# 3–3 CYCLES OF MATTER

# REVIEW:

1. What is an element?

2. What is a compound?

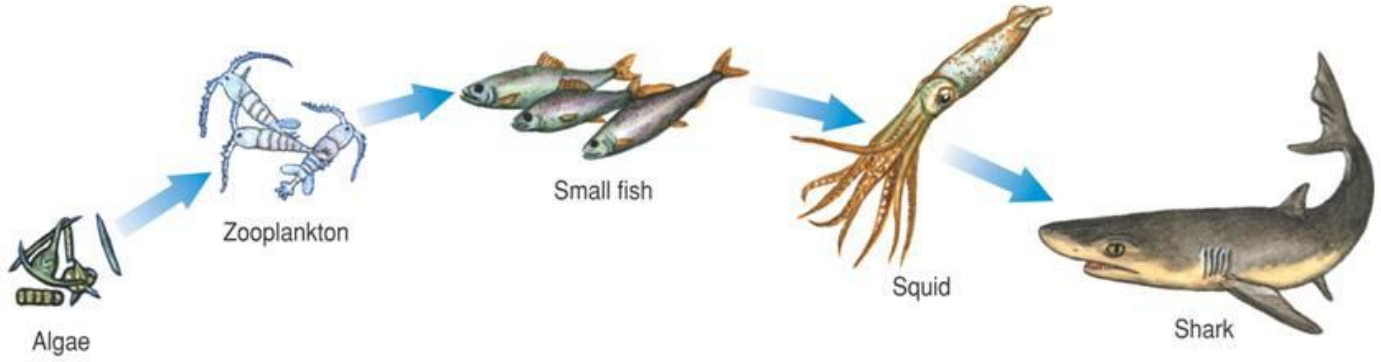
3. What are the 6 elements that are most important to living things?

Matter = a substance that takes up space.

# BIOGEOCHEMICAL CYCLES

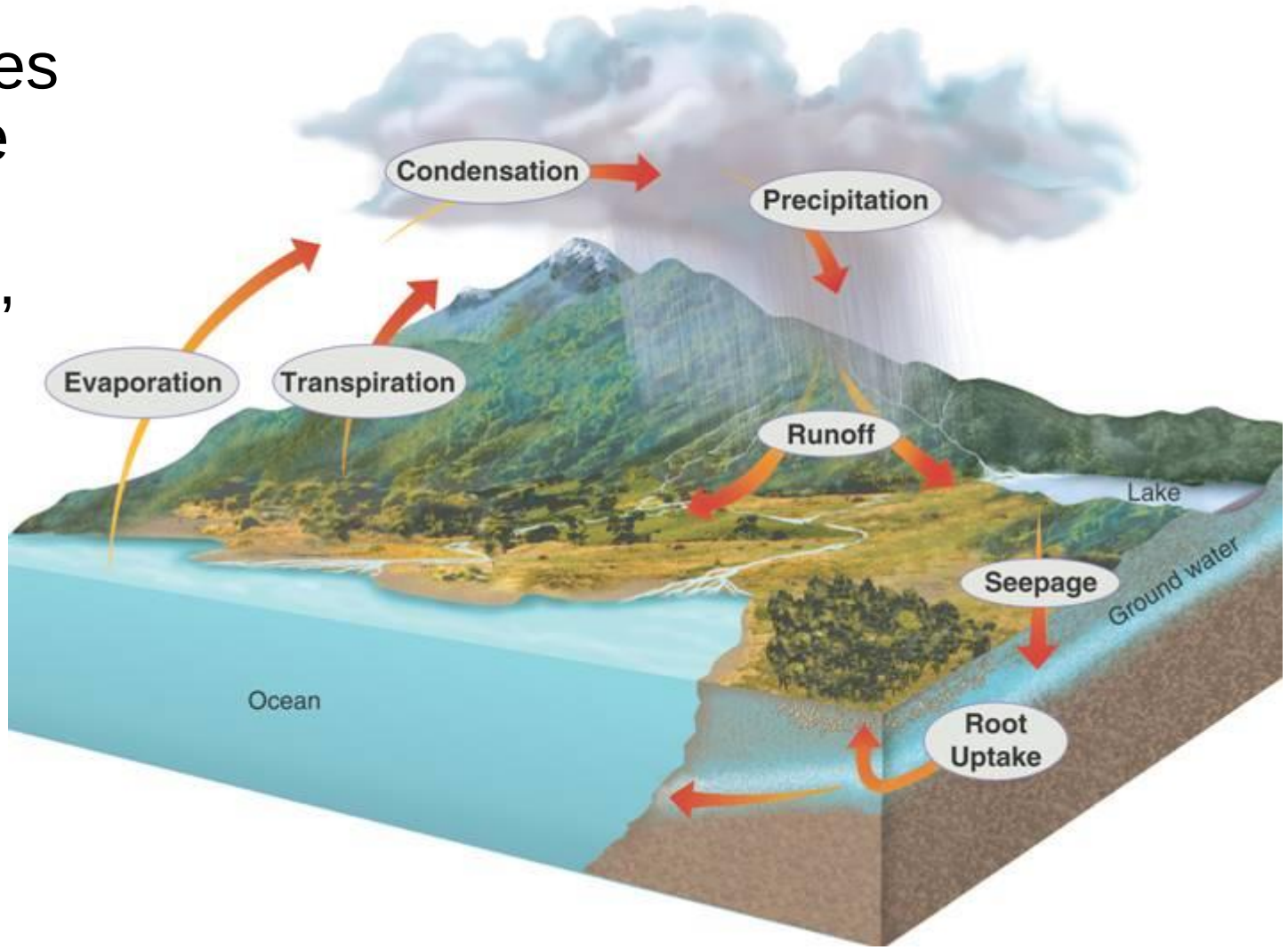
**Energy and matter move through the biosphere very differently.**

- **Energy** flows in **one direction**.
- **Elements** (carbon, nitrogen, and phosphorus) and **compounds** (water) are **recycled in the biosphere**.



