HANDOUT3/3

Class - IX **Subject - Science**

Chapter 14 – Natural Resources

Biogeochemical cycles

Biogeochemical cycles are the transfer of matter and energy between the biotic and abiotic components of the biosphere.

The common biogeochemical cycles are -

i) Water cycle ii) Nitrogen cycle

iii) Carbon cycle iv) Oxygen cycle.

Water cycle

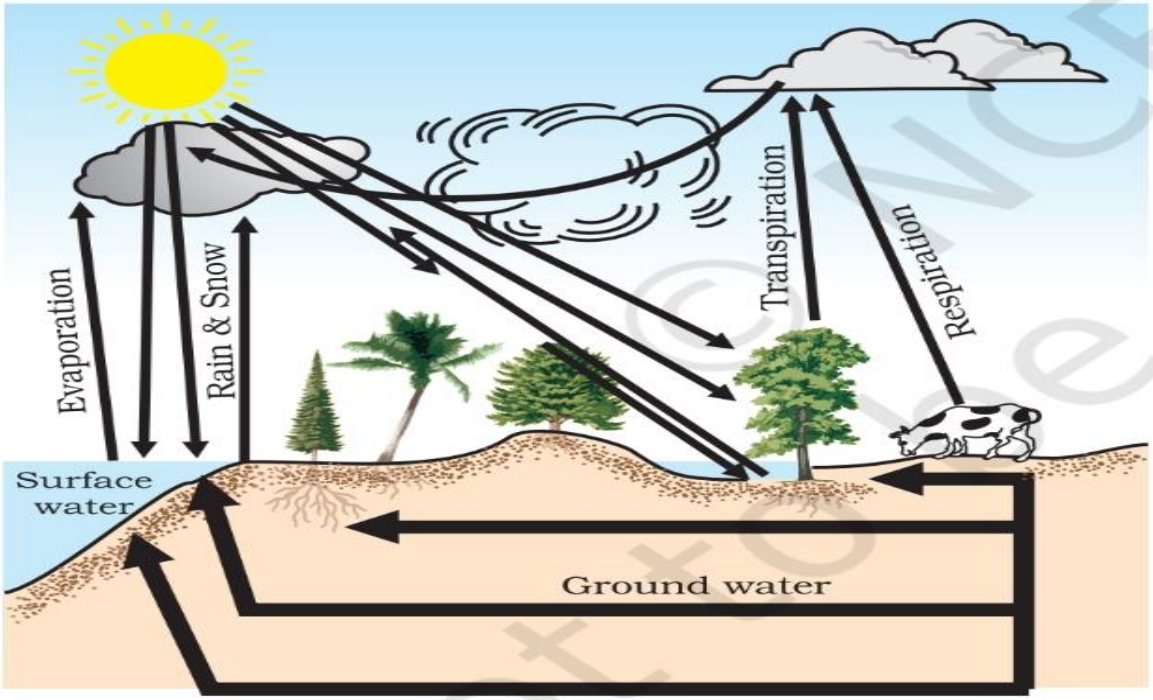


Fig. 14.5: *Water-cycle in nature*

The whole process in which water evaporates and falls on the land as rain and later flows back into the sea via rivers is known as the water-cycle.

When water bodies are heated during the day, a large amount of water evaporates and rises up.

