Bio Geo Chemical Cycles

Improve your learning

Q. 1. What is the importance of different biogeochemical cycles in the nature? (AS1)

Answer : i. Biogeochemical cycle is a circular pathway by which a chemical element such as carbon, oxygen, hydrogen, nitrogen, etc., are cycled through both living (bio) and non-living (geo) compartments of an ecosystem.

ii. The cycles move substances through the biosphere, lithosphere, atmosphere and hydrosphere.

iii. Biogeochemical cycles are of two types-gaseous and sedimentary.

iv. Gaseous cycles include nitrogen, oxygen, carbon and water. These elements cycle through evaporation, absorption by plants.

v. Sedimentary cycles include the leeching of minerals and salts from the Earth's crust, which then settle as sediment or rock before the cycle repeats.

vi. Plants absorb carbon dioxide and release oxygen, during photosynthesis makes air breathable.

vii. Plants also acquire nutrients from sediment. Animals acquire nutrients from plants and other animals, and the death of plants and animals returns these nutrients to the sediment as they decay.

viii. The cycle then repeats and allows other living things to benefit.

ix. The example of biogeochemical cycles is the water cycle. Water evaporates from the oceans, condenses as clouds and precipitates as rain, which returns the water back to the earth in a cycle.

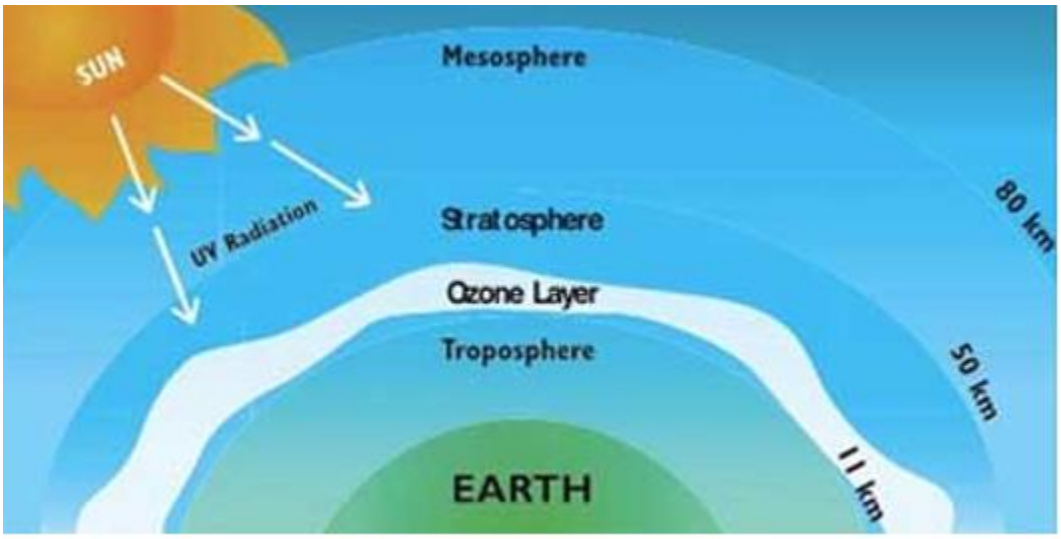
Q. 2. What do you understand by Ozone layer? Write an essay to participate in elocution competition on importance of ozone layer. (AS 6)

Answer : Essay on ozone layer:

Atmosphere of the Earth is composed of many layers. The first layer is the troposphere, it extends approximately 10 kilometres upwards from the earth’s surface. The human activities such as flying of balloons, mountain climbing, and small aircraft flights take place in this layer.

The layer above the troposphere is the stratosphere which extends up to 60 kilometres. The ozone layer is present in stratosphere from about 20-30 kilometres above the earth's surface. The ozone layer is about 3 to 5 mm thick. Ozone is composed of 3 oxygen atoms (O_3). The ozone layer was discovered in 1913 by the French physicists Charles Fabry and Henri Buisson.

The ozone layer has the ability to absorb harmful ultraviolet radiations (UV radiations) coming from the Sun. therefore, ozone protects life on earth from strong ultraviolet radiations. The ultraviolet rays are harmful rays that can cause skin cancer, cataracts and damage the human defence to fight diseases (immune system). Ultraviolet rays are also capable of destroying l plant life, and aquatic life.



