

THE CYCLING OF NUTRIENTS

In addition to obtaining energy from food, organisms must obtain the nutrients necessary to construct body tissues. For proper growth, most organisms require roughly 17 chemical elements or essential elements. Six of these—carbon, hydrogen, oxygen, nitrogen, phosphorus and potassium—are required in large amounts. Calcium, magnesium, sulfur, iron, and manganese are required in lesser quantities. Still smaller amounts of sodium, boron, molybdenum, copper, zinc, and chlorine are needed. Other elements, including vanadium, cobalt, iodine, selenium, silicon, fluorine, and barium, are required in small quantities (*trace* amounts) by some organisms. Several members of these last two groups, though essential in minute amounts, may be toxic in high doses.

Interestingly though, both energy and nutrients are passed from one organism to another within the same complex molecules, the paths that energy and nutrients take through ecosystems are quite different. Energy *flows through* ecosystems, arriving steadily from the sun, passing from one trophic level to the next, and dissipating in the environment along the way. But the earth receives no continuous supply of chemical elements from space; they are neither produced nor used up but are passed around from one organism to another in closed loops called **nutrient cycles**. Because most of these cycles involve the passage of elements through both living organisms (bio-) and geological features (geo-) of the globe, they are often referred to as **biogeochemical cycles**.

Nutrient cycles and recycling have been going on since life began, and atoms circulating today have seen many previous incarnations. Atoms of carbon that reside in your body for the time being may once have been part of rocks on the ocean floor, of single-celled algae in the central Pacific, or of the tail of a long-extinct dinosaur (Miller, Levine. 1994).

Answer the following questions based on the information above.

1. List the six elements required by humans in large quantities.

Carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium

2. List three other elements that are needed in smaller amounts.

Calcium, magnesium, sulfur

3. Why are nutrient cycles necessary?

They allow the elements to be recycled and used again by organisms.

4. How is the nutrient cycle different than the flow of energy?

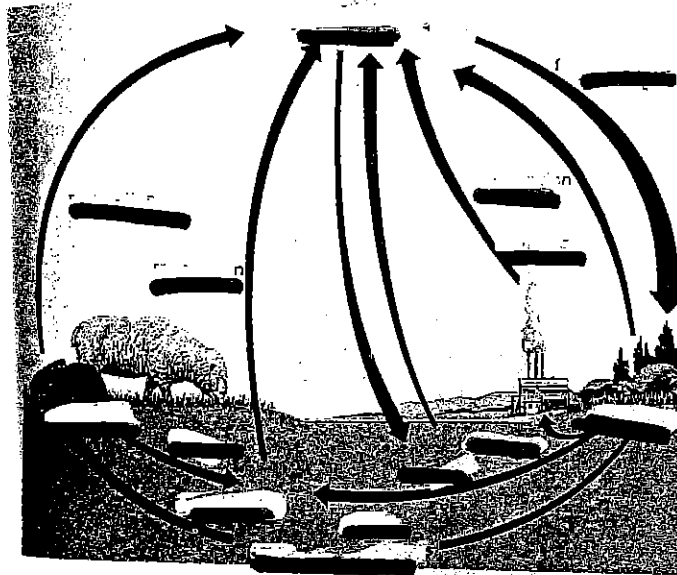
The nutrient cycle is a closed loop where elements are recycled. The flow of energy is a one-way street where energy enters from the sun and is lost as heat.

Oxygen
↓
CARBON CYCLE

Using the class set of BSCS Green Books, page 352, complete the following regarding the carbon/oxygen cycle.

1. Use the list of terms below to diagram the events during the nitrogen cycle.

- | | | | |
|---------------|-------------------|-----------------|--------------|
| • Respiration | -Respiration | -Respiration | -Decomposers |
| • Feeding | - Fossil Fuel | -Photosynthesis | -Producers |
| • Death | -Death | -Consumers | -Respiration |
| • Burning | -Carbon Compounds | | |



