Ch. 8: Photosynthesis

Autotrophs - "Self-feeders", meaning they sustain themselves without eating anything derived from other living beings (producers).

Heterotrophs - Organisms unable to make their own food and live on compounds produced by other organisms (Consumers).

Photosynthesis converts light energy to the chemical energy of food

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Photosynthesis occurs in chloroplasts, organelles containing thylakoids.

Mesophyll - The tissue in the interior of the leaf that contains most of the chloroplasts in a cell.

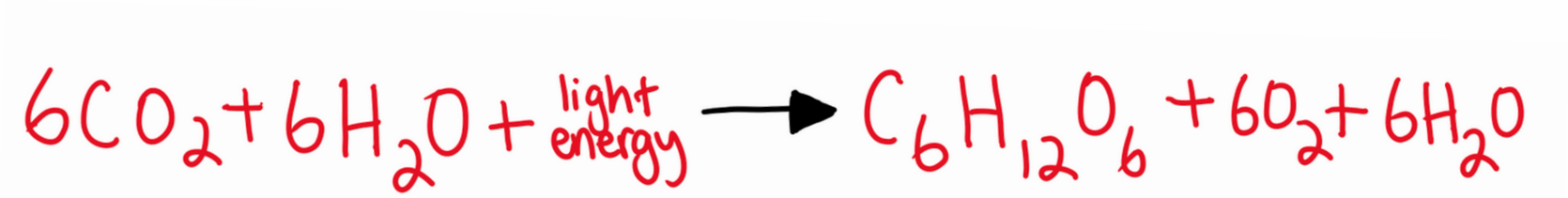
Stomata - Microscopic pores that allow gases to move in and out.

Stroma - Dense fluid that surrounds two membranes.

Thylakoids - Sacs suspended in the stroma.

Chlorophyll - The green pigment that gives leaves their color and resides in the thylakoid membrane.

Photosynthesis Equation



2 stages of photosynthesis

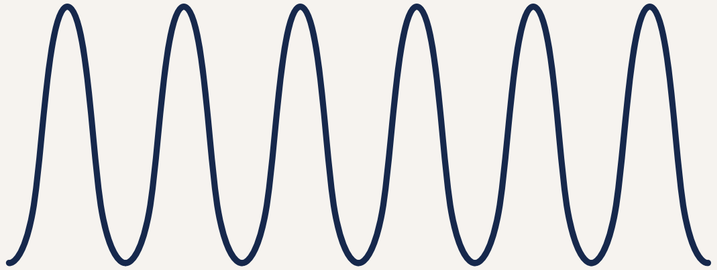
1) Light reactions - happen in the thylakoid membranes and split water, releasing O2, producing ATP and forming NADPH.

2) Calvin cycle - Happens in the stroma forming sugars from CO2, using ATP for energy & NADPH for reducing power.

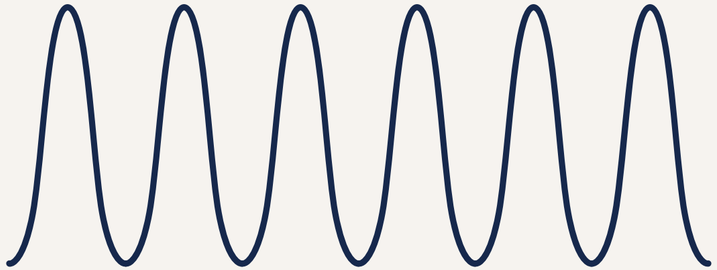
Carbon Fixation - The initial incorporation of carbon into organic compounds.

NADP (Nicotinamide adenine dinucleotide phosphate) - Electron acceptor.

The light reactions convert solar energy to the chemical energy of ATP and NADPH:



Wavelength - The distance between the crests of electromagnetic waves.



Electromagnetic Spectrum - The entire range of radiation.

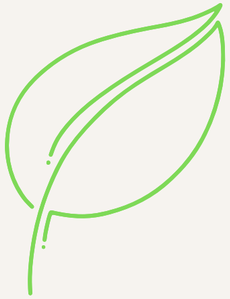
Visible Light (380-750) - radiation that can be detected as various colors by the human eye.

The shorter the wavelength, the greater the energy of each photon of that light.

