CARBON CYCLE

Carbon is the core element of the living matter the Protoplasm, and hence it is necessarily present in all the living things.

Sources of Carbon → In the atmosphere, there are four sources of carbon :—

(i) CO_2 present in air and that which is dissolved in Water ($1.3 - 5 \times 10^{15}$ kg in hydrosphere.

In atmosphere, 0.032 % CO_2 is present. Each acre of earth's surface has about 6 tonns of carbon as CO_2 in the atmosphere.

(ii) Carbonates of earth's crust derived from rocks which by Chemical reactions give rise to CO_2.

(iii) Lithosphere contains about 2.81×10^{21} kg of carbon.

(iv) Oceans where it remains stored as bicarbonates as limestone, and marble rocks. Ocean absorbs CO_2 from atmosphere, so acts as a global sink for CO_2.

Cycle →: Like other chemical elements, Carbon also moves in a circular path. The carbon cycle operates in a following manner.

(A). In the first step, fixation of atmospheric carbon, by the green plants, takes place by the process of Photo-synthesis. Thus CO_2 enters the living world through the process of Photo Synthesis in which it is the basic raw material. As much as $4-9 \times 10^{13}$ kg of atmospheric carbon is fixed annually in Photo-synthesis.

(B) In Photosynthesis, Carbon from atmospheric CO_2 is incorporated into simple carbohydrates. Subsequentially, simple carbohydrate are converted to organic compounds, such as Poly-Saccharides (Sucrose, cellulose, Starch, Protein and complex lipid). As these are stored in plants, green plants are called Producers.

$$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$$

(C) The carbon contained bound in plants is then eaten up by herbivorous or Phyto-Parasites. Thus, it is transferred to the different trophic levels of herbivorous. These

animal digest and resynthesize the carbon compounds. Some of the food is retained by the plants themselves until they die and serve as food for decomposers.

(3). Flesh eating animals or carnivores eat herbivores and the carbon in carbonated as organic compounds in the tissues of herbivores passes to the various levels of carnivores, where these compounds are again redigested and resynthesized in other forms. Carbon is returned to the atmosphere in different ways. Some of the carbon is returned to the atmosphere as CO_2 formed as a by product during respiration. The CO_2 released by plants during respiration may be used by them for Photosynthesis. When plants and animals die, the carbon locked in their protoplasm is released by the activities of the micro organisms such as bacteria, fungi etc.

The carbon-dioxide is not only replenished by the biotic oxidation, i.e. by plant and animal respiration but also through abiotic combustion, e.g. burning of industrial fuels, domestic fuels, forest fires etc. which release CO_2 in to the atmosphere. Occasional volcanic eruptions also add CO_2 to the atmosphere. Some carbon becomes incorporated in the earth's crust as coal, limestone, gas petroleum etc. The carbon components present in these deposites are removed from the cycle for long duration of time. Some of the carbon is librated as gaseous CO_2 by the industrial and agricultural use of these deposits. Some carbon is also released as CO_2 by weathering of the lime stone.

It is estimated that about 99% of the total carbon lies in the geological components. Carbon is essential constituent of all major organic compounds of Protoplasm as carbohydrates, fats and nucleic acids so carbon is generally considered as the basis of life. Next to water, Carbon is the most significant element constituting 49% of the dry weight of organisms. The atmosphere works as a reservoir pool of carbon dioxide dissolved CO_2 occurs in the form of carbonic acid in a reversible from :—

$H_2O + CO_2 \rightleftharpoons H_2CO_3$

$H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$

$HCO_3 \rightleftharpoons H^+ + CO_3$

So, a local depletion of atmospheric CO_2 would result in a net movement of CO_2 into the atmosphere from the dissolved phase and vice-versa.

So, We saw the Carbon Cycle is simplest of all nutrient cycles significance of Carbon Cycle :—

The carbon cycle is essentially a perfect cycle in the sense that carbon is returned to the environment almost as rapidly as it is removed. The CO_2 released due to biological oxidations in the atmosphere is utilized by Plants for the manufacture of food. Thus an equilibrium is maintained between O_2 and CO_2 in the atmosphere. The CO_2 liberated in the atmosphere due to non biological oxidation i.e. combustion of fuels, forest fires etc. acts as a heat screen over the earth that retards the radiations of earth's heat in to space, thus affecting global climate.

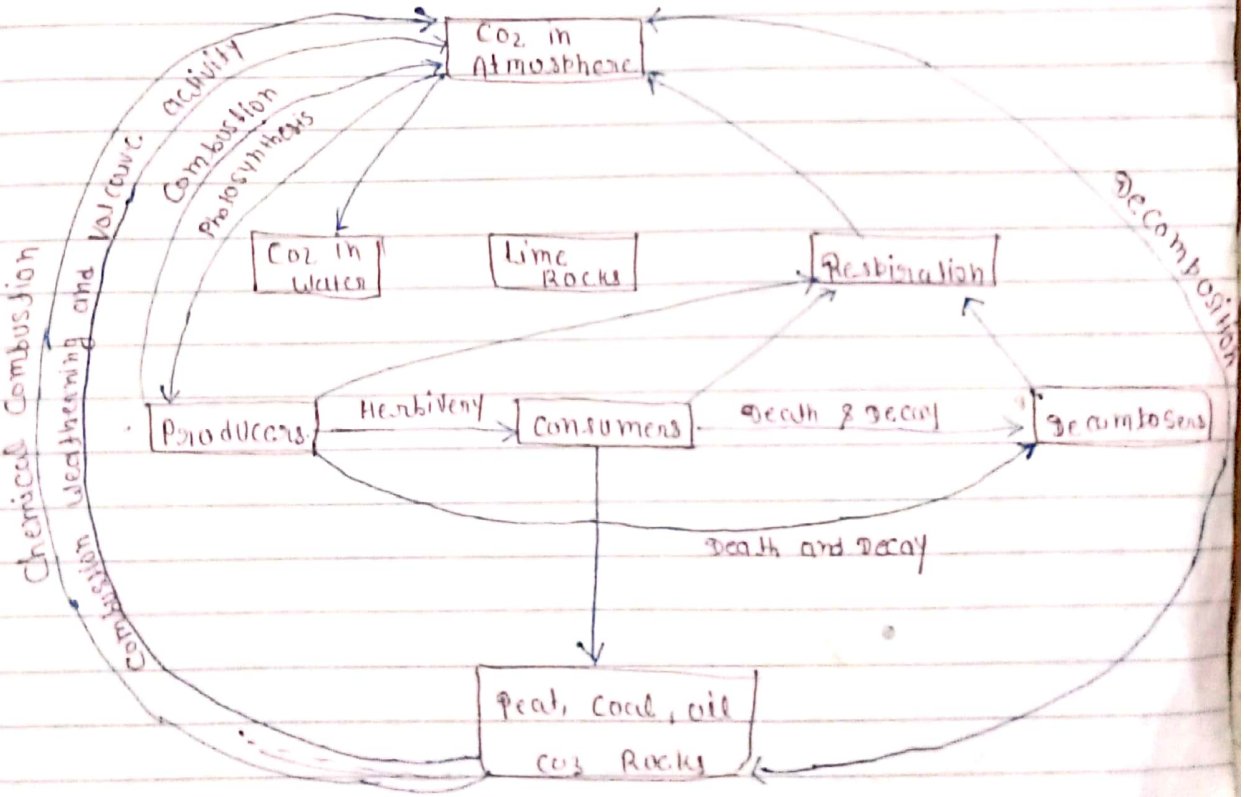

fig → Carbon cycle