# THE WATER CYCLE

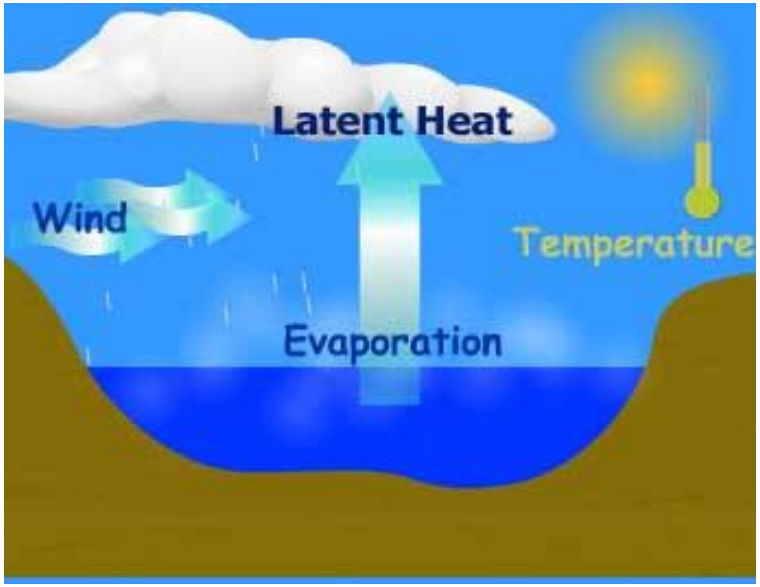
- Water moves between the ocean, atmosphere, and land.



# THE WATER CYCLE

*Water enters the atmosphere by:*

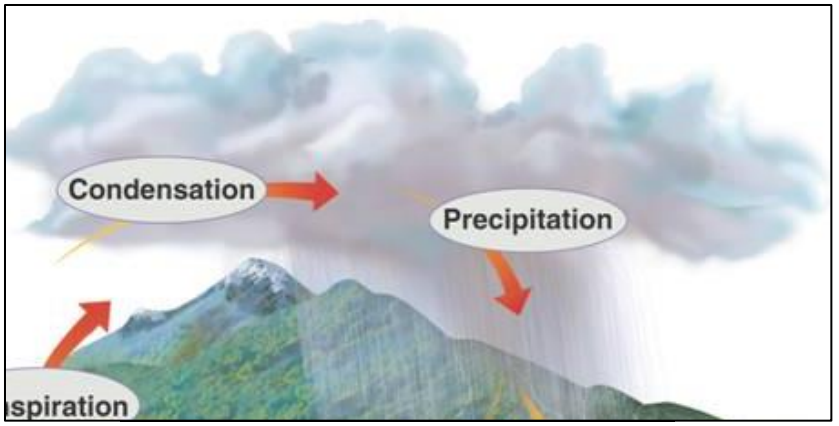
- Evaporation: The process of water changing from a liquid to a gas.
- Transpiration: when water evaporates from the leaves of plants.



# THE WATER CYCLE

*Water returns to Earth by:*

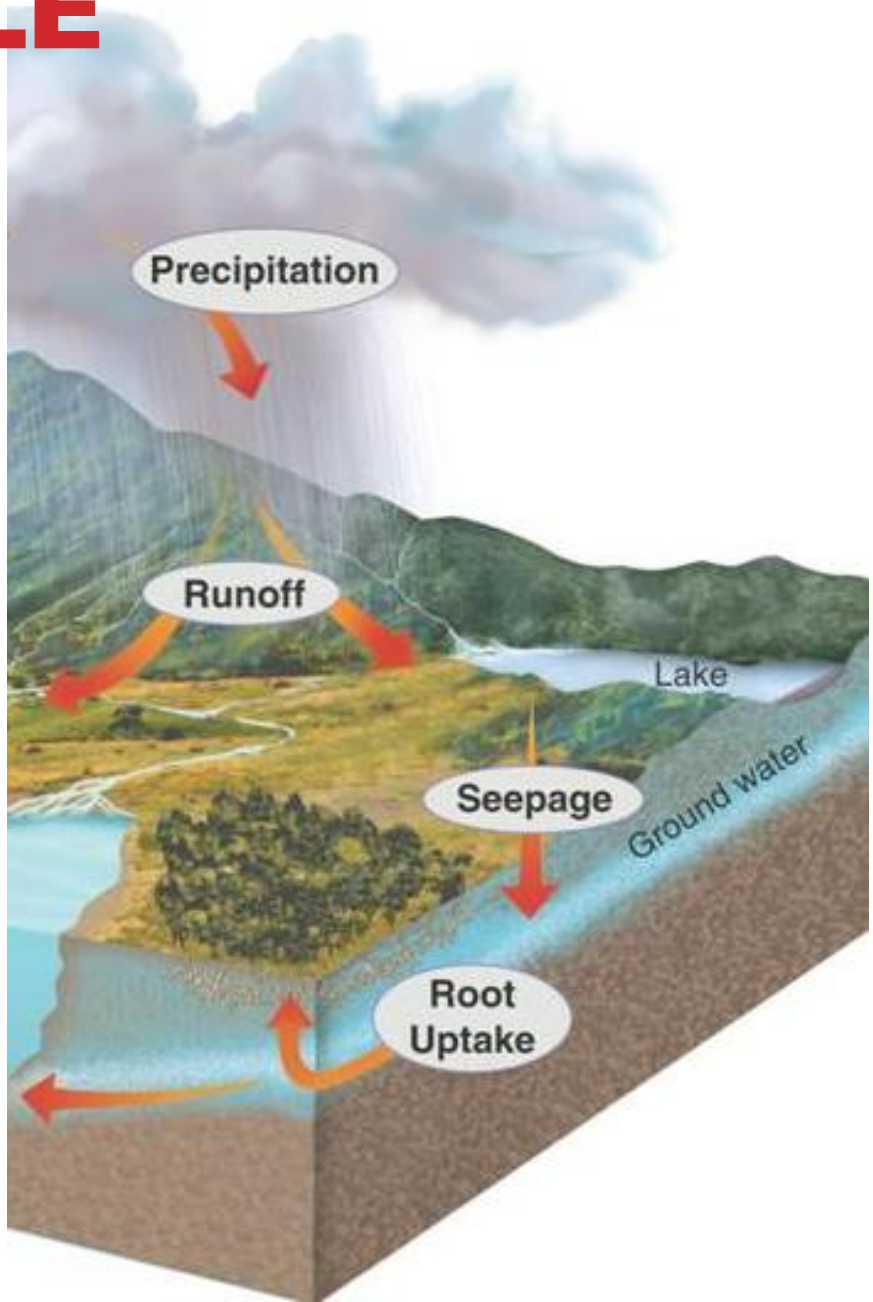
- Condensation: As warm air rises it cools down; it condenses into tiny droplets that form clouds.
- Precipitation: When the droplets are large enough, the water returns to Earth's surface. Precipitation can be rain, snow, sleet, or hail.