Spectrophotometer - An instrument used to measure the ability of a pigment to absorb various wave-lengths of light.

Absorption Spectrum - A graph plotting a pigments light absorption versus wavelength.

Chlorophyll a - The key light-capturing pigment that participates directly in light reactions.



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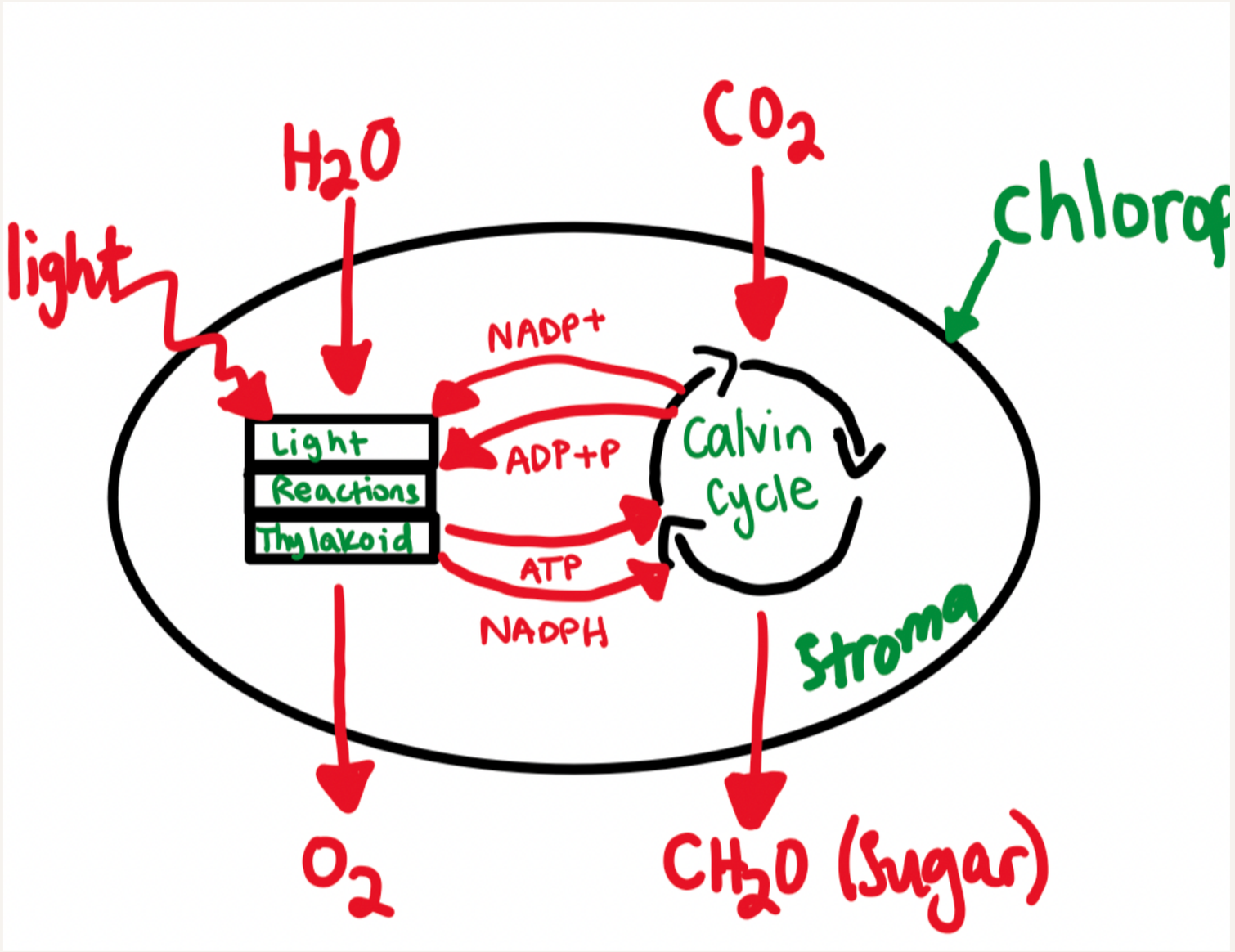
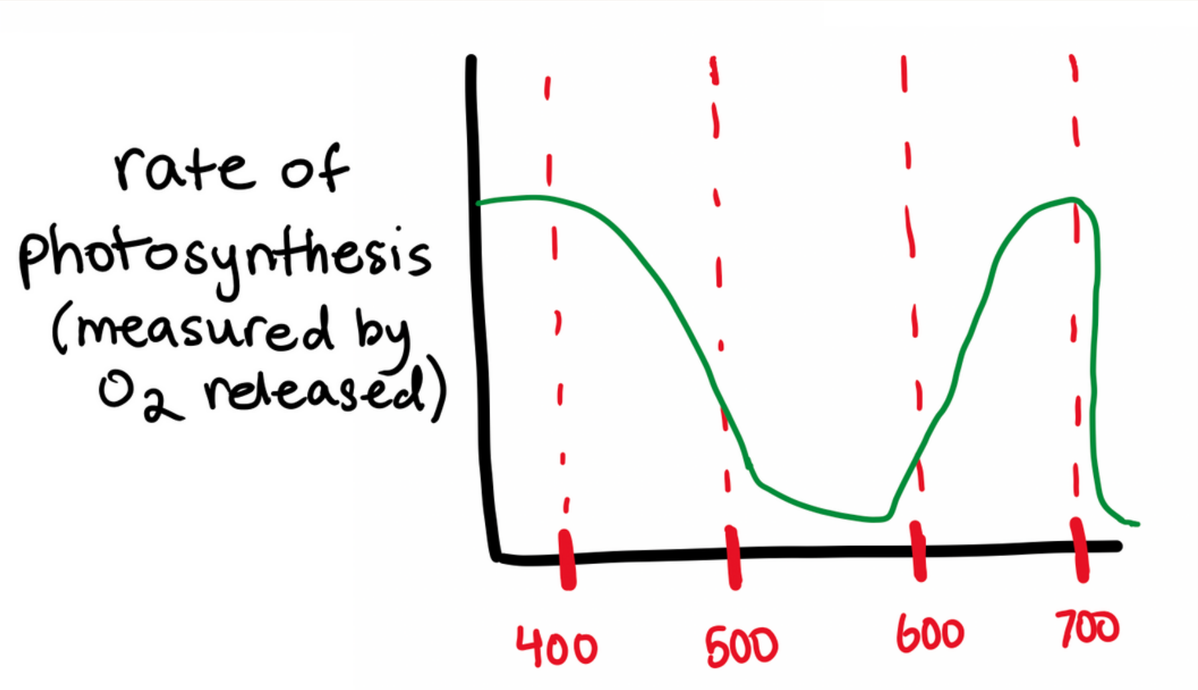


