeds on waste & debris (detritus)	snails, earthworms, mites
(+1)	Decomposer	Heterotroph that breaks down & recycles organic matter	fungus, bacteria
(+1)	Scavenger	Heterotroph that consumes the carcasses of dead animals but does not typically kill them itself	vulture, hyena

5. What is a consumer?

(+1) Consumers rely on other organisms for energy & nutrients.

6. How would you categorize a consumer that usually catches and eats prey, but also eats dead animal carcasses? Carnivore or even Scavenger

(+1)

Apply the Big idea

7. What role do producers play in establishing Earth as a living planet? Producers are the organisms that harness and transform the Suns energy into usable food sources for all of life on our planet. They are the first link in all food chains and the base of all food webs.

(+1)

3.3 Energy Flow in Ecosystems

Lesson Objectives

- Trace the flow of energy through living systems.
- Identify the three types of ecological pyramids.

Lesson Summary

Food Chains and Food Webs Energy flows through an ecosystem in one direction from primary producers to various consumers.

- A **food chain** is a series of steps in which organisms transfer energy by eating and being eaten. Producers, such as floating algae called **phytoplankton,** are at the base of every food chain.
- A **food web** is a network of all the food chains in an ecosystem. Food webs are very complex. Small disturbances to one population can affect all populations in a food web. Changes in populations of **zooplankton,** small marine animals that feed on algae, can affect all of the animals in the marine food web.

Trophic Levels and Ecological Pyramids Each step in a food chain or food web is called a **trophic level**. Producers make up the first trophic level. Consumers make up

higher trophic levels. Each consumer depends on the trophic level below it for energy.

An **ecological pyramid** is a diagram that shows the relative amounts of energy or matter contained within each trophic level in a food chain or food web. Types of ecological pyramids are pyramids of energy, pyramids of biomass, and pyramids of numbers:

- Pyramids of energy show relative amounts of energy available at different trophic levels.
- Pyramids of **biomass** show the total amount of living tissue at each trophic level.
- A pyramid of numbers shows the relative numbers of organisms at different trophic levels.

Food Chains and Food Webs

1. Complete the table about feeding relationships.

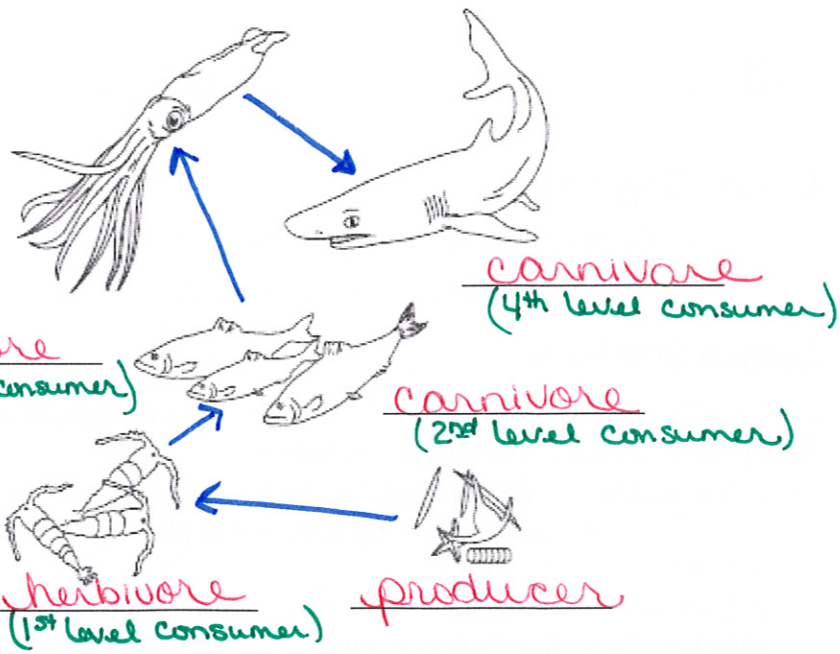
Feeding Relationships

Relationship	Description
Food Chain	A series of "steps" in which energy is being transfered between organism through feeding.
Food Web	a network of interrelated food chains in an ecosystem

(+1) (+1)

Use the food chain to answer Questions 2–4.

