**CBSE TEST PAPER-03**

**CLASS - XI BIOLOGY**

**(Photosynthesis in higher plants)**

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**General Instruction:**

- All questions are compulsory.
- Question No. 1 to 3 carry one marks each. Question No. 4 to 6 carry two marks each. Question No. 7 and 8 carry three marks each. Question No. 9 carry five marks.

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1. Explain chlorophyll is an essential photosynthetic pigment?

2. What is the end product of light reaction?

3. Give examples of photosynthetic micro – organisms which also fixes atmospheric nitrogen?

4. Compare between chlorophyll ‘a’ and chlorophyll ‘b’?

5. What is kranz anatomy?

6. Give advantages of $C_4$ cycle over $C_3$ Cycle.

7. Distinguish between photo system – I and Photo system – II

8. How does temperature affect photosynthesis?

9. Explain the process of bio-synthetic phase of photosynthesis occurring in chloroplast.

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**[ANSWERS]**

Ans 01. Chlorophyll – b and other pigments of a reaction centre or photosystem absorb solar energy and transfer it to chlorophyll–a. Ultimately it is chlorophyll–a that initiates photosynthesis process.

Ans 02. ATP, $NADPH_2$ and $O_2$

Ans 03. Anabaena, Nostoc.

Ans 04.

| | Chlorophyll a | Chlorophyll b |
|---|---|---|
| 1. | Chlorophyll a has methyl group at the 3rd carbon position of II pyrrole ring of porphyrin head. | It has an aldhyde group at the 3rd carbon position of II pyrrole ring or porphyrin head. |
| 2. | It shows maximum absorption at 429 nm (blue) and 660 nm (red) wavelength. | It shaves maximum absorption at 453 nm (blue) and 642 nm (red) wavelengths. |
| 3. | It is highly soluble in petroleum, ether. | It is highly soluble in methyl alcohol. |
| 4. | It is blue – green in colors. | It is yellow green in colors. |

Ans 05. Kranz Anatomy – The anatomy in which, the vein of the leaf is surrounded by the bundle sheath containing a member of chloroplasts, having a bull form cells in upper epidermis is known as “Kranz anatomy”.

Ans 06.

(i) $C_4$ cycle is more efficient than $C_3$ cycle.

(ii) The photorespiration is lacking in $C_4$ plants.

(iii) $C_4$ cycle can use $CO_2$ at very low concentrations in comparison to $C_3$ plants.

(iv) $C_4$ cycle operates in plants adapted to high integrity of light, high temperature and low water availability, $C_3$ cycle cannot operate under these conditions at all.

Ans 07.

| | Photosystem – I | Photosystem – II |
|---|---|---|
| 1. | It is the cluster of pigment molecules which absorb light wavelengths at or below 700nm. | It is the cluster of pigment molecules which absorb light wavelength at or below 680nm. |
| 2. | The light absorbed by any pigment molecule of the cluster is transferred to P700, which is the reaction centre. | The light absorbed by any pigment molecule of the cluster is transferred to P680 which is the reaction centre. |
| 3. | It has a high ratio of chlorophyll – a to chlorophyll – b. | It contains relatively more chlorophyll – b than chlorophyll – a. |

Ans 08. The dark reactions are temperature controlled. The $C_4$ plants respond to higher temperatures, $C_4$ plants exhibit high rate of photosynthesis. $C_3$ have much low temperature optimum. Tropical plants have higher temperature for photosynthesis.

Ans 09. Biosynthetic phase (Dark Reaction) : The process by which carbon – dioxide is reduced to carbohydrates is known as carbon fixation in plants. The fixation of carbon takes place in the stroma of chloroplasts, by a series of enzyme – catalyzed reactions.
$C_3$ pathway: It is known as Calvin cycle. The path of carbon in the dark reaction was traced by Melvin Calvin through a technique called autoradiography, using 14C, hence this pathway is called Calvin cycle.
Calvin cycle consist of three phases:
(i) Carboxylation

(ii) Glycolytic reversal

(iii) Regeneration of RuBP.

(i) Carboxylation – Six molecules of Ribulose 1, 5 biphoshate react with six molecules of

carbon-dioxide to form six molecules of carbon dioxide to form six molecules of a short – lived 6C – compound. The reaction is catalysed by RuBP – carboxylase (Rubisco). The six molecules of the 6C – compound break into 12 molecules of 3-phosphoglyceric acid (PGA), a 3C – compound PGA is the first stable compound in this pathway.

(ii) Reduction – 12 molecules of phosphoglyceric acid are converted into 12 molecules of 1,3 diphosphoglycerate and then reduced to phosphogly acetaldehyde (PGAL) using ATP and NADPH molecules respectively. Two molecules of PGAL are diverted for the synthesis of sugar and then into the starch.

(iii) Regeneration of RuBP – For the cycle to continue, the primary acceptor of carbon-dioxide, i.e, RuBP has to regenerated 10 molecules of PGAL, by a series of complex reaction, are converted into 6 molecules of 5C – compound, RuBP. Formation of 6 molecules of RuBP requires six ATP molecules.