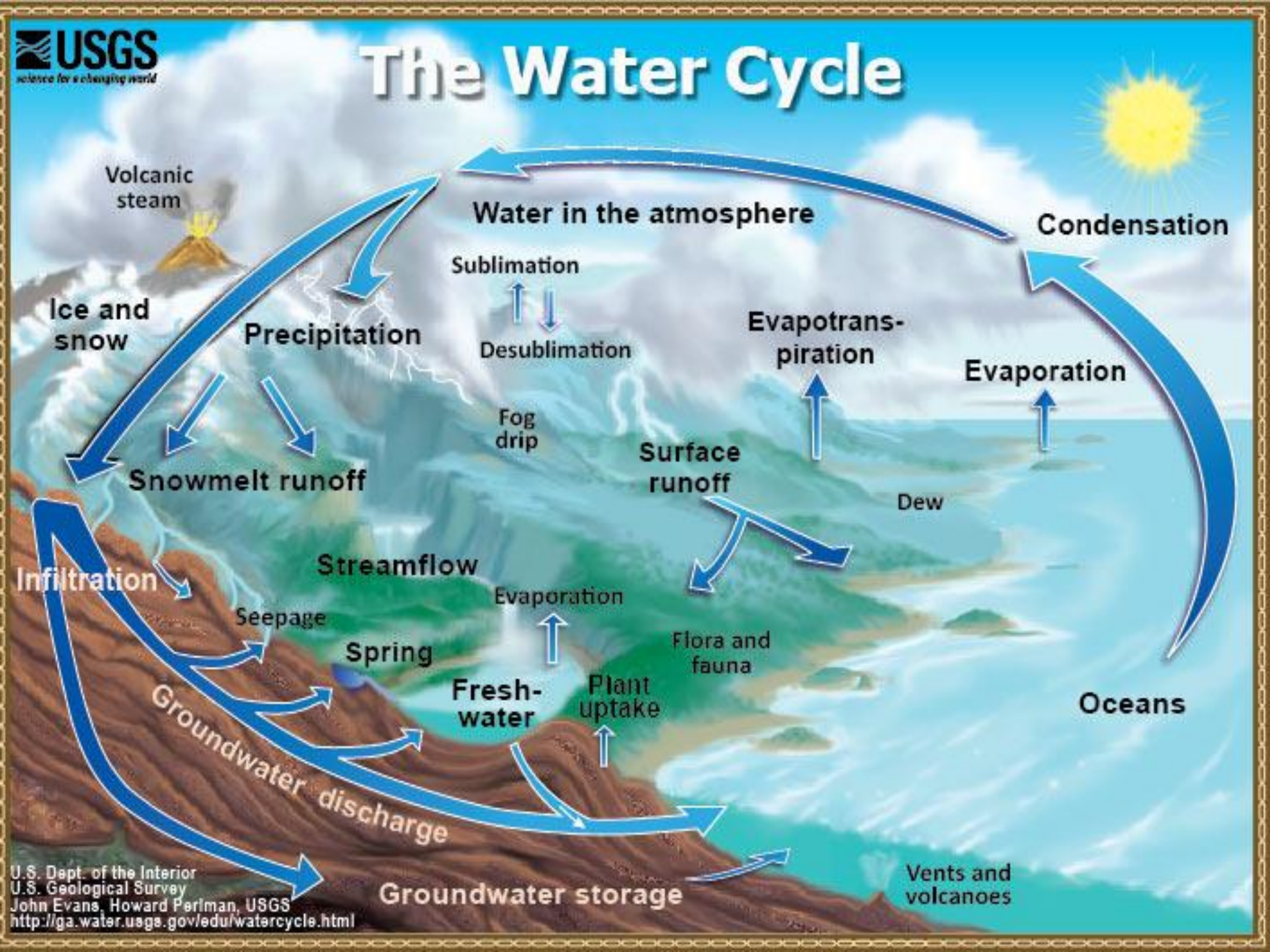


# THE WATER CYCLE

*Back on land:*

- Water runs along the surface of the ground until it enters streams or seeps into soil where it enters plants through their roots – run off.




USGS
science for a changing world
The Water Cycle
Volcanic steam
Water in the atmosphere
Condensation
Sublimation
Desublimation
Ice and snow
Precipitation
Evapotrans-piration
Evaporation
Fog drip
Surface runoff
Snowmelt runoff
Dew
Infiltration
Streamflow
Evaporation
Seepage
Spring
Flora and fauna
Fresh-water
Plant uptake
Oceans
Groundwater discharge
Groundwater storage
Vents and volcanoes
U.S. Dept. of the Interior
U.S. Geological Survey
John Evans, Howard Perlman, USGS
http://ga.water.usgs.gov/edu/watercycle.html

