

## 4. PHOTOSYNTHESIS IN HIGHER PLANTS

### SYNOPSIS

- The basis of life on earth is the utilization of sunlight by green plants to synthesize food by photosynthesis.
- Photosynthesis is the primary source of all food on earth and also releases oxygen into atmosphere.
- Photosynthesis is biophysical and biochemical process because the green plants synthesize carbohydrates, by using sunlight.
- The main requirements for photosynthesis are chlorophyll pigment, light,  $H_2O$  &  $CO_2$  and enzymes.
- The necessity of chlorophyll for photosynthesis can be understood by observing the positive iodine test for starch in green parts of variegated leaves.
- The necessity of  $CO_2$  for photosynthesis was experimentally demonstrated by Van Mohl through half leaf expt by using KOH (absorbs  $CO_2$ ).
- The evolution of oxygen by green plants was experimentally demonstrated by Joseph Priestley through belljar, mint plant, candle, mouse experiment.
- The essentiality of sun light for releasing  $O_2$  was demonstrated by Ingenhousz by repeating the experimental set up of Priestley and also through aquatic plant releasing oxygen containing air bubbles in the presence of light.
- The synthesis of glucose and its storage as starch in the green parts of plant body were established by Julius Van Sachs.
- The first action spectrum of photosynthesis was described by T.W. Englemann by taking the *Cladophora* (green alga) in the aerobic bacterial suspension and exposing to the split light and he observed that blue and red regions are the main regions where bacteria are more accumulated. It resembles more (or) less the absorption spectrum of chlorophyll a and b.
- The key features of photosynthesis is the reduction of  $CO_2$  to carbohydrate with hydrogen

of suitable oxidisable compound by using sun light. Cornelius Van Niel explained the above concept working on green and purple bacteria.

- Green plants release  $O_2$  in photosynthesis as the hydrogen donor is  $H_2O$  where as purple and green sulphur bacteria release sulphur because the hydrogen donor is  $H_2S$ .



(A = O/S)

- The correct equation for plant photosynthesis is



- 12  $H_2O$  are used in the above equation for the net production of one glucose molecule because to form the metabolic water with extra oxygen of 6  $CO_2$  molecules.
- Photosynthesis occurs in all green parts of plant body due to presence of chloroplasts.
- Chloroplasts are abundantly present in mesophyll cells of leaves along their walls to receive maximum sunlight.
- The chloroplasts align themselves with their flat surface parallel to the walls of mesophyll cells under normal incident light but become perpendicular under low light intensity.
- There is a clear division of labour within the chloroplast as to the absorption of light energy and its conversion into kinetic energy in the form of ATP,  $NADPH + H^+$  occur in the membranous system (thylakoids) while enzymatic incorporation of  $CO_2$  into sugars by utilizing ATP,  $NADPH + H^+$  takes place in stroma.
- The set of reactions that occur in membranous system are called light reactions because they are directly driven by light energy.
- The set of reactions that occur in the stroma are driven by the products of light phase (ATP, NADPH) but not directly by light and hence conventionally called dark phase (misnomer) and it is light dependent phase.
- Different shades of green colour in leaves are due to chl a, chl b, carotenes and xanthophylls.

## Mcq 4 Photosynthesis Std12

**Priti Singhal**



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