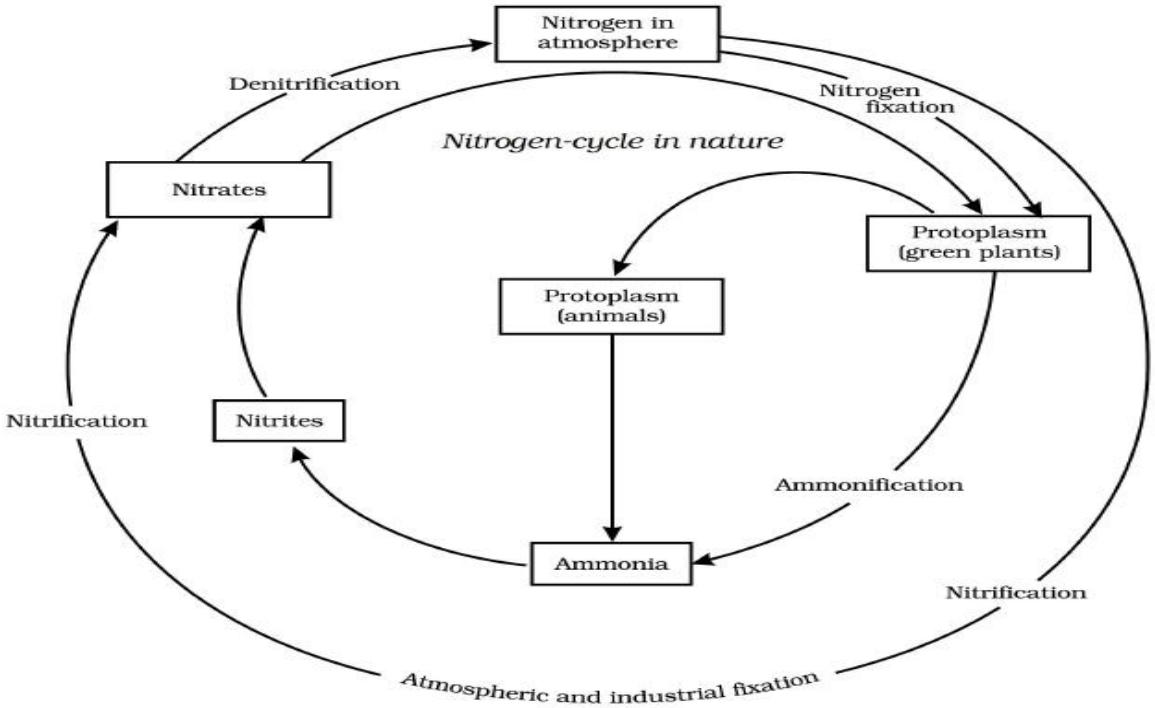
Some water vapour also gets into the atmosphere due to biological activities like transpiration and respiration.

As the water vapour rises, it cools and condenses to form tiny droplets of water.

This appears as clouds. When the tiny droplets of water join together to form bigger drops of water, they fall down as rain, snow or hail.

Some of this water enters the ground and forms ground water. When water flows from the land to the seas it carries many nutrients and minerals which are used by marine organisms.

Nitrogen cycle



Nitrogen-cycle in nature in which nitrogen passes from its elemental form in the atmosphere into simple molecules in the soil and water, which get converted to more complex molecules in living beings and back again to the simple nitrogen molecule in the atmosphere.

1) The nitrogen in the atmosphere is fixed into nitrogen compounds in the soil by nitrogen fixing bacteria in the root nodules ofleguminous plants and also during lightning.

2) These nitrogen compounds are taken by plants and used to make proteins.

3) When animals eat plants, they also get proteins.

4) When plants and animals die, bacteria convert the proteins into nitrogen compounds like nitrites and nitrates.

5) Other bacteria convert these nitrogen compounds back into nitrogen in the atmosphere.

Nitrogen is an essential component of biological molecules like proteins, nucleic acids (DNA and RNA) and some vitamins.

Nitrogen Fixation -

a) Atmospheric Fixation

The enormous energy of lightning breaks nitrogen molecules and enables their atoms to combine with oxygen in the air forming nitrogen oxides. These dissolve in rain, forming nitrates, that are carried to the earth.

Atmospheric nitrogen fixation probably contributes some 5– 8% of the total nitrogen fixed.

b) Industrial Fixation

Under great pressure, at a temperature of 600°C, and with the use of a catalyst, atmospheric nitrogen and hydrogen (usually derived from natural gas or petroleum) can be combined to form ammonia (NH_3).

Ammonia can be used directly as fertilizer, but most of it is further processed to urea and ammonium nitrate.

c) Biological Fixation

The ability to fix nitrogen is found only incertain bacteria and archaea. (like Azotobacter and Rhizobium)

Some live in a symbiotic relationship with plants of the legume family (e.g., soybeans,etc).