# THE WATER CYCLE:

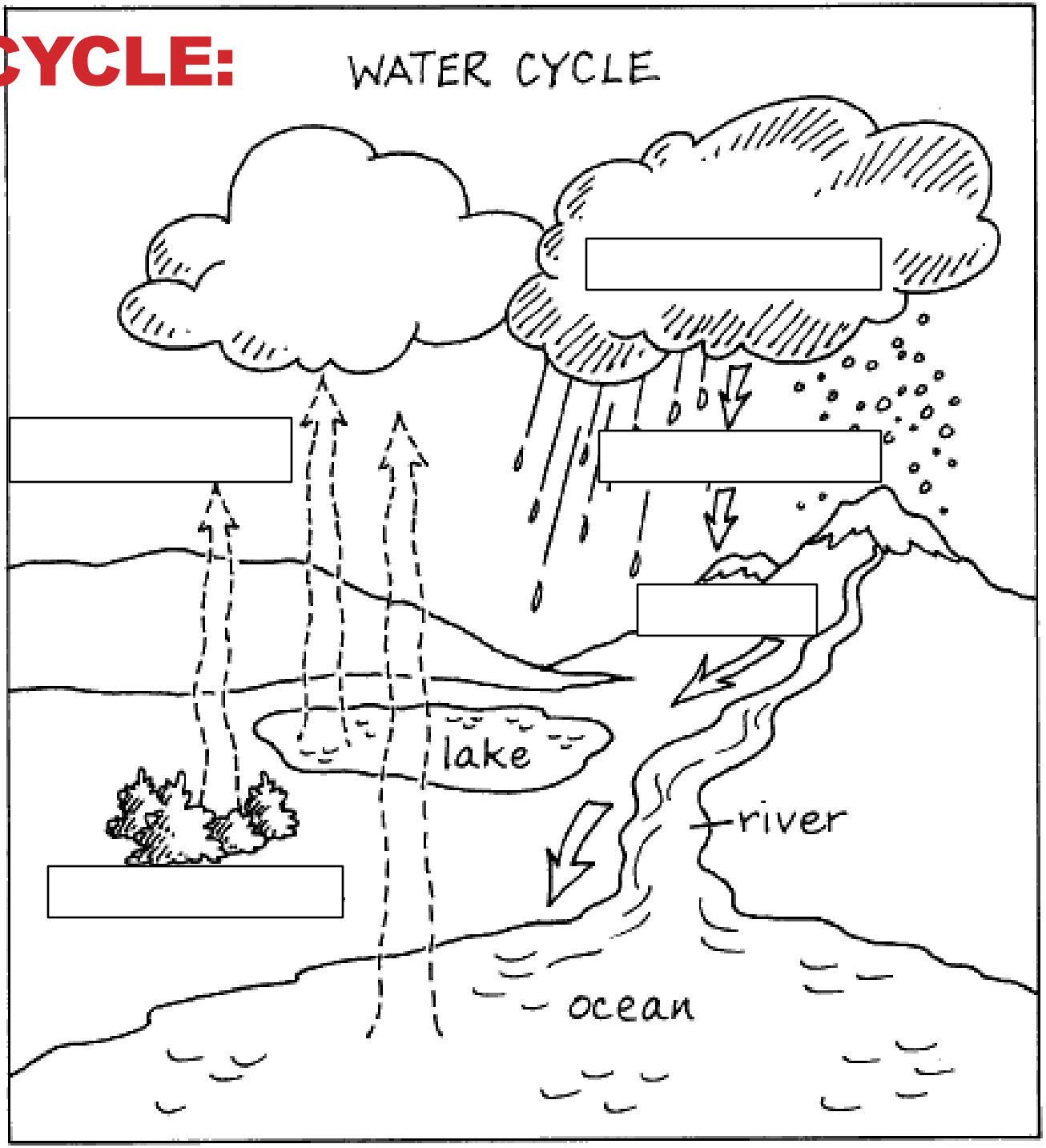
**Evaporation:**

**Transpiration:**

**Condensation:**

**Precipitation:**

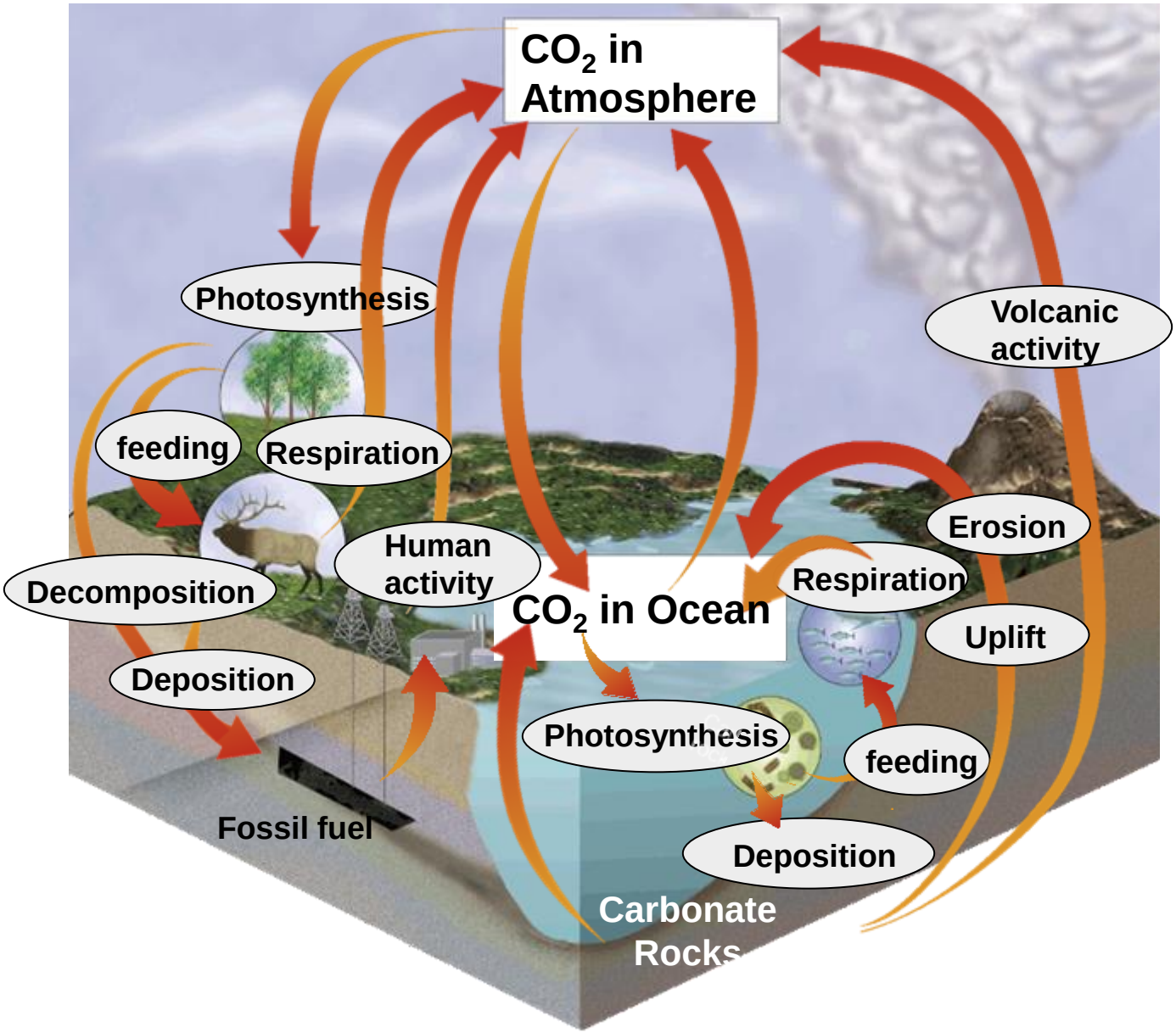
**Runoff:**



# NUTRIENT CYCLES – WHY ARE THEY IMPORTANT?

- The chemical substances that living organisms need are called nutrients.
- Nutrients build tissues and carry out important life functions.
- Plants get nutrients from their environment.
- Consumers get nutrients by eating other organisms.
- Nutrients are passed between organisms and the environment through biogeochemical cycles.

