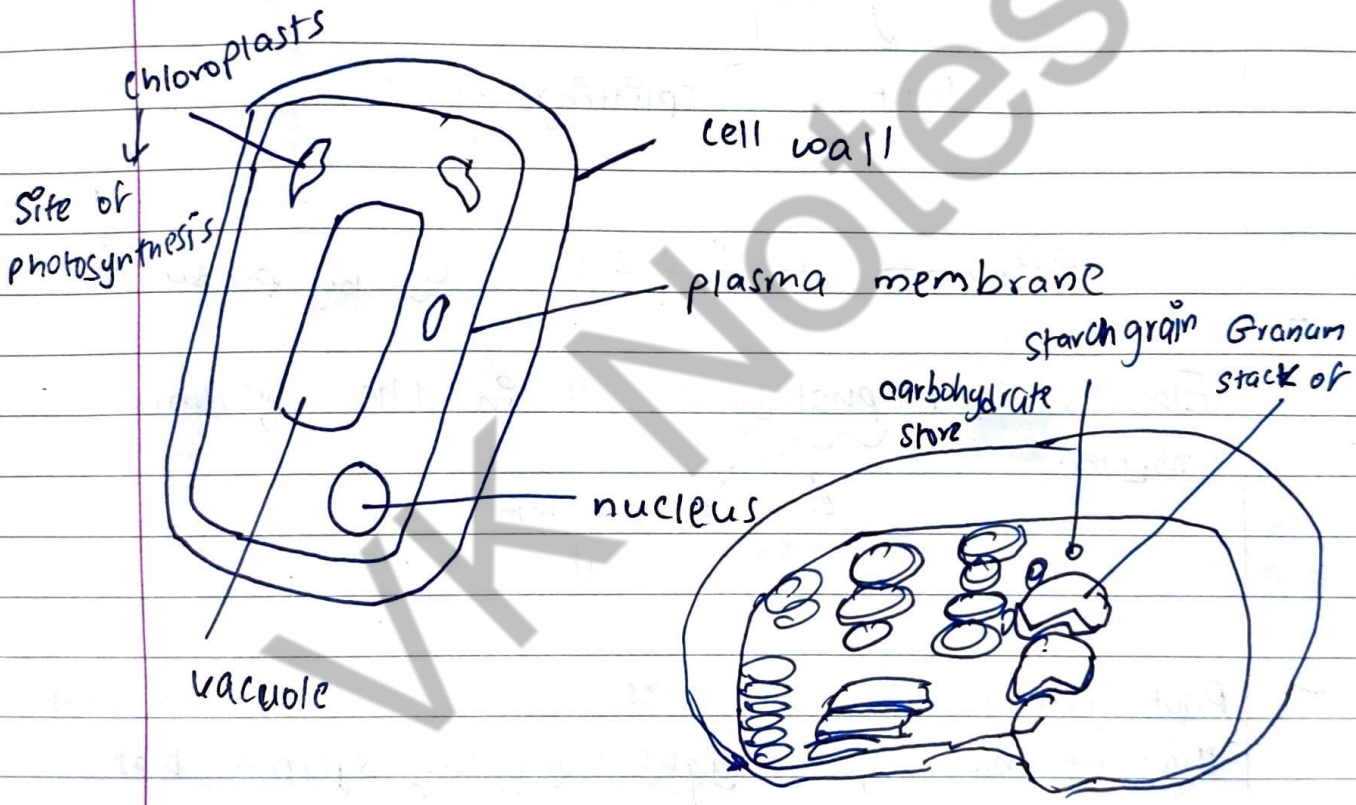
Photosynthesis : Plants

↙ Light using energy from the sun

↘ makes organic compounds ↓ Glucose

water + carbon dioxide ⟶ glucose + oxygen

$6H_2O + 6CO_2 \longrightarrow C_6H_{12}O_6 + 6O_2$



Structure of chloroplasts

Thylakoid membrane - provides a large surface area for light absorption.

Thylakoid space — needed for accumulation of protons

Photosynthesis

① Light depent
- relies on light

② Light independant stage

Water absorbs light and is split into: oxygen, hydrogen ions (protons), electrons.

photolysis
- light
- splitting apart

$4H_2O \longrightarrow 4H^+ + 4e^- + O_2$ by-product

Electrons enter photosystem II in the thylakoid membrane.