Atmosphere layers

Q. 3. What emissions from human activities lead to ozone depletion? And what are the principal steps in stratospheric ozone depletion caused by human activities? (AS1)

Answer : The emissions of chlorofluorocarbons (CFCs) from some industries and from household consumer products such as refrigerators and air conditioning systems. These gases bring chlorine and bromine to the stratosphere, which cause depletion of the ozone layer.

Principal steps in ozone depletion:

Step 1. CFCs released from human activities.

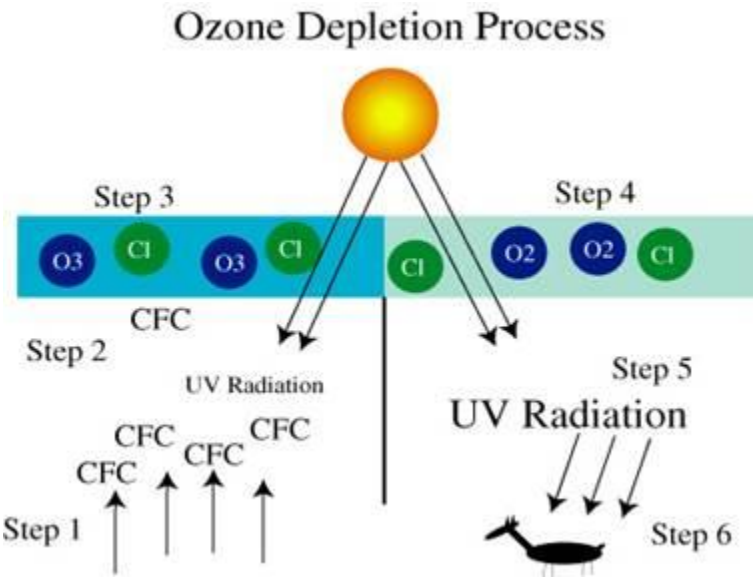
Step 2. CFCs rise into the ozone layer in the stratosphere.

Step 3. In the stratosphere, high-energy UV radiations from the Sun breaks CFC molecules, releases free chlorine (Cl).

Step 4. The free chlorine atoms react with ozone, to convert it to plain molecular oxygen. One chlorine atom can destroy up to 15,000 ozone molecules. In this manner even, minute quantities of CFCs reaching the stratosphere can be disaster for the ozone layer.

Step 5. A depleted ozone layer means that more UV radiations can get through it.

Step 6. More UV radiations coming to the earth has harmful effects on humans, animals and plants.



Q. 4. Why could we say that biogeochemical cycles are in "balance"? (AS1)

Answer : i. Biogeochemical cycles includes both biological, geological and chemical or physicochemical cycles.

ii. The cycles together can be understood like this earth has pool of nutrients.

iii. These nutrients may be of biological origin while others may obtained from rocks and soil (geochemical) in origin.

iv. These interactions consist of transfer of matter and energy between the different components of the biosphere. Bio geo chemical pathways determine the path of transfer of matter on earth.

v. These interactions are in dynamic state and they are stable.

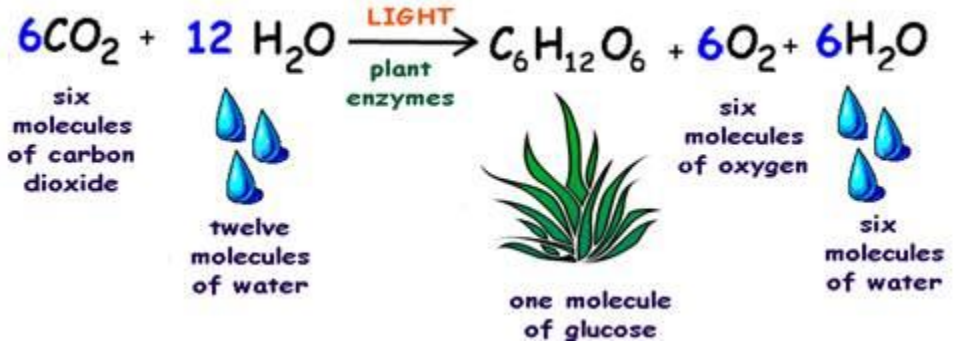
vi. The stability of bio geo chemical cycles ensures the existence of life on earth.