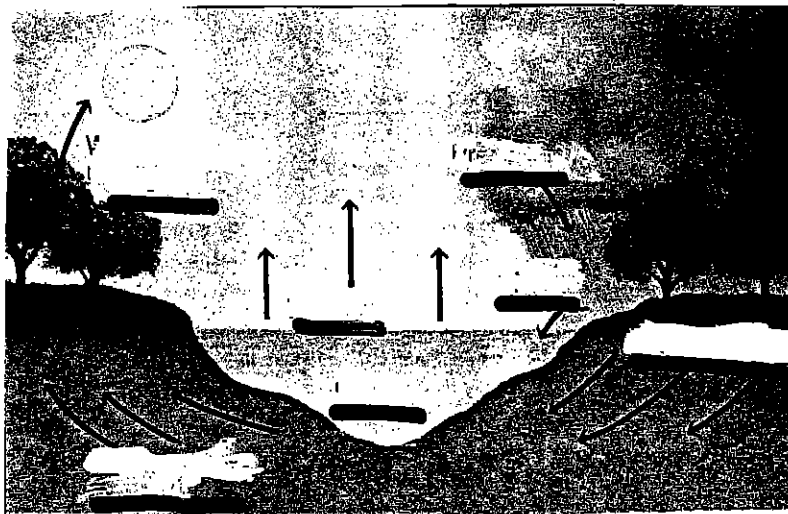
- During which process, photosynthesis or cellular respiration, is oxygen released into the atmosphere?
- During which process, photosynthesis or cellular respiration, is carbon dioxide released into the atmosphere?
- Go back to the diagram and write O_2 where oxygen fits and CO_2 where carbon dioxide fits in.
- List 3 ways that carbon is returned to the atmosphere as CO_2 .

WATER CYCLE

Use page 1024 in your Biology book or in the green BSCS book pages 351 to complete the following.

1. Use the list of terms below to diagram the water cycle.

- Lake
- Precipitation
- Water vapor released by plants
- Groundwater
- Evaporation
- Runoff water
- Water absorbed by roots



2. How do water molecules enter the air?

3. What happens to these water molecules when they enter the air?

4. What happens when the water returns to land (mostly as rainwater)?

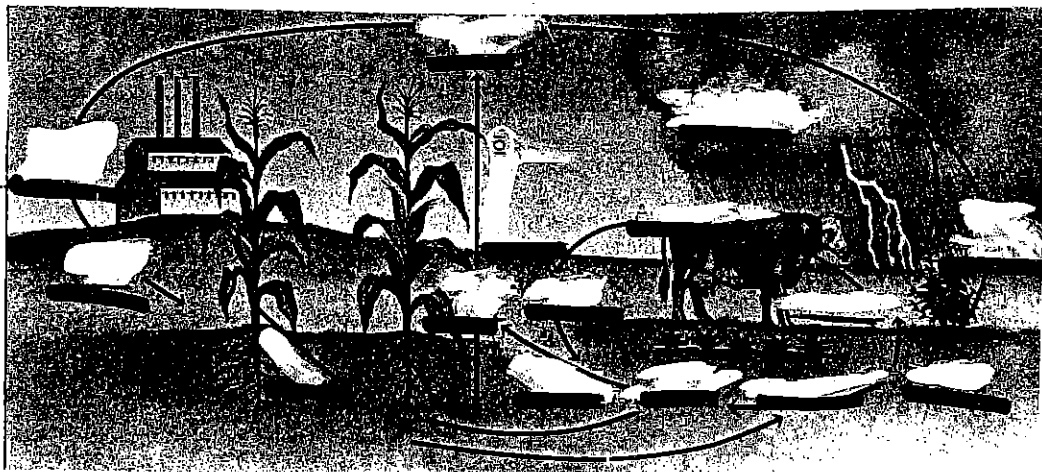
5. What is acid rain? What causes it?

NITROGEN CYCLE

Using page 353 in your Biology book, complete the following.

1. Use the list of terms below to diagram the nitrogen cycle.

- Free Nitrogen
- Nitrates
- Ammonia
- Plant Protein
- Industrial nitrogen fixation
- Decomposition
- Fertilizer
- Denitrification
- Animal Protein
- Animal Protein
- Fertilizer
- Atmospheric Nitrogen Fixation
- Biological nitrogen fixation
- Nitrification
- Legume



2. Why do all organisms require nitrogen for?

3. Where do you find nitrogen?

4. What is the process of nitrogen fixation? Why is it important? (hint: nitrifying bacteria do this)

5. What is the process of denitrification? Why is it important? (hint: denitrifying bacteria do this)