- photosystem I
- photosystem II

Photosystems are structures in the thylakoid membrane that are made up of light harvesting systems that surround a reaction centre.

made up of accessory pigments:-
- chlorophyll b
- caratenoids
- xanthophyll

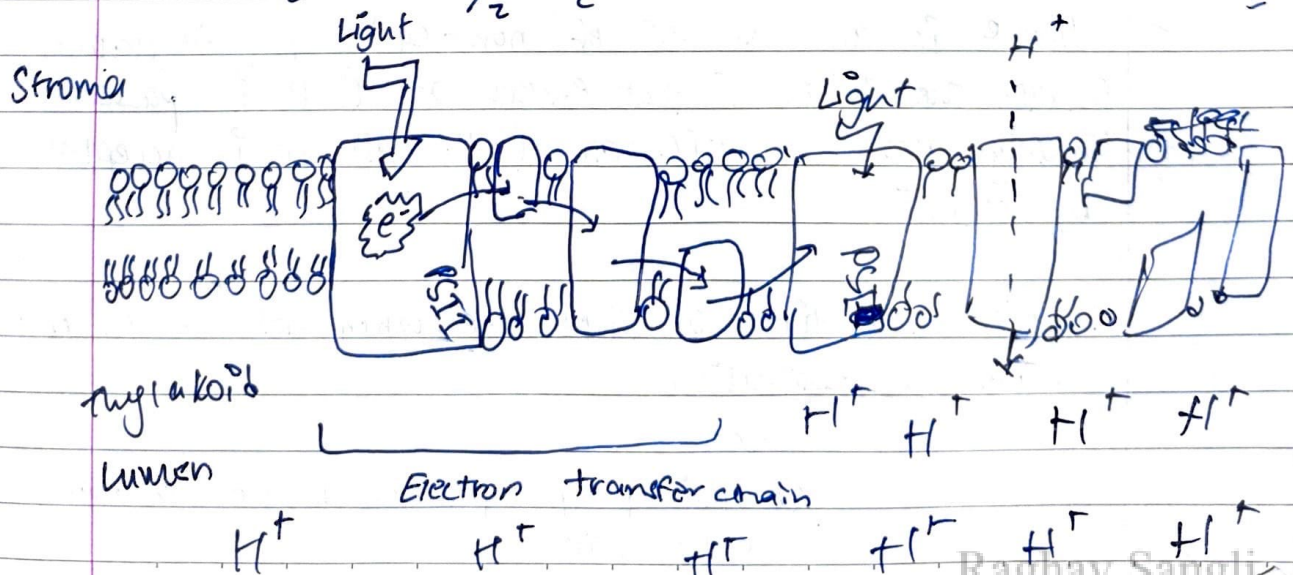
1. Accessory pigments absorb light & use it to excite an electron

2. electron passes to a reaction centre
↓
contains chlorophyll a
↓
3. Chlorophyll a absorbs light, under goes PHOTOIONISATION
↳ excited e^- released + enters electron transport chain.
↓
4. Electrons pass along the ETC, losing all the time, which is transferred to the proteins of the E.T.C
5. proteins use this energy to pump H^+ (produced by photolysis of water) from stroma ⟶ thylakoid space
↳ producing a concentration gradient of H^+ inside the thylakoid space

Light Dependant stage Drawing:

Light

$H_2O \longrightarrow \frac{1}{2} O_2 + 2H^+$



H^+ pass back across the membrane through an enzyme called ATP synthase. ATP synthase produces ATP from ADP and inorganic phosphate.

This is known as chemiasmosis.

→ Electrons from the E.T.C now enter PS I
→ Light excites the electrons & causes photoionisation of chlorophyll in P.S. I.

→ The released electrons enter another E.T.C
↳ energy released / used to pump H^+ into the thylakoid space

accepted by coenzyme called $NADP^+$
↳ combines with electrons and H^+ that flowed through the ATP synthase
↳ NADPH or reduced NADP formed

$NADP^+$ is reduced
↳ gain of electron

★ Above is an example of non-cyclic phosphorylation because the excited e^- that enters at PS II is passed linearly along the ETC and PS I until it is accepted by $NADP^+$

However under times of stress i.e when not enough ATP is made by respiration
↓
cyclic phosphorylation is used to make extra ATP

→ electron keeps being recycled through the ETC pumping H^+ ions into the thylakoid space creating a concentration gradient hence they travel through ATP synthase to create more ATP.

(1) No acceptance of an electron by $NADP^+$
(2) e^- returns to PS I and passes along ETC
(3) Hence no NADPH is made

↓

less light independant photosynthesis occurs.

