

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)  $\text{CO}_2$  present in air and that which is dissolved in water ( $1.3 - 5 \times 10^{15}$  kg in hydrosphere).

In atmosphere, 0.032%  $\text{CO}_2$  is present. Each acre of earth's surface has about 6 tons of carbon as  $\text{CO}_2$  in the atmosphere.

(ii) Carbonates of earth's crust derived from rocks which by chemical reactions give rise to  $\text{CO}_2$ .

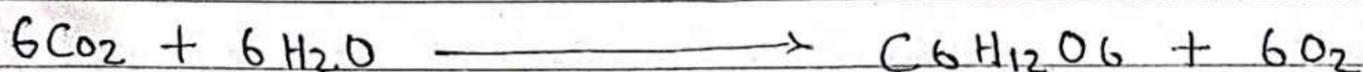
(iii) Lithosphere contains about  $9.81 \times 10^{21}$  kg of carbon.

(iv) Oceans where it remains stored as bicarbonates as limestone and marble rocks. Ocean absorbs  $\text{CO}_2$  from atmosphere, so acts as a global sink for  $\text{CO}_2$ .

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 photosynthesis. Thus  $\text{CO}_2$  enters the living world through the process of photosynthesis in which it is the basic raw material. As much as  $4 - 9 \times 10^{13}$  kg of atmospheric carbon is fixed annually in photosynthesis.

(B) In photosynthesis, carbon from atmospheric  $\text{CO}_2$  is incorporated into simple carbohydrates. Subsequently, simple carbohydrates are converted to organic compounds, such as polysaccharides (sucrose, cellulose, starch, protein and complex lipid). As these are stored in plants, green plants are called producers.



(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.

(D). Flesh-eating animals or carnivores eat herbivores and the carbon incorporated 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  $\text{CO}_2$  termed a by product during respiration. The  $\text{CO}_2$  released by plants during photosynthesis may be used by them for photosynthesis. When plants and animals die, the carbon locked in their proteins 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  $\text{CO}_2$  in to the atmosphere. Occasional volcanic eruptions also add  $\text{CO}_2$  to the atmosphere. Some carbon becomes incorporated in the earth's crust as coal, limestone, gas petroleum etc. The carbon components present in these deposits are removed by the plate for long duration of time. Some of the carbon is liberated as gaseous  $\text{CO}_2$  by the industrial and agricultural use of these deposits. Some carbon is also released as  $\text{CO}_2$  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  $\text{CO}_2$  occurs in the form of carbonic acid in a reversible form:—



So, a local depletion of atmospheric  $\text{CO}_2$  would result in a net movement of  $\text{CO}_2$  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  $\text{CO}_2$  released due to biological oxidations in the atmosphere is utilized by plants for the manufacture of food. Thus an equilibrium is maintained between  $\text{O}_2$  and  $\text{CO}_2$  in the atmosphere. The  $\text{CO}_2$  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 reflects the radiations of earth's heat into space, thus affecting global climate.

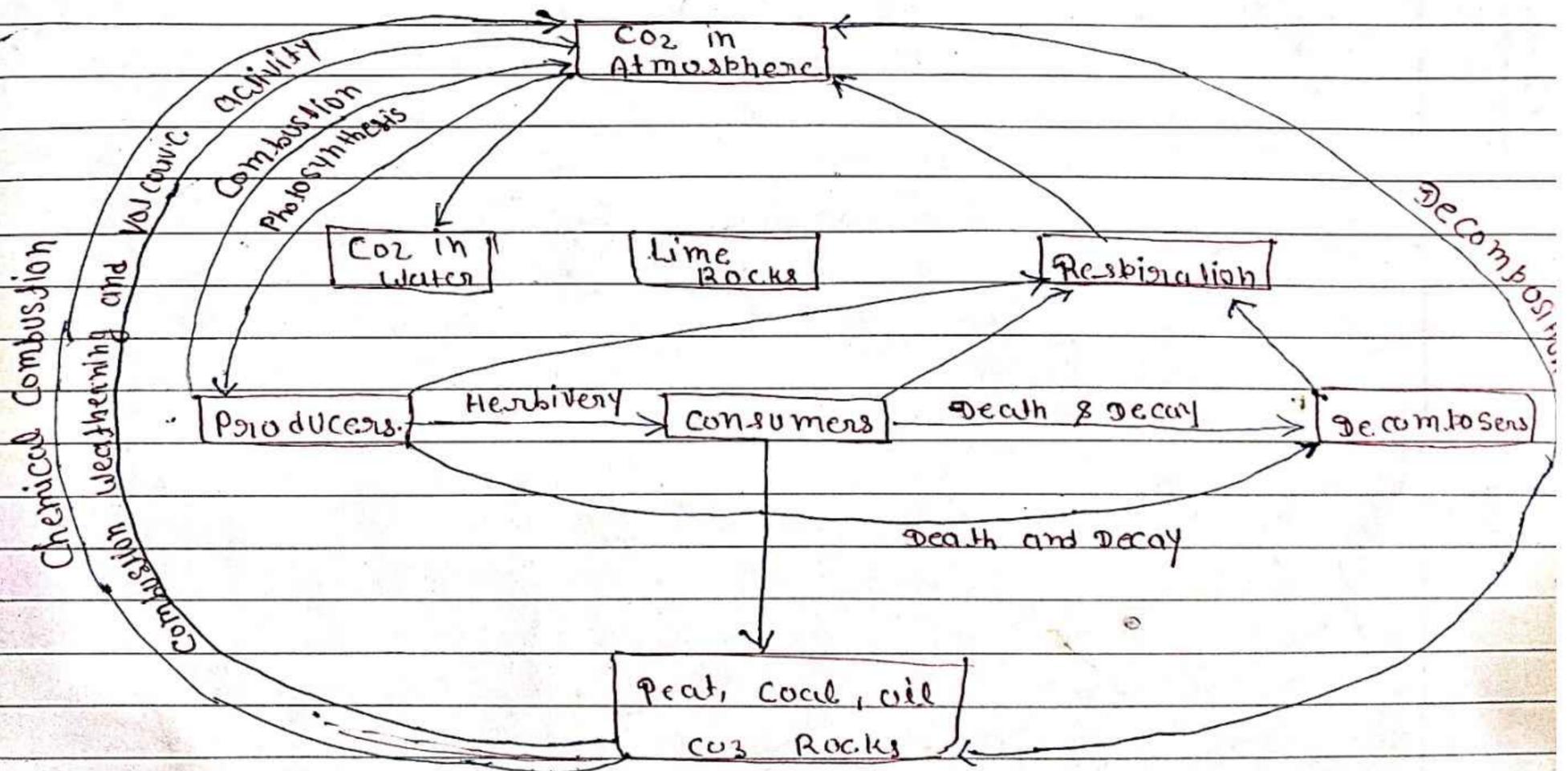


Fig → Carbon cycle