2. Draw arrows between the organisms to show how energy moves through this food chain. Write *producer, herbivore,* or *carnivore* under each organism.



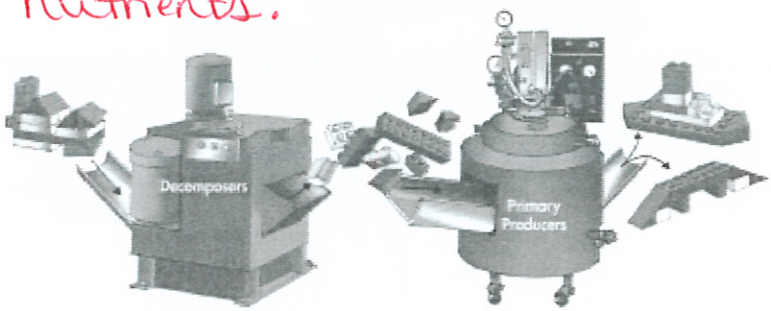
(+1)

3. Explain how energy flows through this food chain. The producers capture & transform sun energy, herbivores eat them for only 10% of the energy. Herbivors are eaten by carnivores, each time only getting 10% of the available energy.

(+1)

4. What would happen to this food chain if a disturbance caused a serious decline in the shark population? When sharks decrease, squid numbers will increase; therefore the fish numbers will decrease causing the plankton numbers to increase which will lead to a decline in producers. (+1)

5. VISUAL ANALOGY What role does energy play in the diagram, and how is it represented? Energy is needed by the "machines" to break down & build up their "Lego houses" just like energy is needed by organism to break down & build up their organic molecules and nutrients. (+1)



Trophic Levels and Ecological Pyramids

Write True or False on the line provided.

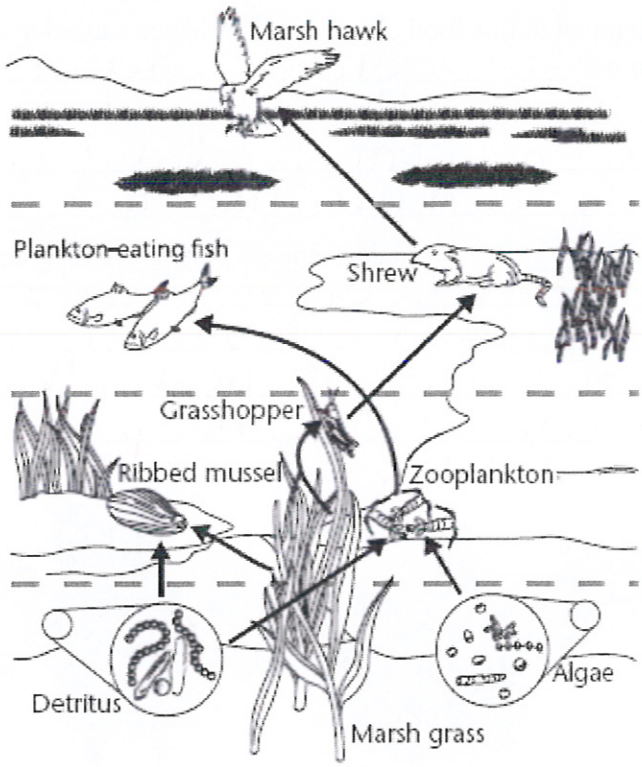
6. False (+1) Primary consumers always make up the first trophic level in a food web.

7. True (+1) Ecological pyramids show the relative amount of energy or matter contained within each trophic level in a given food web.

8. False (+1) On average, about 50 percent of the energy available within one trophic level is transferred to the next trophic level.

9. False (+1) The more levels that exist between a producer and a given consumer, the larger the percentage of the original energy from producers is available to that consumer.

