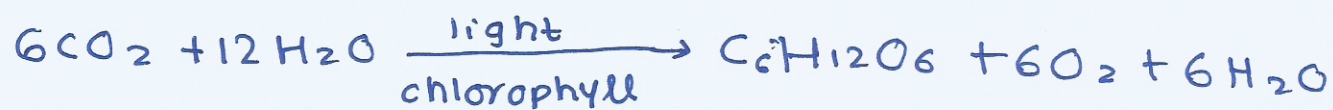
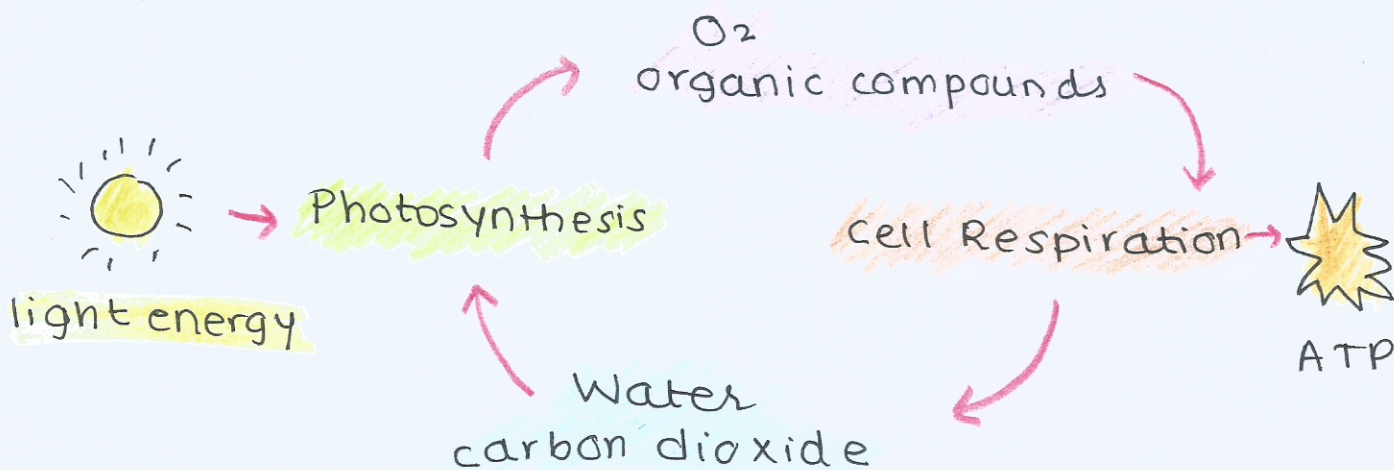


2.9. PHOTOSYNTHESIS

Photosynthesis is the production of carbon compounds in cells using light energy. It is an example of energy conversion as light energy is converted into chemical energy.



Relationship between Photosynthesis and Cell Respiration:



Photosynthesis takes place in the chloroplasts whereas cell respiration takes place in the mitochondria.

WAVE LENGTHS OF LIGHT

Sunlight is made up of all wavelengths of electromagnetic radiations that are visible to us.

- ▶ Shorter wavelengths of light have high energy & longer wavelengths of light have lower energy.

Visible light has wavelengths longer than U.V. & shorter than infrared.

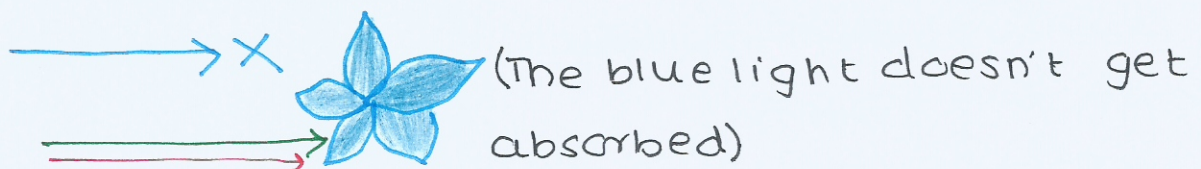
VIBGYOR (shortest to longest wavelength).

LIGHT ABSORPTION BY CHLOROPHYLL

Substances called **pigments** absorb the sunlight. As they absorb light, they appear coloured to us.

- There are pigments that absorb some wavelengths but not others (visible light).

Eg:- In gentian flower, the pigment absorbs all colours except blue. Only this colour is reflected and our retinas detect the colour blue.