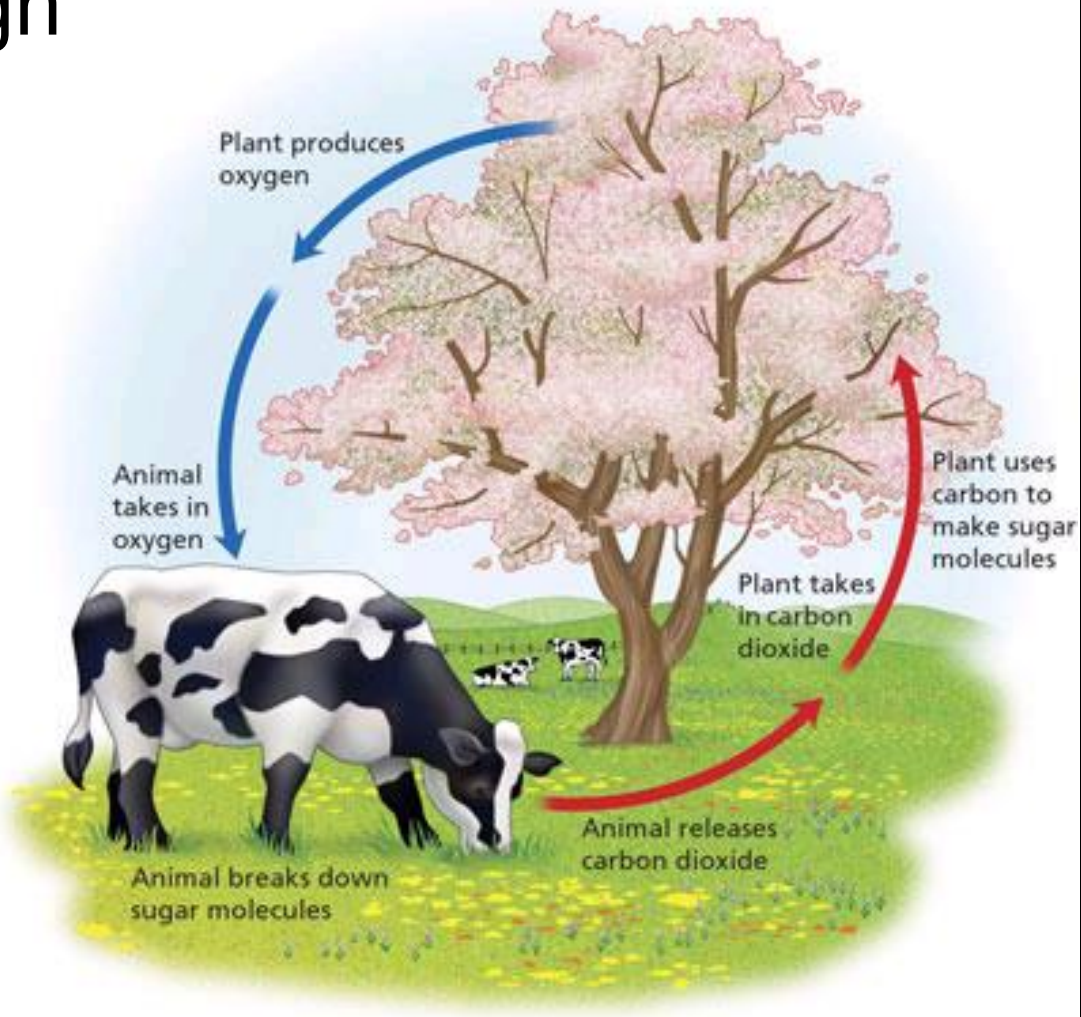
# THE CARBON CYCLE



# THE CARBON CYCLE

Carbon cycles through **living things**:

through **photosynthesis**, **respiration**, and **decomposition**.



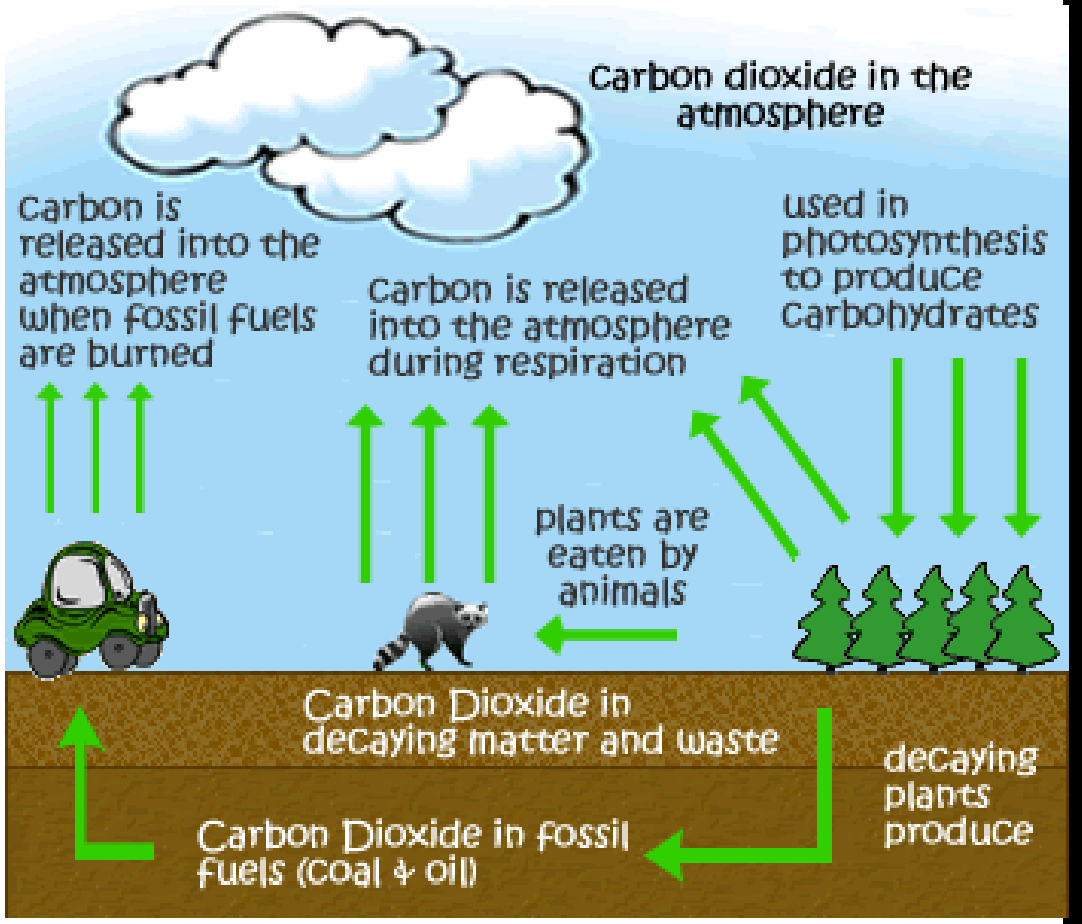
# CARBON CYCLE

**Photosynthesis**: plants take in $CO_2$ from the atmosphere to make glucose.

**Respiration**: plants and animals produce $CO_2$ and release it into the atmosphere. **Consumers**: eat plants to get carbon; waste from animals has carbon in it (goes into soil).

