

Material Cycles in Ecosystems



Total Recall: What happens to energy with increasing levels of a food chain?

Available energy decreases with increasing levels of a food chain.

*What must occur for there to be stability in ecosystems with regards to energy?

Energy must constantly be supplied (typically by the sun)

How is matter different?

Matter cannot be created or destroyed and therefore is only converted from one form to another.

Introduction to the Carbon-Hydrogen-Oxygen Cycle: These three elements make up a large majority of compounds found in living things. Therefore, in order for ecosystems to remain stable, these elements must be cycled within food webs and their surrounding environments. Use the terms and pictures on the following page to create a diagram illustrating how these elements are cycled.

Directions:

- 1) Cut out the pictures on the following page.
- 2) Brainstorm how these organisms use the processes and gases listed on the following page to cycle these three elements.
- 3) Glue the pictures onto the paper provided and connect with arrows to show how the organisms use the gases and processes to cycle these elements; indicate on the arrow the gas(es) released AND the process responsible

Process	Gas taken in (if applicable)	Gas/elements released
Photosynthesis	Carbon dioxide, water	Oxygen, water
Respiration	oxygen	Carbon dioxide, water
Deforestation	n/a	Carbon dioxide remains in atmosphere
Burning fossil fuels	oxygen	Carbon dioxide
Decomposition	oxygen	Carbon dioxide

Gases and elements involved

- Oxygen, carbon dioxide, water, carbon, hydrogen, oxygen



Applying Your Knowledge:

1. Explain how photosynthesis and respiration are involved in the cycling of carbon, hydrogen and oxygen.

Photosynthesis takes in carbon dioxide and water, and gives off oxygen and water. Respiration takes in oxygen and gives off carbon dioxide and water.

2. How have deforestation and burning fossil fuels disrupted the carbon-hydrogen-oxygen cycle?

Deforestation keeps carbon dioxide in the atmosphere and burning fossil fuels releases excess carbon dioxide into the atmosphere.

3. Describe the role of decomposers in the cycling of these three elements.

Decomposers break down organisms, taking in oxygen and releasing carbon dioxide.

The Nitrogen Cycle- The atmosphere is composed of approximately 78% nitrogen, however this form (N_2) cannot be used by most organisms. Bacteria, known as **nitrogen fixing bacteria**, typically of the genus *Rhizobium* are capable of taking in the N_2 and combining it with hydrogen to form ammonia (NH_3). These bacteria live freely in the soil or in the roots of plants such as legumes (bean plants, peanuts, etc.).

Ammonia is not usable by most organisms with the exception of certain bacteria. These bacteria carry out the process of nitrification, and as a result ammonia is converted to nitrites and nitrates. **Nitrifying bacteria** are responsible for the conversion to nitrates (NO_3^-), which are now usable by plants.

Questions:

1. Explain the importance of bacteria such as nitrogen fixers and nitrifying bacteria.

Nitrogen fixers and nitrifying bacteria take in nitrogen (nitrogen compounds) and convert them to a usable form.

Once nitrates are made available by these bacteria, plants are able to take these compounds in from their environment (soil or water). Animals that consume the plants take in the nitrates and use them to create proteins and their building blocks. Other animals get nitrates by consuming herbivores.

2. How do animals obtain nitrates?

Animals obtain nitrates by eating plants or by eating other animals.

3. Why are nitrates important for organisms?

Organisms use nitrates to create proteins and their building blocks.

4. When organisms die what happens to them?

They are decomposed

In the nitrogen cycle, organisms known as denitrifying bacteria break nitrogen compounds down to return nitrogen back to the atmosphere.

5. Explain the importance of denitrifying bacteria in the nitrogen cycle.

Denitrifying bacteria return nitrogen to the atmosphere to be used again

6. Use the following terms to create a diagram illustrating the steps of the nitrogen cycle:

Nitrifying bacteria

Ammonia

Denitrifying bacteria

SEE DIAGRAM ON FOLLOWING PAGE

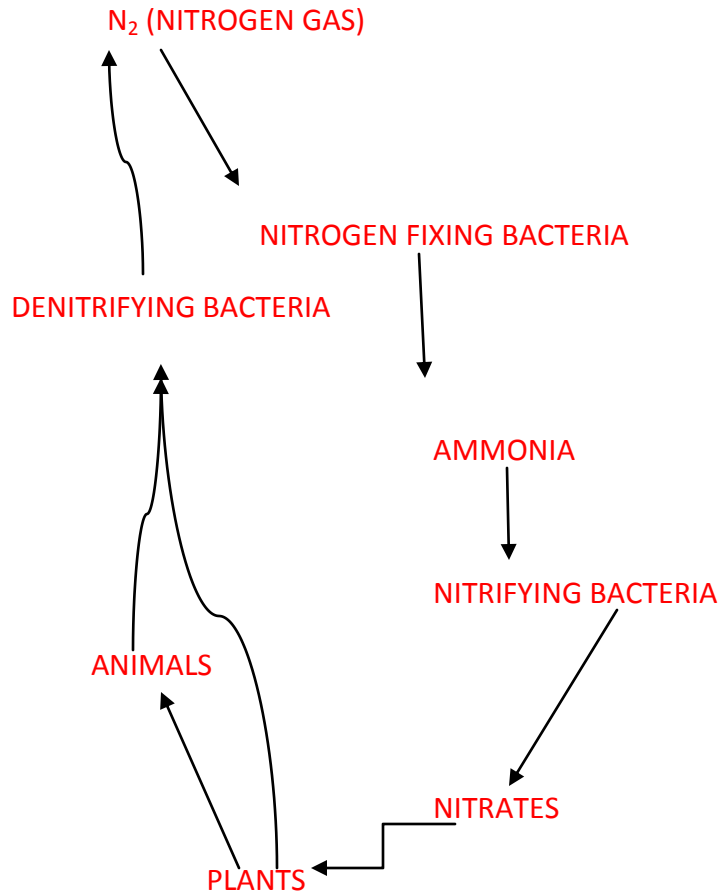
Nitrogen fixing bacteria

N_2

Nitrates

Plants

Animals



(ANSWERS TO MULTIPLE CHOICE CONTINUE ON NEXT PAGE)

QUESTION	ANSWER
1	3
2	4
3	4
4	3
5	4
6	2
7	1
8	2
9	1

10	1
11	3
12	1
13	4
14	3
15	3