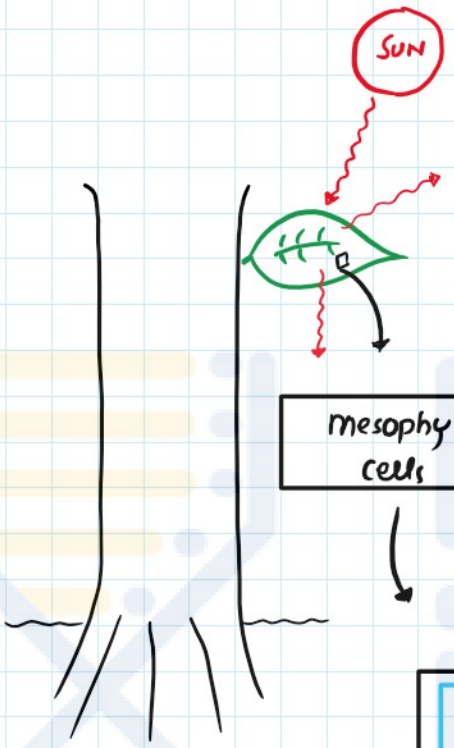
15.3 Light, Photosynthetic pigments, Light Reaction

LIGHT (380 – 750nm)
- Wave
- Particle

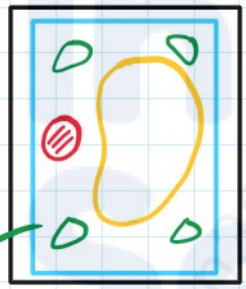
1% [. Absorption
99% [. Transmission
. Reflection

1 photon = 1e
Energy Packet

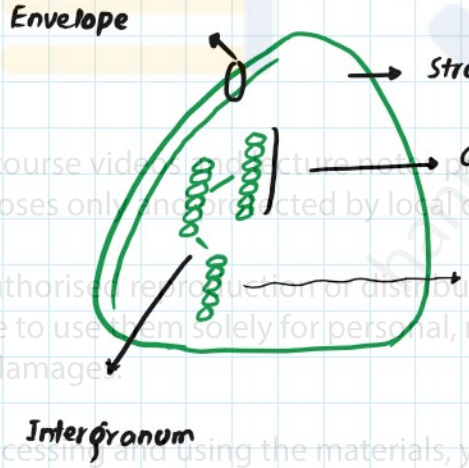
V I B G Y O R
Violet ↔ Red
E ↑↑ ; λ ↓↓
E ↓↓ ; λ ↑↑



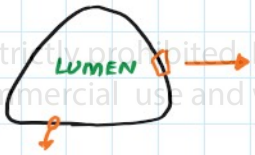
- SPECTROMETER (PHOTOSPECTROMER)
  - → Absorption Spectrum (Blue 430, Red 670)
  - → Action Spectrum → Photosynthesis

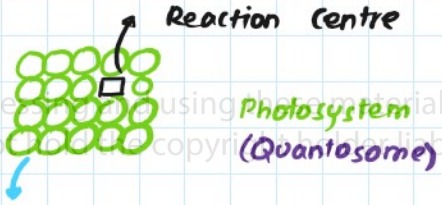


→ Mesophyll cells (Photosynthetic cells)
Chloroplasts → 20 – 100
. 0.5 million / mm² of leaf surface



- Photosystems
  - PS – I (700nm)
  - PS – II (680nm)





PHOTOSYNTHETIC PIGMENTS → That absorbs light

(V → B, O → R) → Absorb

least Absorbed ← G, Y, I

(B → V) → Absorb

CHLOROPHYLL
- Chl a
- Chl b

→ Plants

ACCESSORY PIGMENTS
- CAROTENOIDS (Red → Orange)
  - Attract for Pollination

- Chl a, Chl b → Plants
- Chl c, Chl d → Algae
- Chl e, f (Bacteriochlorophyll)

- CAROTENOIDS (Red → Orange) — Attracts for Pollination
- XANTHOPHYLLS (Yellow - Orange)
  - → Fucoxanthine ($C_{40}H_{56}O_6$)
  - → Lutin, Zeaxanthin ($C_{40}H_{56}O_2$)
- Carotenes ($C_{40}H_{56}$)
- β-carotene ↷ Vitamin A