**Decomposition**:decaying matter releases carbon into the ground.

**Fossil fuels**: release $CO_2$ when burned.



# THE CARBON CYCLE

**Photosynthesis**: plants _____ _____to make glucose.
**Respiration**: plants and animals _____ _____ into the atmosphere.
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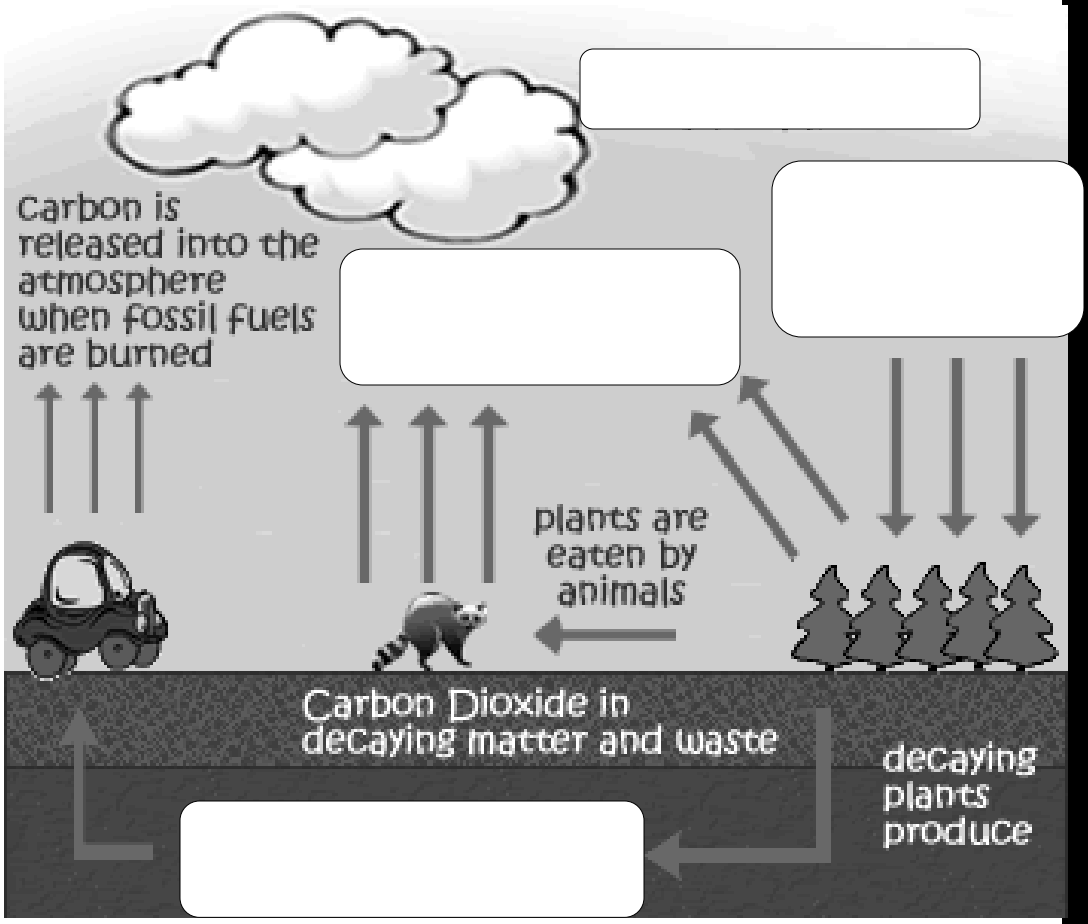


# THE CARBON CYCLE

Carbon cycles through **the environment:**

Erosion and Volcanic activity, release carbon dioxide to the atmosphere and oceans.

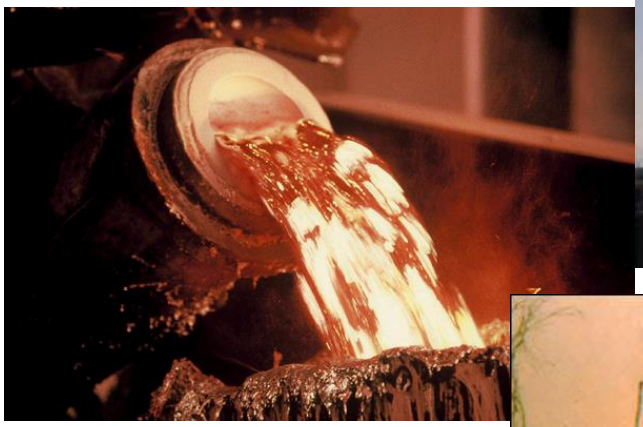
# THE CARBON CYCLE

Carbon cycles from **living things into the environment:**

The buried remains of dead organisms under pressure over time can become coal and petroleum (fossil fuels).

# HUMANS PRODUCING $CO_2$

Human activities, such as <u>burning forests and burning fossil fuels</u> can release carbon dioxide into the atmosphere.



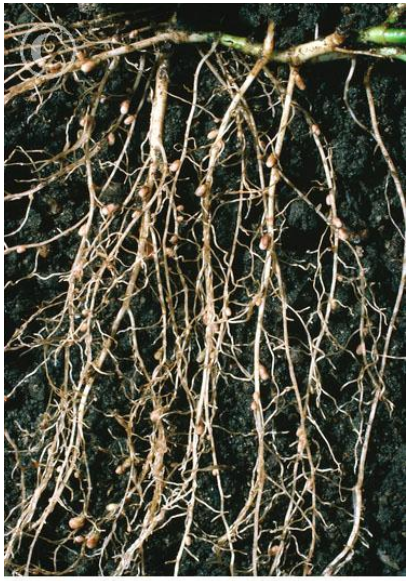
# THE NITROGEN CYCLE

- The circulation of nitrogen between organisms (both living and dead), the atmosphere and abiotic factors (soil).