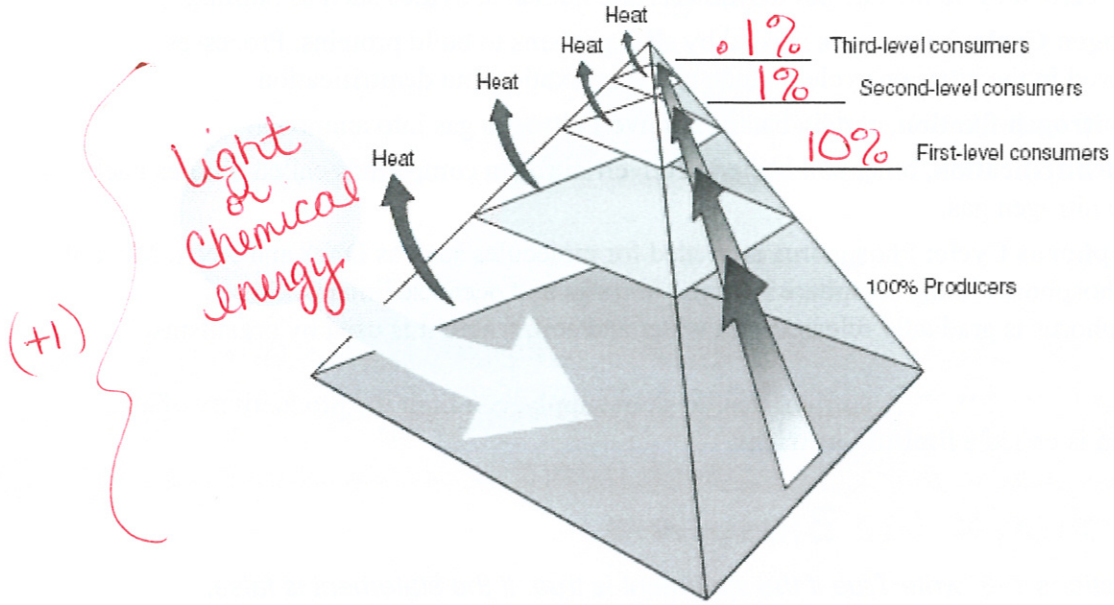
Use the diagram to answer Questions 10–17.



Match the organism with its trophic level. A trophic level may be used more than once.

Organism			Trophic Level
+1	A	**10.** algae	**A.** primary producer
+1	B	**11.** grasshopper	**B.** first-level consumer
+1	A	**12.** marsh grass	**C.** second-level consumer
+1	D	**13.** marsh hawk	**D.** third-level consumer
+1	C	**14.** plankton-eating fish	
+1	B	**15.** ribbed mussel	
+1	C	**16.** shrew	
+1	B	**17.** zooplankton	

18. Complete the energy pyramid by writing the source of the energy for the food web and how much energy is available to first-, second-, and third-level consumers.



For Questions 19–21, complete each statement by writing the correct word or words.

(+1) **19.** A pyramid of biomass illustrates the relative amount of living organic matter available at each trophic level in an ecosystem.

(+1) **20.** A pyramid of numbers shows the relative numbers of individual organisms at the trophic levels in an ecosystem.

(+1) **21.** A pyramid of energy shows the relative amounts of energy available at the trophic levels of a food chain or food web

3.4 Cycles of Matter

Lesson Objectives

- Describe how matter cycles among the living and nonliving parts of an ecosystem.
- Describe how water cycles through the biosphere.
- Explain why nutrients are important in living systems.
- Describe how the availability of nutrients affects the productivity of ecosystems.

Lesson Summary

Recycling in the Biosphere Matter, unlike energy, is recycled within and between ecosystems. Elements pass from one organism to another and from one part of the biosphere to another through **biogeochemical cycles**, which are closed loops powered by the flow of energy.

The Water Cycle Water moves between the ocean, the atmosphere, and land.

- Evaporation is the process in which water changes from a liquid to a gas.