⊡ Ammonification

This is another process by which ammonia can be generated. Organic remains of plants and animals are broken down in the soil by some bacteria to release ammonia into the soil. These dead and waste matter is used by these microorganisms as food and they release ammonia into the soil.

⊡ Nitrification

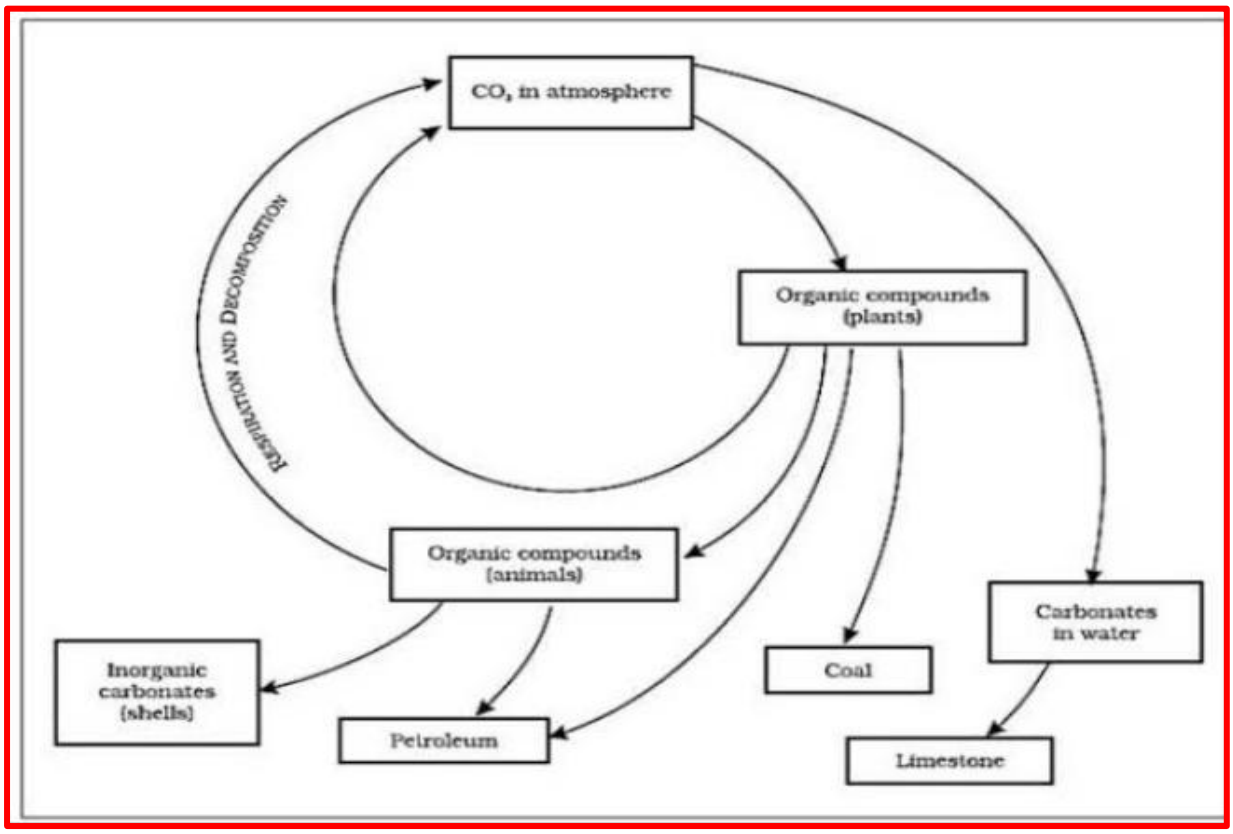
This occurs in two-steps. The first step is in which NH_3/NH_4^+ is converted to NO_3^- (nitrates). The bacteria Nitrosomonas and Nitrococcus present in the soil convert NH_3 to NO_2^-, and another bacterium, Nitrobacter converts NO_2^- to NO_3^-. These bacteria gain energy through these conversions.