LIGHT ABSORPTION PATTERN

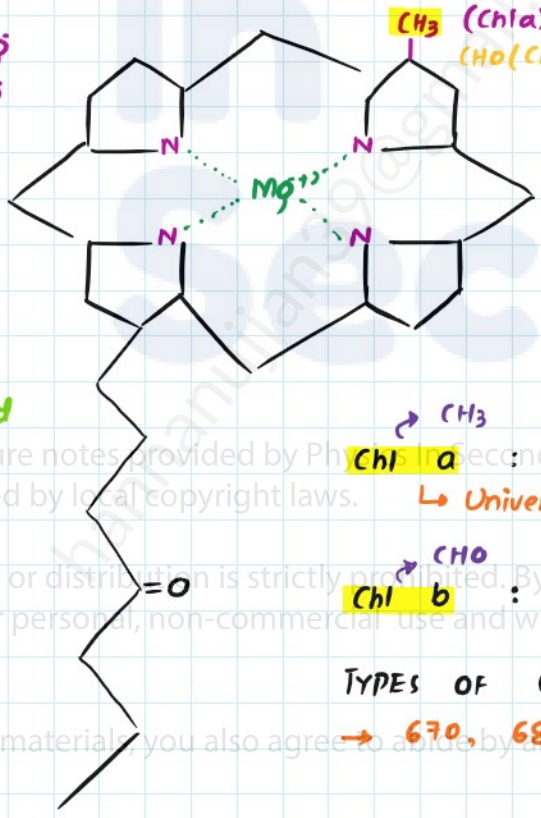
CAROTENOIDS → Chl b → Chl a → Most Sensitive pigment

CHLOROPHYLLS → Organic molecules
↳ Soluble in organic solvents

HEAD
- Tetrapyrrole Ring
- Porphyrrin Ring
- → Hydrophilic
- → Flat, Square
- → Light Absorbing

- Pyrrole Ring
- → Five cornered ring, unsaturated

- Haem of Hb is also a porphyrrin ring



TAIL
- Phytol chain (Main)
- Methyl ester
- → Hydrophobic
- → Long, Anchoring
- → Hydrocarbon

Phytol ($C_{20}H_{39}$) consists of four isoprene units

CH3 → Chl a : $C_{55}H_{72}O_5N_4Mg$ (BG)
↳ Universal Photosynthetic Pigment.

CHO → Chl b : $C_{55}H_{70}O_6N_4Mg$ (YG)

TYPES OF CHL. A.
→ 670, 680, 690, 700 nm

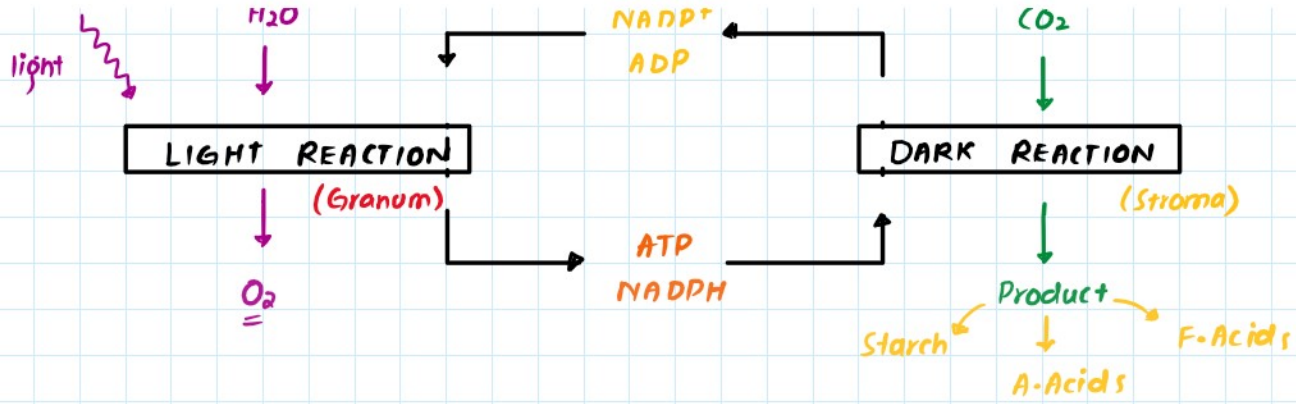
Chl. a Head Formula.

$C_{55}H_{72}O_5N_4Mg$
$C_{20}H_{39}$
$C_{35}H_{33}O_5N_4Mg$

Chl. b Head Formula.