- Transpiration is the process in which water evaporates from the leaves of plants.

Nutrient Cycles The chemical substances that an organism needs to survive are called **nutrients**. Like water, nutrients pass through organisms and the environment.

- **Carbon Cycle:** Carbon is a key ingredient of all organic compounds. Processes involved in the carbon cycle include photosynthesis and human activities such as burning.
- **Nitrogen Cycle:** Nitrogen is needed by all organisms to build proteins. Processes involved in the nitrogen cycle include nitrogen fixation and denitrification.
  - In **nitrogen fixation**, certain bacteria convert nitrogen gas into ammonia.
  - In **denitrification**, other soil bacteria convert nitrogen compounds called nitrates back into nitrogen gas.
- **Phosphorus Cycle:** Phosphorus is needed for molecules such as DNA and RNA. Most of the phosphorus in the biosphere is stored in rocks and ocean sediments. Stored phosphorus is gradually released into water and soil, where it is used by organisms.

Nutrient Limitation A nutrient that, in short supply, can limit the productivity of an ecosystem is called a **limiting nutrient**.

Recycling in the Biosphere

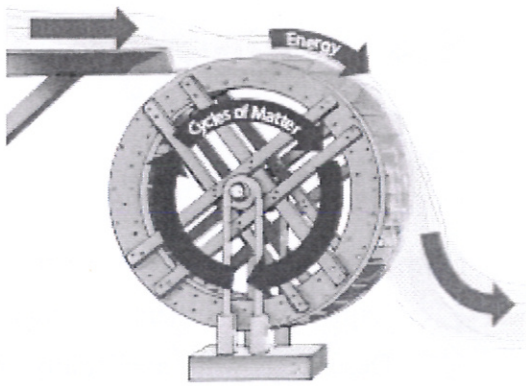
For Questions 1–3, write True if the statement is true. If the statement is false, change the underlined word or words to make the statement true.

(+1) Carbon **1.** The four elements that make up over 95 percent of the body in most organisms are oxygen, sulfur, nitrogen, and hydrogen.

(+1) True **2.** Matter moves through an ecosystem in cycles.

(+1) Lightening **3.** Chemical and physical processes include the formation of clouds and precipitation, "burning" food, and the flow of running water.

4. VISUAL ANALOGY The illustration draws an analogy between the way energy drives matter to cycle in an ecosystem and the way water causes a waterwheel to turn. Give an example of another analogy that could be used to show the relationship between energy and the cycles of matter.



(+1)
* Wind & windmill
* foot & bike pedal

5. Explain why Earth is considered a closed system.

(+1) Since matter cannot be created or destroyed, it must be recycled; therefore, Earth is a closed system.

6. How might building a new highway affect the cycles of matter?

(+1) A new highway could cause the need to clear plants, trees and animals which would disrupt the food chains & webs; therefore, affecting the cycles of matter in that ecosystem.

The Water Cycle

7. What role do plants play in the water cycle?

(+1) Plants take water up through their roots and will release water through their leaves through transpiration.

Nutrient Cycles

9. Complete the chart about the carbon cycle.

Processes That Cause Carbon to Move into the Atmosphere		Processes That Cause Carbon to Move out of the Atmosphere	
Process	**Description**	**Process**	**Description**
Respiration (+1)	Releasing CO_2 by organisms as they break down food.	Photosynthesis	Using CO_2 from the air to make carbohydrates (+1)
Volcanic activity (Geologic) (+1)	the release of CO_2 and other gases into the atmosphere through vents in Earth's crust	Chemical Physical (Raining)	CO_2 mixes with rain water to fall back to earth. (+1)

For Questions 10–12, write the letter of the correct answer on the line at the left.

(+1) B **10.** The carbon in coal, oil, and natural gas came from

A. the combustion of fossil fuels.

B. the remains of dead organisms.

C. carbon-fixing bacteria in swamp soil.

D. carbon dioxide dissolved in ocean water.

(+1) A **11.** How does most of the carbon in an organism's body return to the environment after the organism dies?