⊡ Denitrification

Is the reverse of nitrification that occurs in the deep layers of soil where the bacteria convert NO_3^- is converted into N_2 and other gaseous compounds like NO_2gas. This occurs because in deep layers

of soil, oxygen is not available and the soil bacteria use these nitrogen compounds instead of oxygen.

Carbon cycle



Carbon in the form of carbon dioxide is used by plants to prepare glucose by the process of photosynthesis.

The glucose is used to provide energy and to convert into other organic compounds When animals eat plants it enters the body of animals.

During respiration energy and carbon dioxide are produced. The carbon dioxide goes back into the atmosphere.

Another process which adds carbon dioxide back into the atmosphere is the combustion of fuels like coal and petroleum.

The organic compound in plants and animals are also converted into carbonates, limestone, coal, petroleum, exoskeletons (shells) of some animals.

Carbon is an essential component of biological molecules like carbohydrates, fats, proteins, vitamins, nucleic acids etc.

Oxygen -

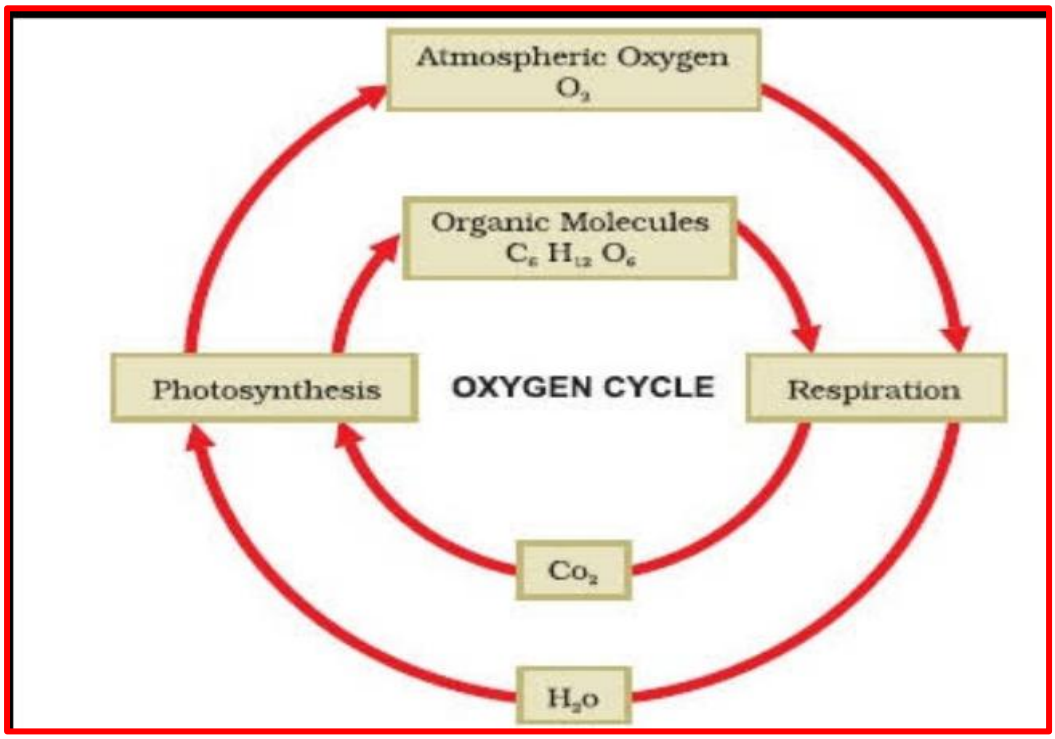
Oxygen is found in the elemental form in the atmosphere to the extent of 21%.

It also occurs extensively in the combined form in the Earth's crust as well as also in the air in the form of carbon dioxide.

In the crust, it is found as the oxides of most metals and silicon, and also as carbonate, sulphate, nitrate and other minerals.

It is also an essential component of most biological molecules like carbohydrates, proteins, nucleic acids and fats (or lipids).

