StdX

Photosynthesis

Dated-29.04.2020

What is photosynthesis?

Photosynthesis is the process by which living plant cells, containing chlorophyll, produce glucose ,from carbon dioxide and water using light energy.

Significance of photosynthesis

1. produces food for all
2. releases oxygen

Internal structure of chloroplast

1 minute, oval bodies with double membrane

2 presence of ground substance called stroma

3 presence of closely packed flattened sacs called thylakoids.

4 chlorophyll is present in the walls of thylakoid.

5 chlorophyll is composed of carbon, hydrogen, oxygen, nitrogen and magnesium.

Location of chloroplast

1 in palisade and spongy mesophyll cells

2 also found in guard cells and outer layers of young green stems.

Regulation of stomatal opening

Stomata remains open in presence of light to let in carbon di oxide but it causes transpiration. Therefore, transpiration is the price paid for photosynthesis.

K+ ion concentration theory

During day time, the chloroplast in the guard cells photosynthesize to produce ATP. The ATP produced is used to actively pump the potassium ions of the adjacent cells into the guard cells. The cells become hypertonic, so, water from adjacent cells is drawn in. The guard cells thus become turgid and the stomata is opened. Reverse happens at night. The K+ ions passively leaks out, which causes exosmosis. The guard cells become flaccid and the stomata gets closed.

Process of photosynthesis

1 sunlight is trapped by chlorophyll of the palisade mesophyll cells.

2 carbon dioxide enters through stomata by diffusion down a concentration gradient.

3 water is taken up by roots and sent up to the leaves by xylem.

Chemical equation representing photosynthesis

$6CO_2+12H_2O$------light energy and chlorophyll---------- à $C_6H_{12}O_6+6H_2O+6O_2$

Note : The 6 molecules of H2O liberated are reformed during a series of chain of reactions. These are not the 6 out of the reactants.

The process of photosynthesis involves two phases:

1 Light independent phase (light phase) 2 Light independent phase (dark phase)

Light dependent phaseLight reactions take place inthylacoidsof the chloroplast. It consist of following steps :+

1Activation of chlorophyll –chlorophyll a and b molecules get activated by absorbing photons.

2Photolysis-- à Absorbed energy is used to split water molecules into hydrogen ions(H^+) and hydroxyl ions (OH^-) and release electrons.

$2H_2O$----energy of 4 photons----- à $2H^+ + 2OH^-$

3 Evolution of molecular o_2 à The hydroxyl ions combine inpresence of enzyme catalase. The reaction ends in releasing H_2O, $O_2$and $4e^-$.

$2OH^- + 2OH^-$---- à $2H_2O + O_2 + 4e^-$

4Photophosphorylation à The 4 electrons released are absorbed by ADP. ADP then combines with inorganic phosphate (P_i) and gets converted into ATP.

5 Formation of NADPH à The H^+ions released during photolysis is picked by NADP.NADP gets activated and reduced to NADPH.

$NADP^+ + e^- + H^+$----enzyme-- à NAD

Lightindependentphase-- à (or dark phase or biosynthetic phase)

1 CO_2 is reduced to glucose. Fixation of CO_2 occurs in a series of steps. Each step is enzyme specific. This cyclic reaction is called Calvin cycle.

2 Energy required by the process is provided by ATP and NADPH formed during the light phase.

3 The reactions take place in the stroma of chloroplasts.

4 The glucose thus formed gets polymerised to form starch.

Assignment

1 Define photosynthesis.

2 Write down the significance of photosynthesis

3 Write down the exact location of chloroplast.

4 Explain the statement---transpiration is the price paid for photosynthesis.

5 Write down the balanced chemical equation representing photosynthesis.

6 What is photolysis? Name the products of photolysis.

7 Write down the fate of products formed during photolysis.

8 What is photophosphorylation?

9 Expand the term NADP.

10 Draw a labelled structure of chloroplast.