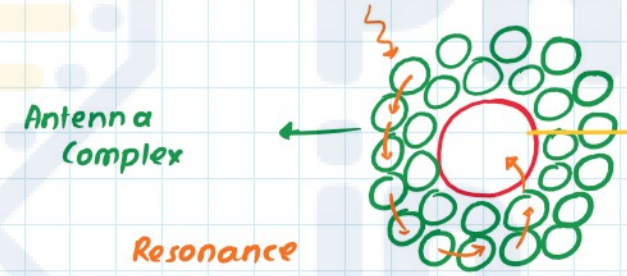
$C_{55}H_{70}O_6N_4Mg$
$C_{20}H_{39}$
$C_{35}H_{31}O_6N_4Mg$

light ↯ H_2O ↓ NADP+ ADP ← CO_2 ↓



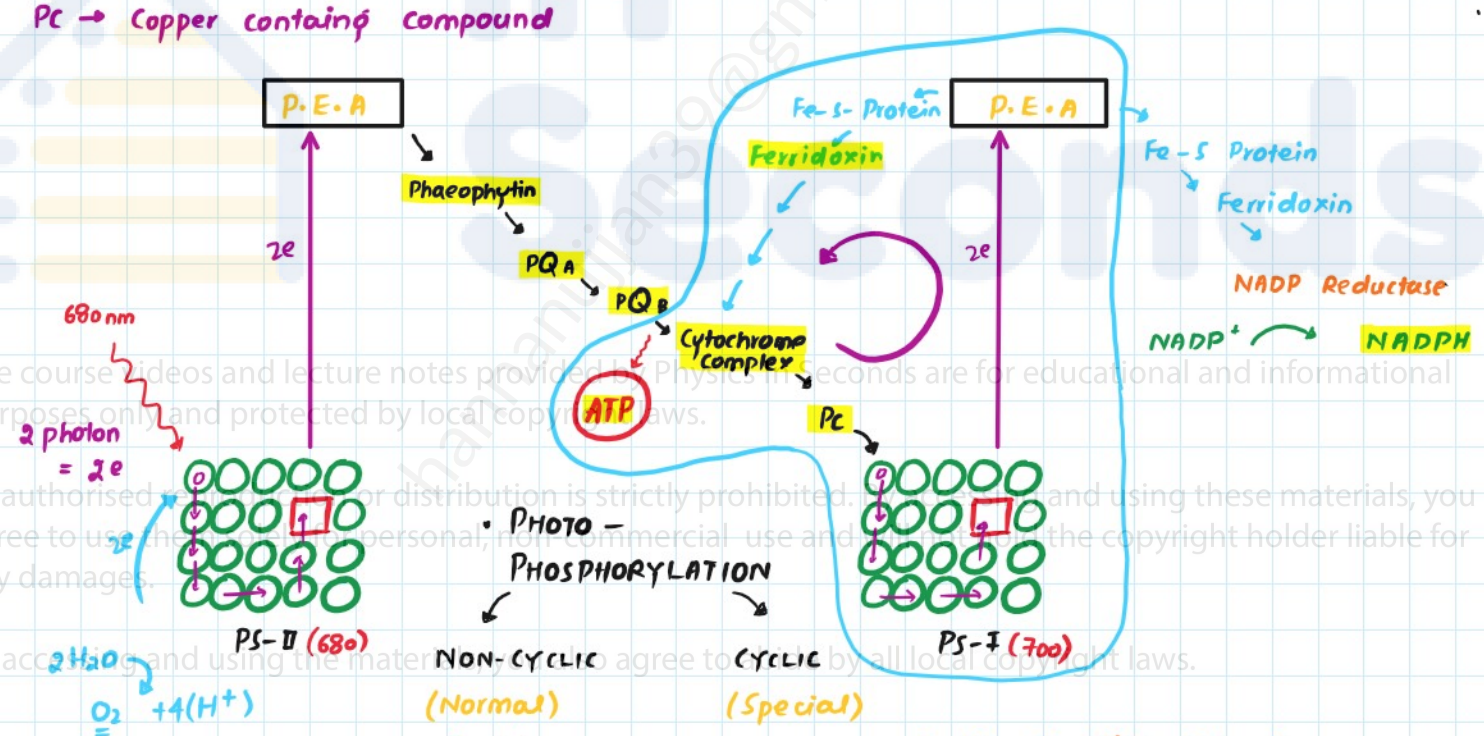
PHOTOSYSTEMS → Quantasome

- PS - I (700 nm)
- PS - II (680 nm)



Resonance

Pc → Copper containg compound



- PHOTO - PHOSPHORYLATION

NON-CYCLIC (Normal)	CYCLIC (Special)
→ Z-scheme	
Photosystems	
• PS I, II	PS - I
Products	
• ATP + NADPH	ATP
O_2 - release	
✓	×

- Cyclic Reaction Stimulus

ATP	(↓↓)
NADPH	(↑↑)