BIOLOGY

CLASS NOTES FOR CBSE

Chapter 13. Photosynthesis

01. Introduction

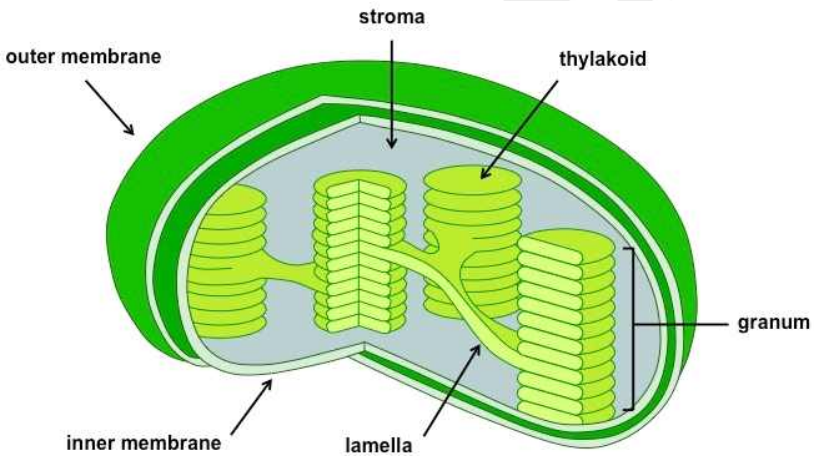
Autotrophic organisms have the ability to synthesise organic food from inorganic raw materials. In this process, they consume physical and chemical forms of energy. One such group of organisms are called **photoautotrophs.** They manufacture organic compounds, i.e. carbohydrates inside the chlorophyll containing cells from CO_2 by utilizing light energy. This process is known as **photosynthesis.** It takes place in plants, phytoplanktons, cyanobacteria, algae, etc. *A simple equation of photosynthesis is as follow*

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

02. Site of Photosynthesis

Chloroplasts

The most active photosynthetic tissue in higher plants in the mesophyll cells of leaves. These have many chloroplasts, which contain the specialised light absorbing pigment, the chlorophylls.



Structure of chloroplast

03. Photosynthetic Pigments

(i) **Chlorophylls**

It is a green pigment, which traps solar radiations and converts it into chemical energy. The molecular structure of chlorophyll consists of a porphyrin head (ring) and a phytol tail. Porphyrin head contains four pyrrol rings with one Mg–atom in its centre. It is the site of electron rearrangements when the chlorophyll is excited.

Phytol tail is a long hydrocarbon tail, which always remain attached to the ring structure. Phytol tail interacts with the hydrophobic regions of proteins. These proteins are present in thylakoids. Most of the chlorophyll molecules are found to be immersed in the hydrophobic core of the membrane. Chlorophyll can be of several types. These include Chl–*a,* Chl–*b,* Chl–*c,* Chl–*d,* Chl–*e,* bacteriochlorophyll–*a* and *b,* etc.

(a) **Chlorophyll-a** ($C_{55}H_{72}O_5N_4Mg$) It is a bluish–green pigment that reflects green light. It has a methyl group bonded to the porphyrin. Chl–*a* is the primary photosynthetic pigment.

(b) **Chlorophyll-*b*** ($C_{55}H_{70}O_6N_4Mg$) It is olive–green in colour. It has an aldehyde group instead of a methyl group bounded to the porphyrin. Chlorophyll–*a* and *b,* both are soluble in organic solvents like alcohol, acetone, etc.

(ii) **Carotenoids**

These are yellow, brown and orange pigments. These absorb light strongly in the blue–violet region. These prevent photo–oxidation of chlorophyll pigments. These are called **lipochromes** because of their fat–soluble nature. Chl–*b* carotenoids are also called as **accessory pigments.** They absorb light energy and transfer it to chlorophyll–*a.i*

(iii) Phycobilins (red and blue pigments)

These are proteinaceous pigments found in red algae and cyanobacteria. Phycobilins do not contain magnesium and phytol tail. These are soluble in hot water.

Differences between PS-and PS-II are as follows

Photosystem-I	Photosystem-II
Reaction centre is P_{700}, i.e. it absorbs 700nm wavelength.	Reaction centre is P_{680}, i.e. it absorbs 680 nm wavelength of light.
It is situated on the outer surface of thylakoid membrane. It is found on stroma lamellae also.	It is situated on the inner surface of thylakoid membrane.
It is involved in both cyclic and non-cyclic photo- phosphorylation.	It is involved in non–cyclic photo–phosphorylation only.

04. Process of Photosynthesis

It is a complicated oxidation–reduction process. In this, process oxidation of water and reduction of CO_2 takes place. Photosynthesis consists of two phases. i.e. photochemical phase or light reaction and biosynthetic phase or dark reaction.