Oxygen cycle –



Oxygen in the atmosphere is used for respiration, combustion and formation of oxide of elements.

Oxygen is sent back into the atmosphere during photosynthesis.

The Greenhouse Effect –

Gases like carbon dioxide, methane, chlorofluro carbon(CFCs) traps the heat radiated by the earth and prevents the escape of heat from the earth. The increase in the presence of these gases in the atmosphere causes increase in the temperature of the atmosphere. This is called the greenhouse effect.

Greenhouse effect can cause melting of polar ice, increase in sea levels, flooding of coastal areas and submerging of islands.

Ozone layer

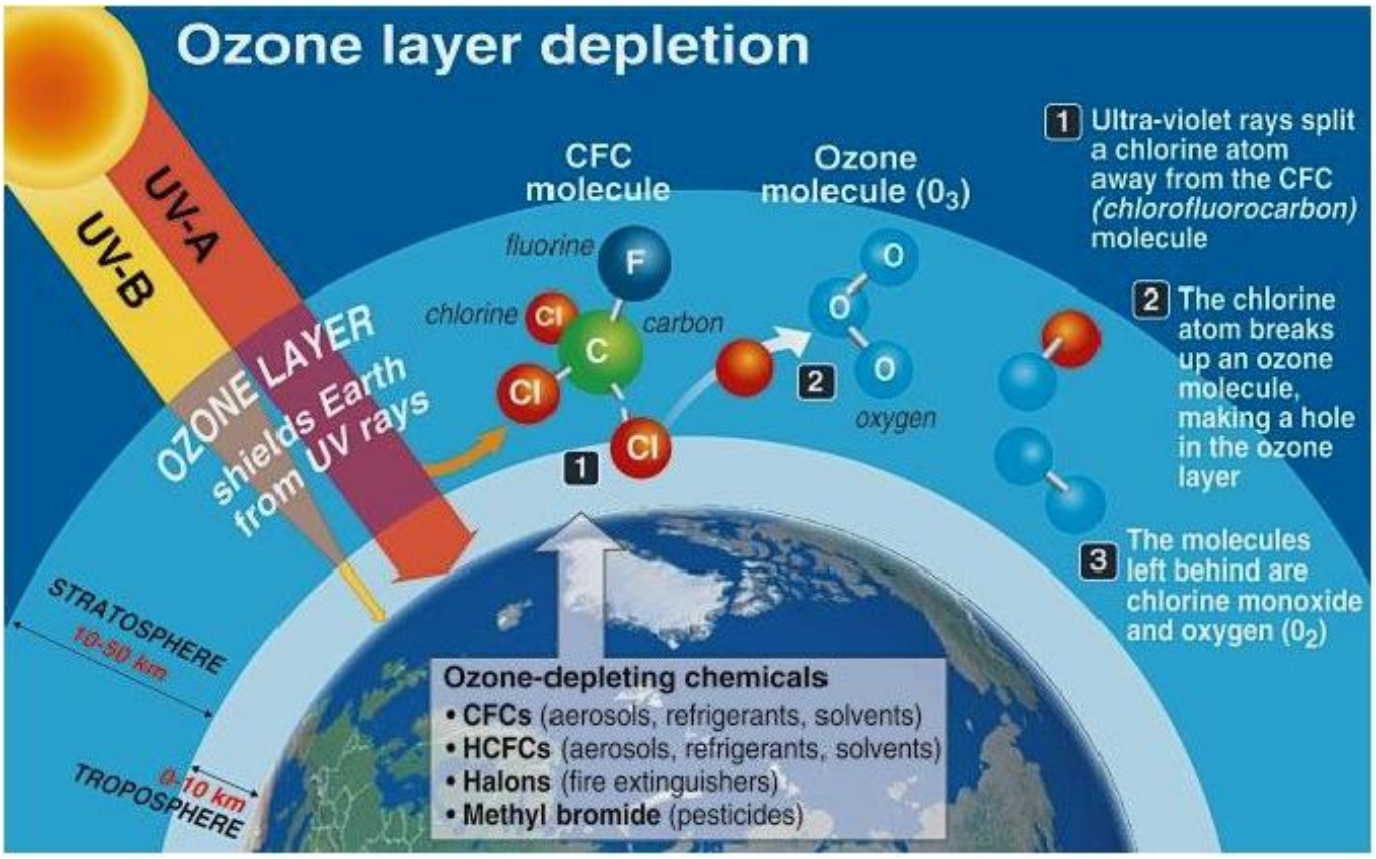
Ozone molecule contains three atoms of oxygen (O_3). It is present in the upper layers of the atmosphere. It is poisonous gas.

