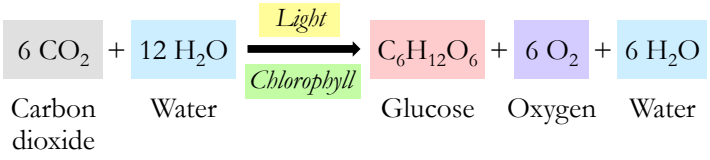
TOPIC 2.9: PHOTOSYNTHESIS

Photosynthesis

Photosynthesis involves the use of light energy to synthesise organic compounds from inorganic molecules

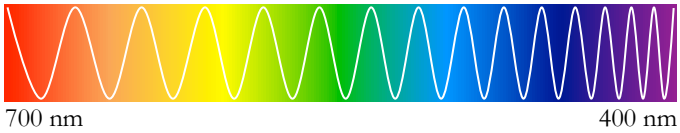


Light Spectrum

Visible light has a range of wavelengths (~ 400 – 700 nm)

- Violet has the shortest wavelength, red has the longest

The Visible Spectrum



Light Absorption

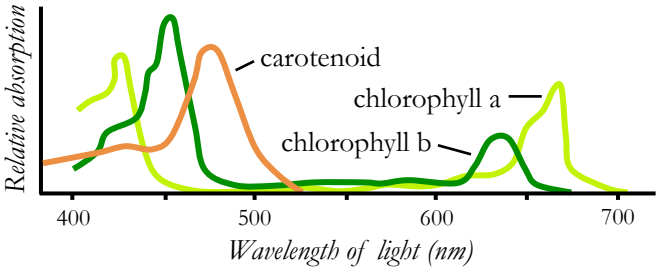
Pigments are required for the conversion of light energy into chemical energy in photosynthetic organisms

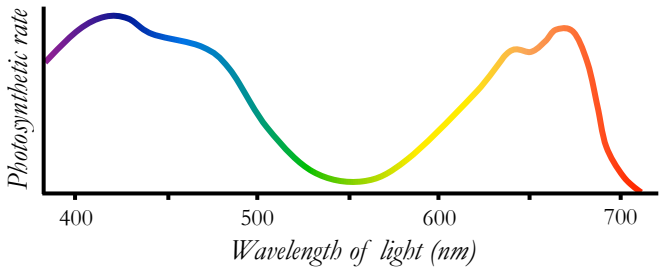
Chlorophyll is the main photosynthetic pigment, although other accessory pigments also exist (e.g. carotenoids)

- Chlorophyll absorbs **red** light and **blue** light most effectively and reflects **green** light more than other colours

An **absorption spectrum** (left) indicates the wavelengths of light absorbed by each photosynthetic pigment (e.g. chlorophyll)

An **action spectrum** (right) indicates the overall rate of photosynthetic activity at each wavelength of light



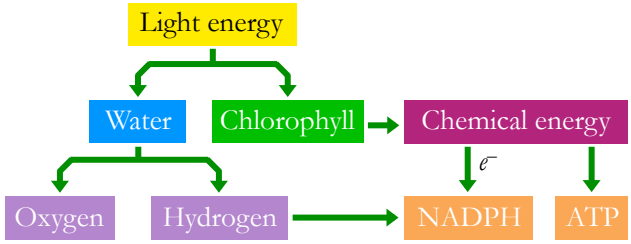


Stages of Photosynthesis

Light Dependent Reactions

Light energy is converted into chemical energy

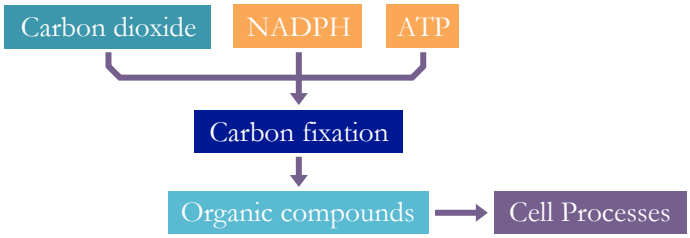
- Light is absorbed by chlorophyll to produce ATP
- The photolysis of water forms oxygen and hydrogen



Light Independent Reactions

Carbon compounds are made from the chemical energy

- ATP and hydrogen are fixed with carbon dioxide
- This results in the formation of organic molecules



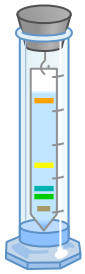
Chromatography

Pigments can be separated by chromatography

- Pigments are dissolved in fluid
- The fluid is passed through a static material
- Pigments are separated according to size

A retardation factor (Rf value) is calculated:

Rf = distance of pigment ÷ distance of solvent



Limiting Factors

When a process depends on more than one condition, the rate will be limited by the factor nearest its minimum value

Limiting factors in photosynthesis include:

- Temperature (influences photosynthetic enzymes)
- Light intensity (required for chlorophyll photoactivation)
- Carbon dioxide concentrations (CO_2 is a core substrate)