# THE NITROGEN CYCLE

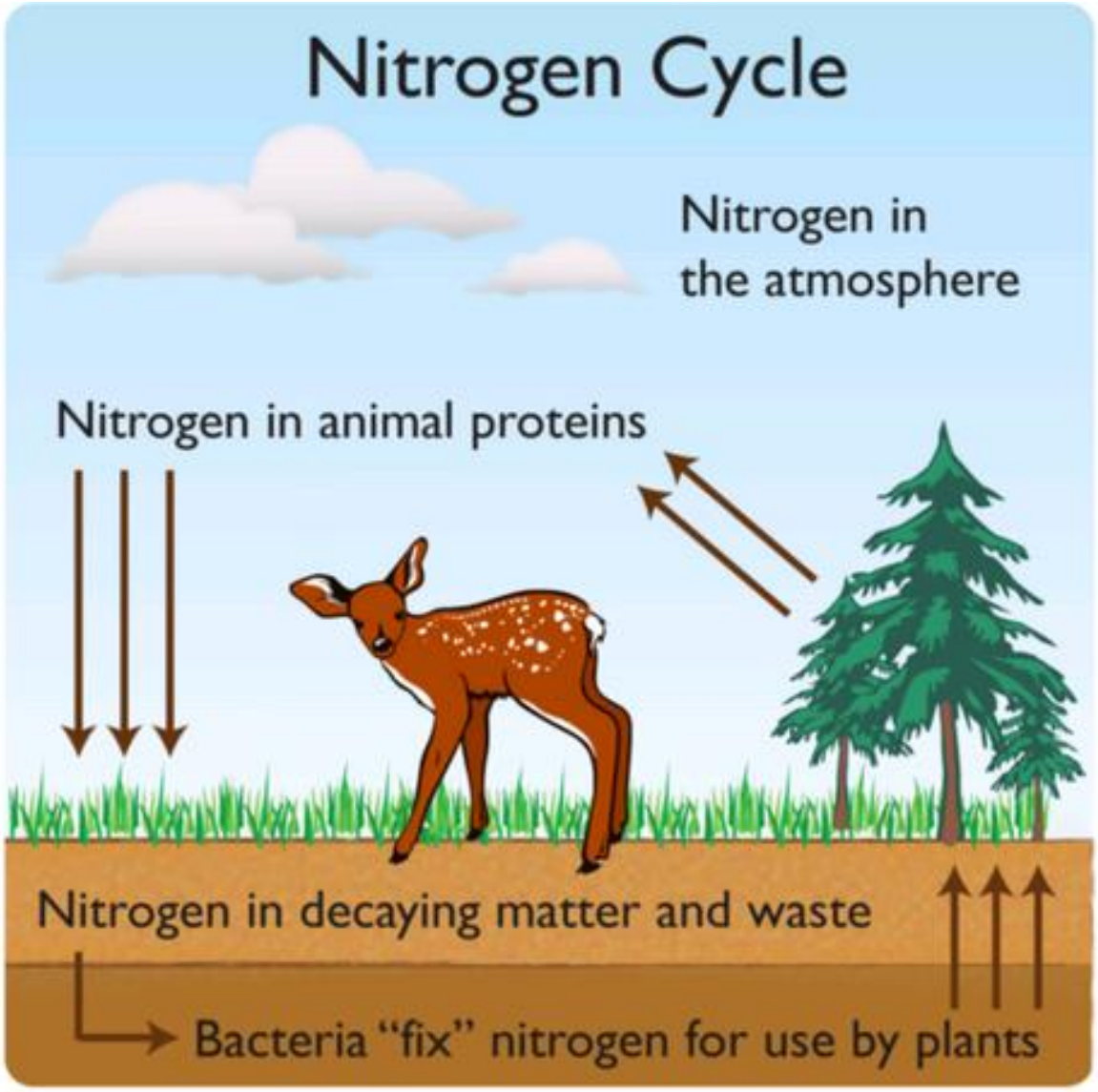

**Nitrogen Fixation:**

- Nitrogen gas makes up about 78% of our air.
- Only certain types of bacteria can use nitrogen gas. These bacteria live in the soil and on the roots of plants.
- Bacteria change nitrogen in the air into a form that plants can use (nitrogen fixation).
- Plants and animals need this 'fixed' nitrogen to make proteins.



# THE NITROGEN CYCLE

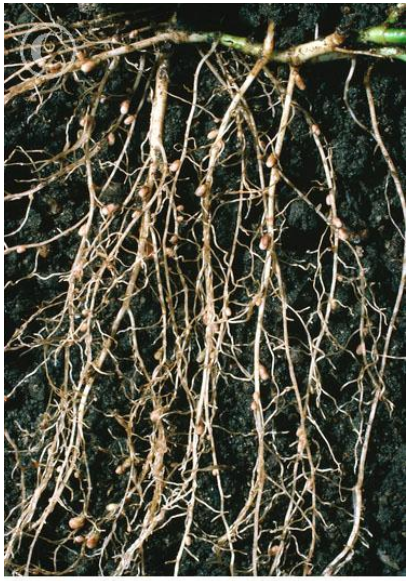
1. Plants (producers) use nitrates to make proteins.
2. Consumers eat plants and get nitrogen to make proteins.
3. Some nitrates are released back into the air.
4. Some nitrates are released back into the soil.



# THE NITROGEN CYCLE


## Nitrogen Fixation:

- Nitrogen gas makes up _____ _____.
- Only certain types of bacteria can use nitrogen gas. These bacteria _____ _____.
- Bacteria change nitrogen in the air ____ _____ _____.
- Plants and animals _____ _____ _____.