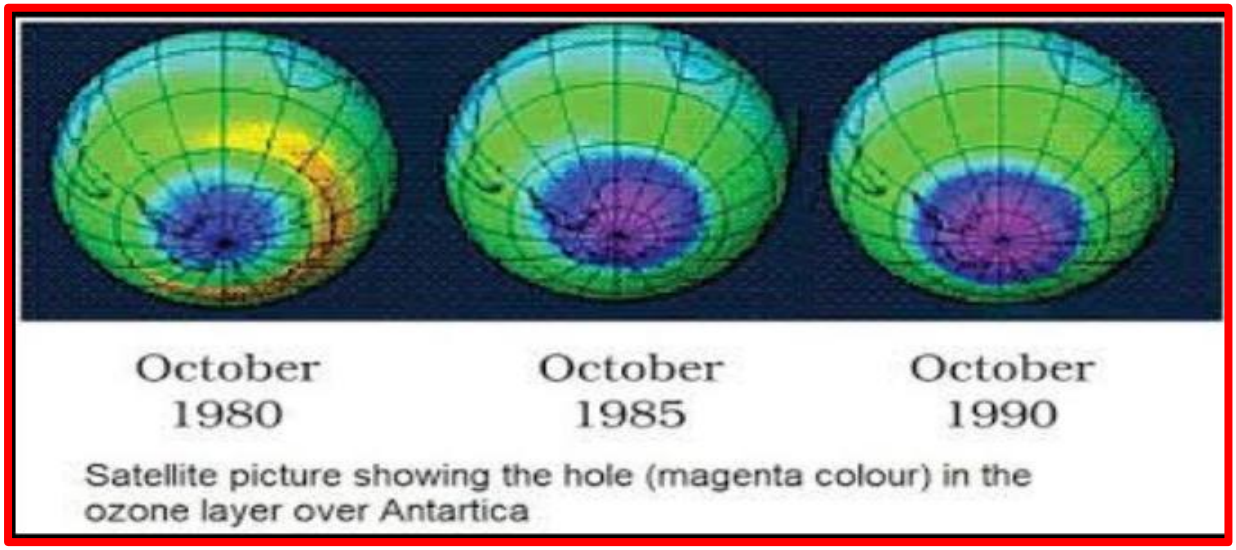
It protects the earth from the harmful ultra-violet radiations from the sun which is harmful for living organisms.

Depletion of Ozone Layer

The ozone layer is being damaged by carbon compounds like chlorofluoro carbons (CFSs).

To prevent the damage to the ozone layer, the use of (CFSs) is being reduced.





Satellite picture showing the hole (magenta colour) in the ozone layer over Antartica

Forests influence the quality of air, soil and water resources in following ways:

(i) Influence of forests on air occurs in these ways:

(a) Forests help to maintain oxygen and carbon dioxide balance in the air. They reduce the level of CO_2 in the air and to prevent greenhouse effect.

(b) These maintain temperature of the environment.

(c) Forests increase the rate of photosynthesis in surrounding region.

(ii) Influence of forests in quality of soil:

(a) Trees spread their roots deep inside the Earth and bind the soil particles firmly. This reduces soil erosion.

(b) Forests help to maintain nutrient cycles (biogeochemical cycles) in the atmosphere.

(iii) Influence of forests in quality of water:

(a) Trees help to maintain water cycle.

(b) Forests conserve water and make them available on the surface of Earth as water sources.

CONCEPT MAPPING