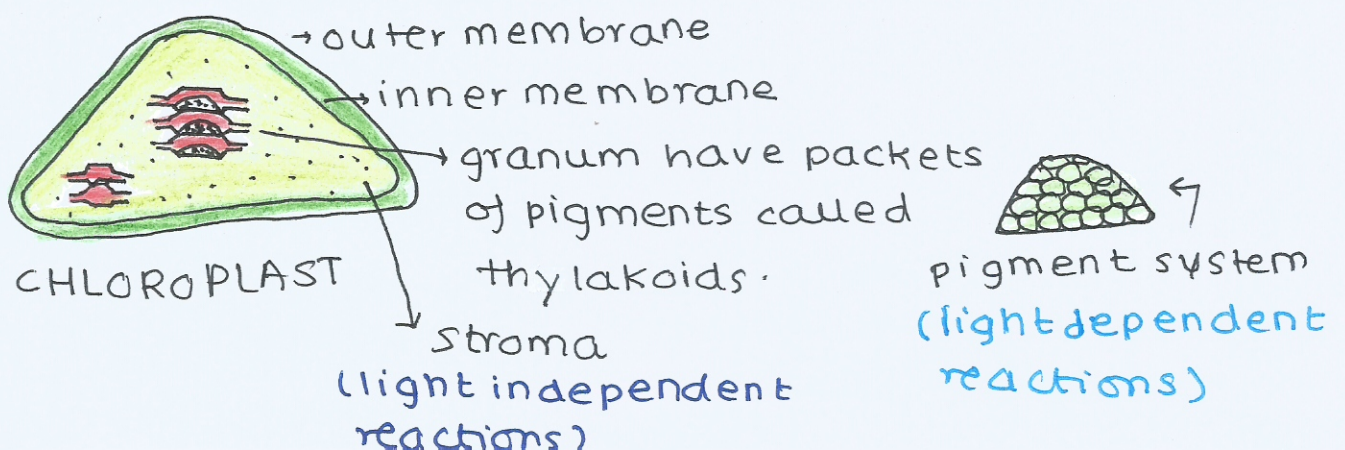


Chlorophyll is the main photosynthetic pigment. It absorbs red and blue light most effectively & reflects green light.

∴ all the plants and trees around us appear green.

Action spectrum: It is a graph showing the rate of photosynthesis at each wavelength of light.

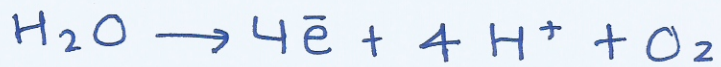
Absorption spectrum: It is a graph that shows percentage of light absorbed at each wavelength by a pigment / group of pigments.



PHOTOLYSIS

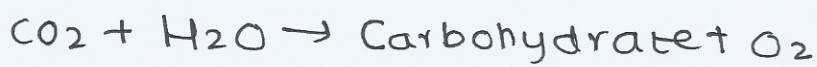
The sunlight breaks down the water molecule to produce oxygen.

Oxygen is the waste product & it diffuses away.



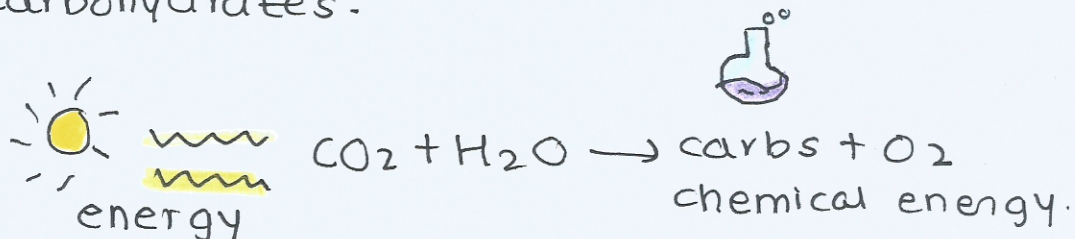
PRODUCTION OF CARBOHYDRATES

Energy is needed to produce carbohydrates & other carbon compounds from carbon dioxide.



→ This is an endothermic reaction as energy is needed to carry out this process.

• The energy is obtained by absorbing sunlight. The energy absorbed is converted to chemical energy in carbohydrates.



LIMITING FACTORS

TEMPERATURE

LIGHT INTENSITY

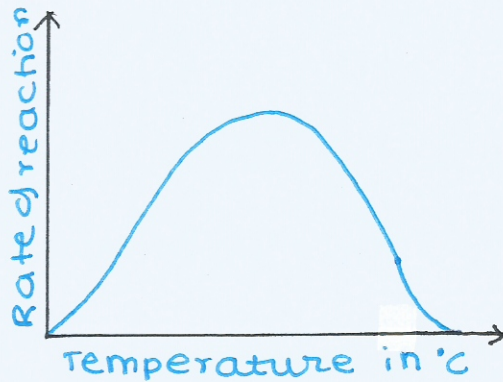
CO₂ CONCENTRATION

- They can limit the rate of photosynthesis if they are below their optimum level.
- Under any combination of these 3, only one of them can be a limiting factor.