A. Decomposers break the body down into simpler compounds.

B. Heat from the sun causes the carbon in the body to evaporate.

C. Geological processes cause the body to turn into a fossil fuel.

D. Rainwater dissolves the carbon in the body and carries it to the ocean.

(+1) A **12.** Human processes mainly contribute to the

A. release of carbon dioxide into the atmosphere.

B. decrease of the total amount of carbon found on Earth.

C. depletion of carbon dioxide reserves in the atmosphere.

D. increase in the amount of carbon contained in rock materials.

Write True if the statement is true. If the statement is false, change the underlined word or words to make the statement true.

(+1) True **13.** Nitrogen, in the form of ammonia, nitrate, and nitrite, is found in the soil.

(+1) Ammonia **14.** Nitrogen fixation is the process in which certain bacteria convert nitrogen gas into nitrates.

(+1) True **15.** Denitrification is the process by which some soil bacteria convert nitrates into nitrogen gas.

(+1) proteins **16.** All organisms require nitrogen to make amino acids, which in turn are used to build carbohydrates.

(+1) True **17.** Phosphate is released as rocks and sediments wear down.

(+1) True **18.** Plants absorb phosphate from the soil or from water.

(+1) Nitrogen **19.** Phosphorus is the most abundant gas in the atmosphere.

(+1) CO_2 **20.** Organic phosphate is taken up by producers during photosynthesis and released by cellular respiration.

(+1) True **21.** Phosphorus forms part of the important life-sustaining molecules such as DNA and RNA.

(+1) Soil **22.** Plants absorb phosphorus from the atmosphere or water.

23. List and describe the biological steps in the nitrogen cycle.

Biologically - bacteria and producers play a big part in the nitrogen cycle. (+1) Bacteria can take nitrogen out of the air as well as out of the earth to keep the cycle going. Producers make nitrogen in to organic molecules.

24. What is atmospheric nitrogen fixation, and how does it affect organisms?

(+1) Lightening converting nitrogen in the air into usable nitrogen in the soil is what atmospheric nitrogen fixation is. It allows nitrogen to then be used by producers.

25. How do humans add nitrogen to the biosphere?

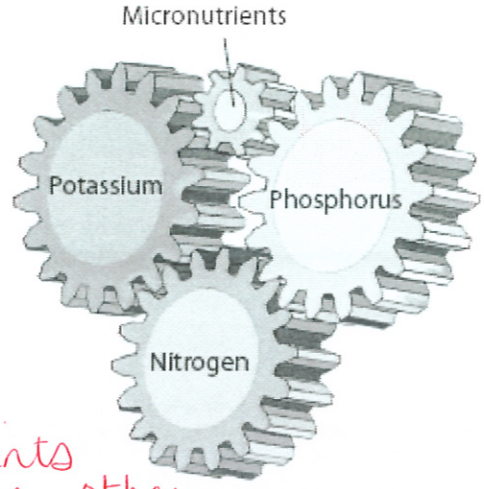
(+1) The application of fertilizers by humans adds nitrogen to the biosphere.

26. Which parts of the phosphorus cycle are geological processes?

(+1) The phosphorus that is in the rocks is a geological component of the phosphorus cycle.

Nutrient Limitation

Use the diagram of the interlocking nutrients to answer Question 27.



27. **VISUAL ANALOGY** The visual analogy compares interlocking gears to the major nutrients— potassium, phosphorus, and nitrogen. What other "gears" would be affected if these gears stopped working together?

(+1) If the gears in the diagram stopped working together, the environment and ecosystems would be out of balance. Micronutrients would not cycle, as well as other elements; therefore, disrupting life as we know it on our planet.

28. If a nutrient were in short supply in an ecosystem, how might it affect an organism?

(+1) The growth of organisms is affected by lack of nutrients.

29. When is a substance a limiting nutrient?

(+1) A scarce or slowly recycling nutrient is considered a limiting nutrient.