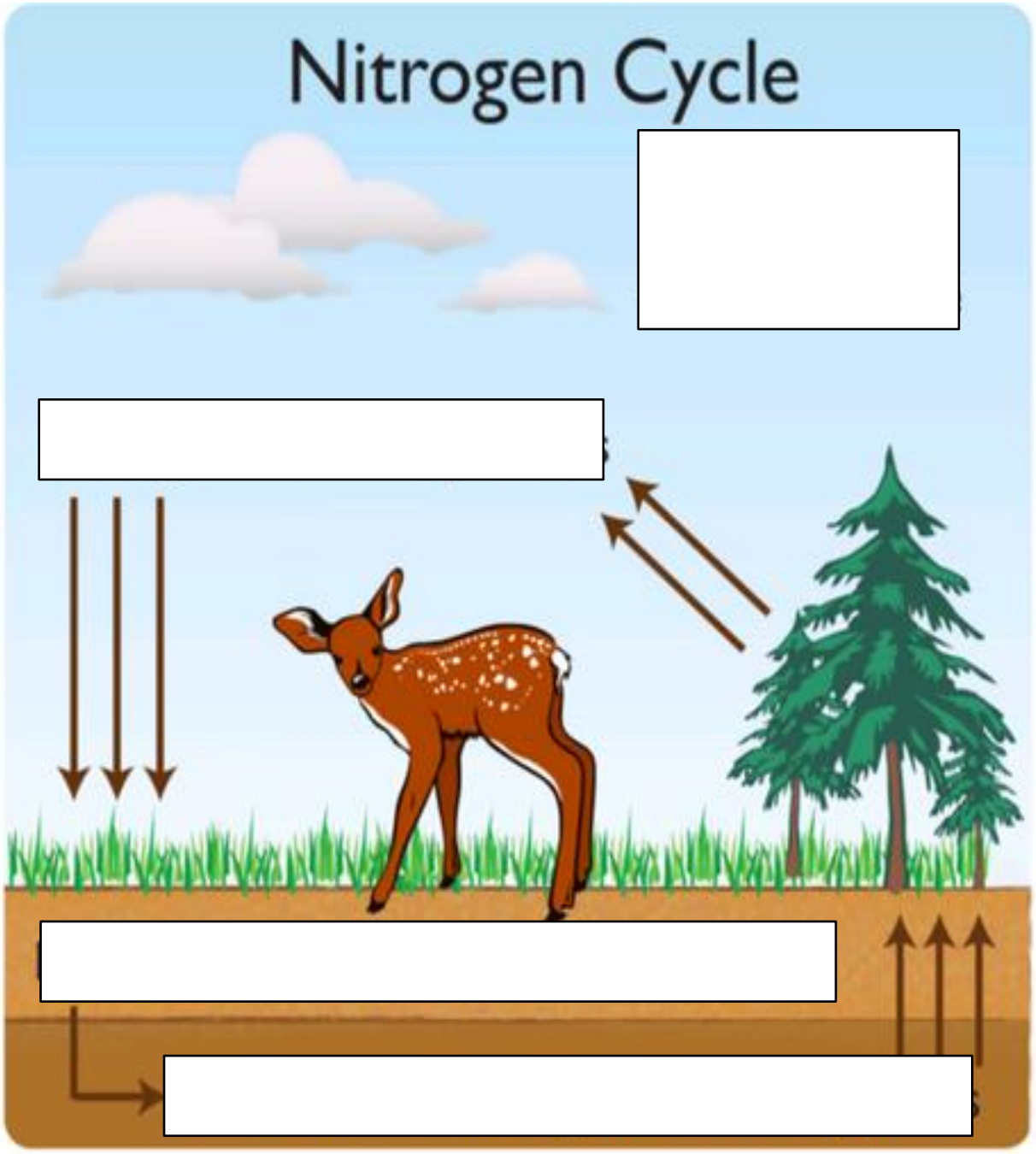


1._____
_____
_____

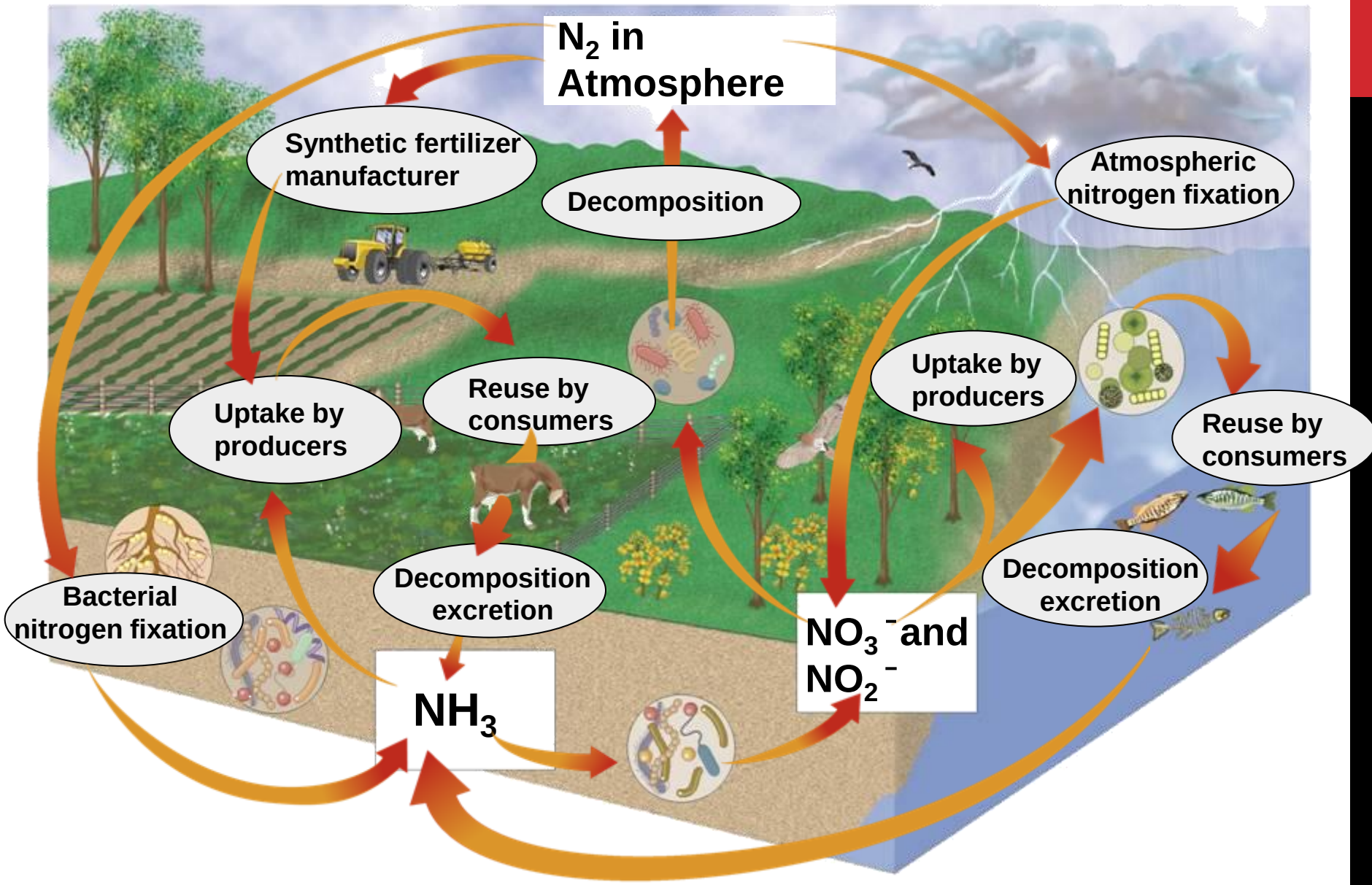
2._____
_____ and get nitrogen to make proteins.

3.Some nitrates are
_____
_____
_____.

4.Some nitrates are released back __
_____
_____.



# CYCLES


$N_2$ in Atmosphere
Synthetic fertilizer manufacturer
Decomposition
Atmospheric nitrogen fixation
Uptake by producers
Reuse by consumers
Uptake by producers
Reuse by consumers
Bacterial nitrogen fixation
Decomposition excretion
Decomposition excretion
$NO_3^-$ and $NO_2^-$
$NH_3$