4.3 CARBON CYCLING

CARBON CYCLE

It is a biochemical cycle whereby carbon is exchanged between the different spheres of the Earths.

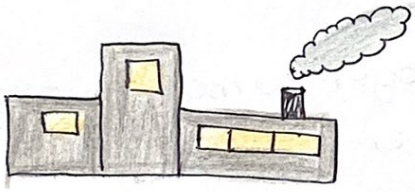
Atmospheric gases - CO_2 and CH_4

Oceanic carbonates - bicarbonates & calcium carbonates

organic materials - carbohydrates, lipids & proteins

Non-living remains - fossil fuels

carbon is exchanged between a variety of forms



Autotrophs:

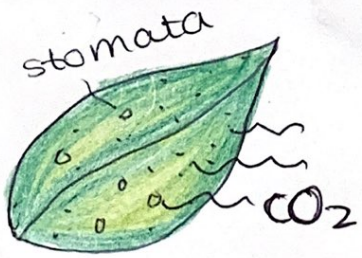
- inorganic CO_2 into organic compounds via photosynthesis

Autotrophs use CO_2 for photosynthesis ∴ levels of CO_2 should always be low in the organism.

- Atmosphere CO_2 should be at a higher concentration.

This gradient allows the CO_2 to passively diffuse into the autotrophic organism as required.

In terrestrial plants, CO_2 is diffused at the stomata. In aquatic CO_2 gets diffused directly.



Compensation point:

The point where the amount of CO_2 being taken in by plants = the amount of CO_2 released by ~~the~~ respiration.

More photosynthesis - CO_2 levels in atmosphere ↓

More respiration - CO_2 levels in atmosphere ↑.

AQUATIC CONVERSIONS

CO_2 can get dissolved in water.

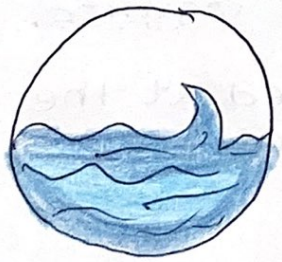
some of the CO_2 combines with water to form carbonic acid.

↓

this breaks down to form hydrogen carbonate ions.

∴ the pH of the water gets lower when it is dissolved in water.

- Animals like molluscs have hard parts that are composed of calcium carbonate.
- Hard corals that build reefs secrete $CaCO_3$ to produce the exoskeletons.

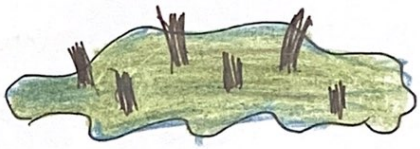


METHANOGENESIS

Methanogens - Archaean microorganisms that produce methane as a by-product in anaerobic conditions.

They can be found in:

- swamps, marshes
- marine sediments - along the shores there are mud deposits.
- Guts of cows, sheeps and goats.



Methane can accumulate under the ground and can diffuse into the atmosphere.

Oxidation of methane:

Methane gets oxidised to form carbon dioxide & water.

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

∴ methane's concentration in the atmosphere is low despite the large quantities being produced.

FOSSIL FUELS

Partial decomposition:

Dead organisms get decomposed by saprotrophic bacteria and the nutrients are then recycled as they return to the soil.

In water logged conditions, the atmosphere is acidic which doesn't allow the bacteria to function properly. This results in partial decomposition.

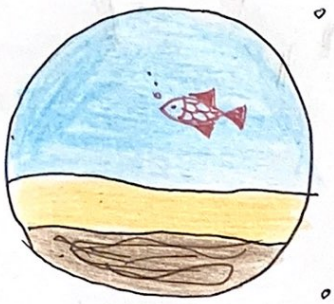
Coal Formation:

The organic matter that is partially decomposed, stays in the soil & forms peat.

Peat is compressed under heat & pressure and then undergoes a chemical transformation to produce coal.

Oil and natural gas formation:

They are formed in the mud at the bottom of seas & lakes.



- clay and mud get deposited on top of the organic matter creating conditions that prevent decomposition.
- As a result, hydrocarbons are formed which then combine to form oils & gas which get accumulated in porus rocks.

COMBUSTION

- When hydrocarbons burn in the presence of oxygen they undergo a combustion reaction.
- carbon dioxide & water are the by-products.
- The CO_2 released cause the concentration of CO_2 in the atmosphere to rise.

Fossil fuels are generally burned in vehicles & industries. These take millions of years to form & are non-renewable.

Alternative fuel can be biomass as it is a renewable source of energy.