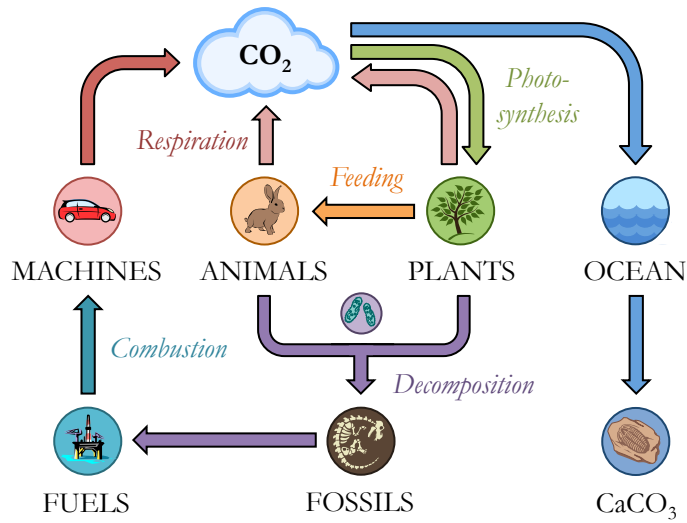


TOPIC 4.3: CARBON CYCLING

Carbon Cycle



Organic Conversions

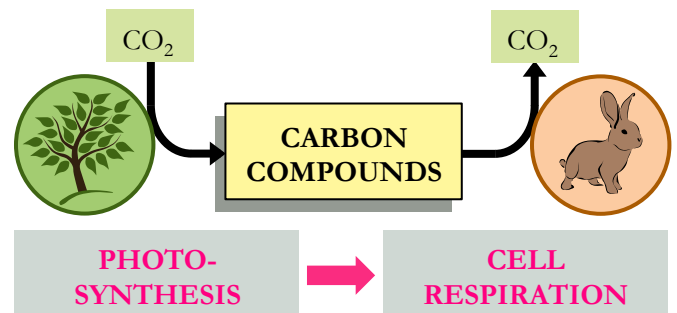
Autotrophs convert atmospheric carbon dioxide into organic compounds via the process of **photosynthesis**

- Equation (*balanced*): $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

Heterotrophs obtain organic compounds via **feeding**

The breakdown of organic compounds via **cell respiration** (to produce ATP) releases carbon dioxide as a by-product

- Equation (*balanced*): $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$



Fossil Fuels

In *aerobic conditions*, saprotrophic bacteria will break down organic material and return it to the soil (i.e. decomposition)

In *anaerobic conditions*, decomposition is prevented as the saprotrophic bacteria cannot function effectively

- Anaerobic respiration will produce organic acids (↓ pH)

Peat / Coal

- Organic matter that is not fully decomposed in anoxic or acidic soils will become peat
- When peat is compressed under layers of sediment, heat and pressure remove moisture to transform it into coal

Oil / Natural Gas

- When marine organisms are buried under sediment on the ocean floor, compaction and anaerobic conditions transform the organic matter into oil and natural gas

Combustion

Hydrocarbons undergo combustion in the presence of O_2

- The reaction is exergonic and CO_2 and H_2O is produced

Sources of hydrocarbons include:

- Fossilised organic matter (i.e. coal, oil and gas)
- Biomass (e.g. bioethanol and biofuels)

The energy produced by combustion reactions is typically used to power industrial processes

- The combustion of fossil fuels is responsible for a significant increase in atmospheric CO_2 concentrations

Aquatic Conversions

In aquatic ecosystems, carbon dioxide may remain dissolved in water or alternatively form hydrogen carbonate ions

Animals may combine the carbonate ions with calcium to form hard shells (e.g. mollusca) and exoskeletons (e.g. coral)

Carbonate ions may also interact with rock and sediment to form limestone

Methane Production

Methane (CH_4) is produced from organic compounds by methanogenic archaeans

This requires **anaerobic conditions** (commonly found in wetlands, marine sediments or digestive tract of ruminants)

Methane diffuses into the air or forms deposits underground

- In the air, methane is oxidised to form CO_2 and H_2O