If this factor is increased then the rate of photosynthesis increases whereas no effect will be seen if the other 2 factors are increased.

Graphs:

Temperature:

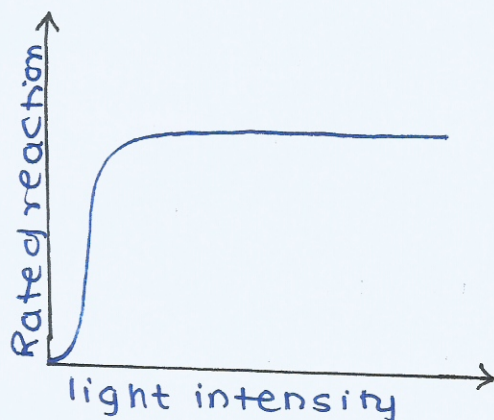


→ enzymes that control photosynthesis are sensitive to fluctuations in temperature.

→ the rate & temp will increase till the optimum temp. is reached.

→ the enzymes get denatured & the rate slows down.

Light Intensity:

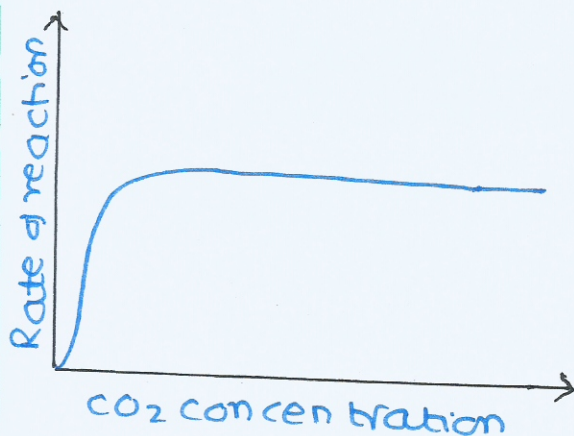


→ as light intensity ↑ the chlorophyll are being photo-activated.

→ at a certain intensity, the available chlorophyll get saturated with light

→ Photosynthetic rate will plateau.

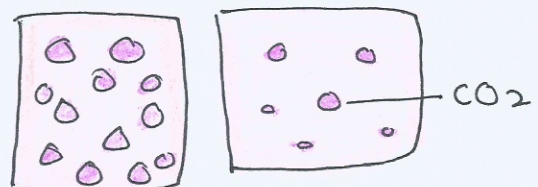
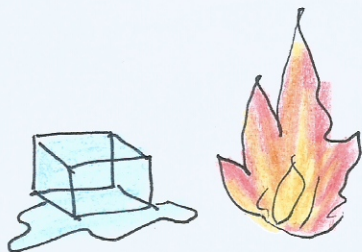
Carbon dioxide concentration:



→ CO₂ helps in the fixation of carbon atoms for the formation of organic molecules.

→ As CO₂ ↑, reaction rate ↑ & more organic compounds are being produced.

→ It reaches a plateau when the enzymes are saturated.



EFFECTS OF PHOTOSYNTHESIS ON THE EARTH

Photosynthesis resulted in the rise in the oxygen concentration of the atmosphere.

This began 2,400 million years ago, rising to 2% by volume by 2,200 million years ago. This is known as the Great oxidation event.



$O_2 \uparrow$ $O_2 \uparrow$

The formation of glaciers was probably due to a reduction in green house effect. The oxygen in the atmosphere increased causing a decrease in the concentration of methane in the atmosphere.

Photosynthesis caused a decrease in CO_2 levels as well.



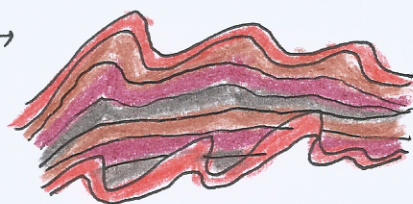
The reaction between iron & oxygen gas created oceanic deposits called banded iron formations. Photosynthesis in bacteria is the reason for this.



Bacteria

$\rightarrow O_2$
 $\rightarrow O_2$

O_2 & $Fe \rightarrow$



Banded iron formations.