Q. 5. What role does carbon dioxide play in plant life processes? (AS7)

Answer : i. One of the processes in which carbon dioxide plays an important role in plants is known as photosynthesis.

ii. Photosynthesis is a process through which green plants make food using carbon dioxide and water in presence of sunlight.

iii. The process requires a pigment called chlorophyll, which gives plants their green colour and allows them to absorb light.



iv. This equation tells us that plants use carbon dioxide and water, plus energy from the sun, to produce sugar (glucose) and oxygen (which is released into the air).

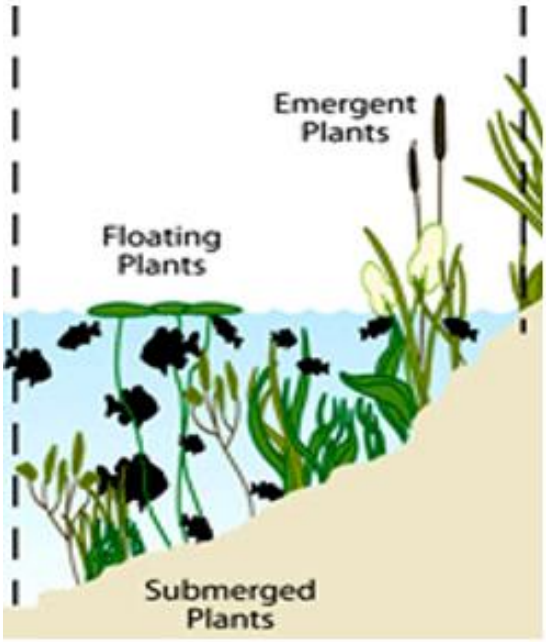
v. The carbon dioxide and water are **reactants,** (what you start with) are on the left, and the glucose, oxygen are the **products** (what you end up with) are on the right.

vi. We know that animals and plants need energy to live.

vii. That energy is usually in the form of sugars like glucose.

Q. 6. If all the vegetation in the pond died, what effects would it have on the animals? Why? (AS2)

Answer : i. The vegetation (aquatic plants) of the pond includes algae, submerged plants and other plants.



Vegetation of pond

ii. The plants in the pond carry out photosynthesis to make food for other aquatic animals.

iii. If the plants in the pond die, the pond would lose its source of oxygen and food for the aquatic animals.

iv. Therefore, aquatic animals will die due to lack of oxygen and food.

Q. 7. Burning of fossil fuels a concern for scientists and environmentalists, why? (AS 6)

Answer : i. The fossil fuels includes coal, oil, and natural gas.

ii. The fossil fuels were formed hundreds of millions of years ago, and they still contain the carbon that was present in the organisms when they died.

iii. The carbon makes them a source of energy.

iv. When we burn coal, oil, and natural gas for fuel, large amount of carbon is released and it enters the atmosphere to combines with oxygen to form carbon dioxide (CO_2), a greenhouse gas.

v. Besides carbon dioxide, combustion of fossil fuels releases carbon monoxide in the environment. It is very harmful and poisonous gas.

vi. Greenhouse gases are contributing to global warming (increase of earth's temperature) because they trap more of the Sun's energy in the Earth's atmosphere.

Q. 8. How human activities caused an imbalance in biogeochemical cycles? (AS 7)

Answer : Humans interfere the natural balance in many ways. Let's understand some of them.

I. Excessive use of nitrogen containing chemical fertilizers in the agriculture and untreated domestic sewage which are often washed into water bodies such as streams and rivers and even seep down to groundwater before these nitrates can be converted into atmospheric nitrogen. Water with high concentrations of nitrates is unsafe for consumption for humans and animals.

II. The excessive amount of nitrates in the rivers and lakes, cause too much algae growth called algal boom. Too much algae use oxygen in the water. When oxygen level falls, other organisms of water die.