Photosynthesis Diagram

Action Spectrum - Profiles the relative effectiveness of different wavelengths of radiation ofr photosynthesis.



Chlorophyll a suggests violet-blue & red light work best for photosynthesis.

Carotenoids - Hydrocarbons that are various shades of yellow & orange because they absorb violet & blue-green light (photo-protection).

Photosystem - Composed of a reaction-center complex surrounded by several light-harvesting complexes.

2 types are photosystem II and photosystem I.

Light-Harvesting Complex - Consists of various pigment molecules bound to proteins.

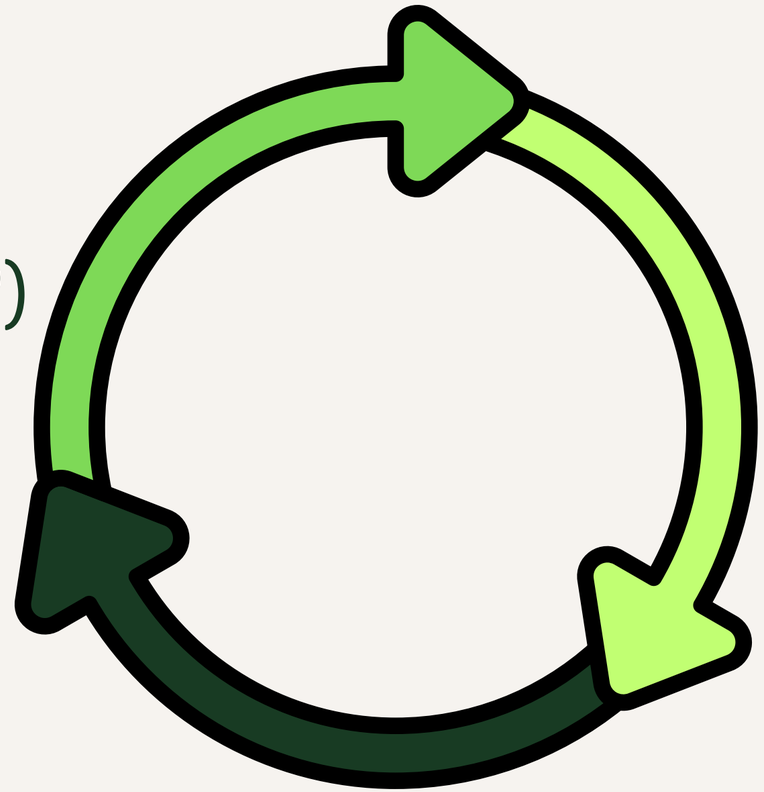
Photophosphorylation - Conversion of ADP to ATP using sunlight.

The Calvin cycle uses the chemical energy of ATP & NADPH to reduce CO_2 to sugar:

Glyceraldehyde 3-phosphate (G3P) - The carbohydrate produced by the Calvin cycle.

3 Phases of Calvin cycle:

3) Regeneration of CO_2 acceptor (RUBP)



1) Carbon fixation

2) Reduction

C3 Plants - Their first organic product of carbon fixation is a 3-carbon compound (3 phosphoglycerate).

Ex. Rice, wheat, soybeans.

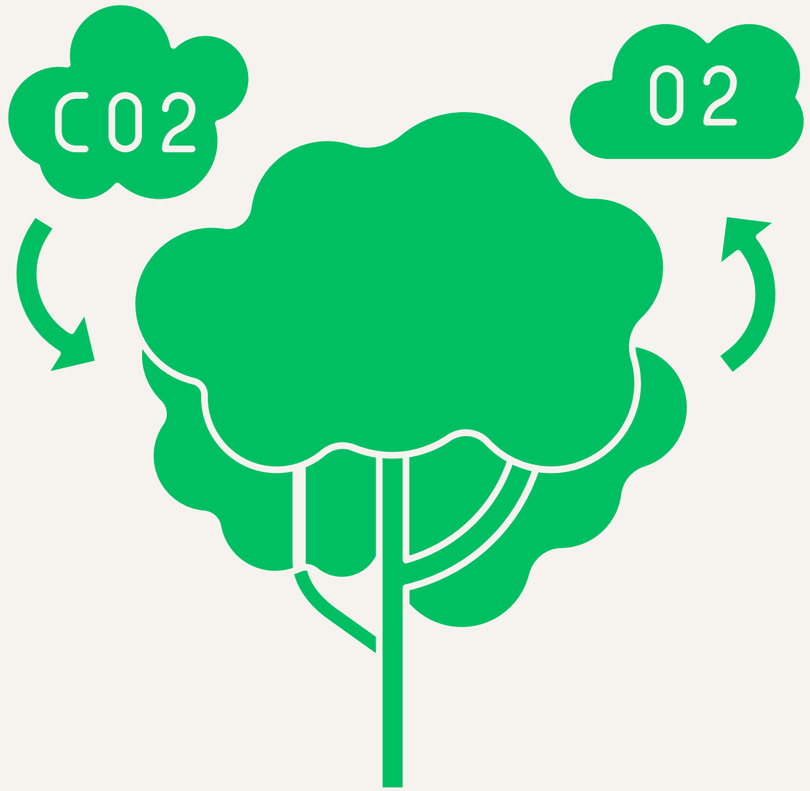
Photorespiration - Occurs in the light and consumes O2 while producing CO2.

C4 Plants - Carry out a modified pathway for sugar synthesis that first fixes CO_2 into a 4-carbon compound.

Ex. Sugarcane, maize (corn).

CAM Plants - Store organic acids they make during the night in their vacuoles until morning, when stomata closes.

Life depends on photosynthesis:



Organic compounds produced by photosynthesis provide the energy & building material for Earth's ecosystems.