The light Independant Stage : Calvin Cycle

uses products : ATP and reduced NADP

→ takes place in the Stroma

Purpose : makes glucose

The calvin cycle:

(1) Carbon dioxide is fixed to Ribulose bisphosphate (RuBP) (decarboxylation)

Carried out by RUBISCO

(2) An unstable 6C compound is formed

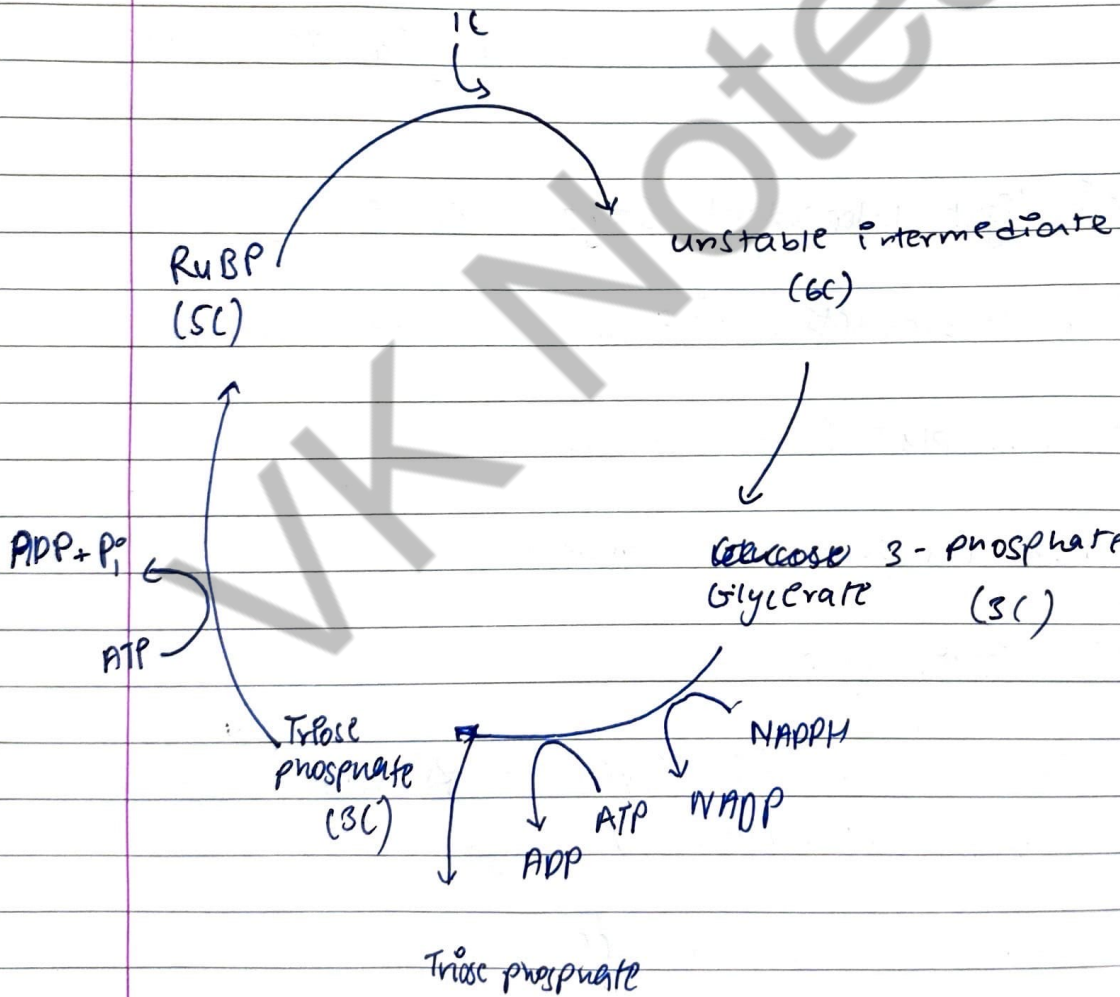
↓ &
immediately splits → 2 molecules of glycerate 3 - phosphate (GP)

- glycerate - 3 - phosphate is then reduced to triose phosphate with the presence of ATP and NADPH

- ATP provided energy
- NADPH provided H

Some are used to produce hexose e.g glucose

Calvin cycle



→ Photosynthesis is the fixation of CO_2 and its subsequent reduction to carbohydrate, using hydrogen from water, taking place in the chloroplast; where two reactions or

→ The photosynthetic pigments fall into two categories; primary pigments (chlorophylls) and accessory pigments (carotenoids) of which are arranged in light harvesting clusters called photosystems (I and II), where several hundred accessory pigment molecules surround a primary pigment molecule to pass absorbed light energy towards the reaction centre.