III. Human activities such as clearing of forest and land use that interfere in the natural carbon cycle. Burning of forest trees release huge amount of carbon dioxide in the atmosphere as well as by clearing trees the carbon dioxide is not used in the photosynthesis. Since carbon dioxide is a primary greenhouse gas, the increase in atmospheric CO_2 due to human activities has resulted in an enhanced greenhouse effect resulting in higher global temperatures.

Q. 9. List three ways we, as humans, have affected the water cycle. (AS 7)

Answer : Water is one of the most precious resources. The more we develop our land and increase infrastructure by building roads and developing towns, the bigger the human effect is on the water cycle.

I. Increase in population: When our population grows, there are many human actions that we do such as use water to produce electricity, irrigation, and other agricultural work all of these activities disturbed the cycle.

II. Increased used of use of toxic chemicals in the agriculture, and manufacturing industries, as well as the runoff from chemical fertilisers and pesticides, these are polluting our surface water as well as contaminate our ground soil, making crop production difficult.

III. Cutting of trees on the large scale is called deforestation. Deforestation affects water cycle in two ways, first it increases the carbon dioxide in the atmosphere causing global warming. Secondly, less tree, do less transpiration which causes less rainfall.

Q. 10. Describe interdependence of biotic and abiotic components by taking Nitrogen cycle as an example. Draw Nitrogen Cycle. (AS 5)

Answer : i. Approximately 78% of air is nitrogen.

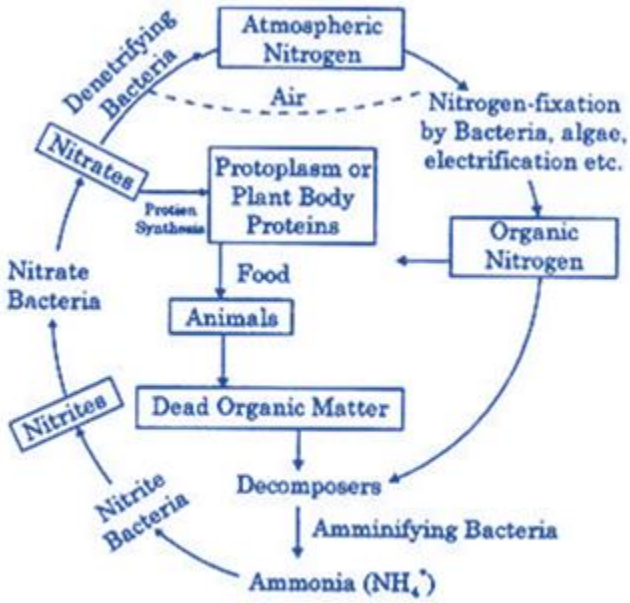
ii. Nitrogen is an abiotic component. It is a part of many molecules essential to life such as proteins, nucleic acids (DNA and RNA), ATP, and some vitamins.

iii. The nitrogen gas must be changed to a form called nitrates, which plants can absorb through their roots.

iv. The process of changing nitrogen gas to nitrates is called **nitrogen fixation**. It is carried out by nitrogen-fixing bacteria, *Rhizobium*, a biotic component.

v. The bacteria live in soil and roots of legumes, such as peas.

vi. Hence, interaction abiotic (nitrogen, soil) and biotic (bacteria, plants and animals) interact to use nitrogen in usable form.



Nitrogen-Cycle

Q. 11. Go to a nearby pond observe organisms living in the pond and bio degradable substances mixing in water. How they effect on those organisms? Write your observation. (AS4)

Answer : i. In a pond water is fresh and standing or stagnant water. This is usually smaller than a lake and may either be man-made or natural. Pond water contains a variety of plants such as algae, pistia and animals such as protozoa, *Hydra*, fish, frog,

tadpoles, insects. Depending on the pond, students will be able to observe a variety of living things under the microscope.

ii. Bio degradable substances are those which can be degrade or decomposed by certain bacteria and fungi. Bio degradable substances in the ponds include some plant parts such as root, stem, and leaves, body of algae, some dead animals, etc.

iii. These materials decomposed into nutrients which required for growth and development of aquatic life as a whole.

A pond

Q. 12. Prepare slogans on Greenhouse Effect to announce in your school assembly (AS 7)

Answer : Slogans


Saving Trees
is our Duty


SAVE TREES
THEY WILL SAVE YOU