

Topic :- Photosynthesis in Higher Plants

- 1 (d)
12 extra ATP molecules are needed for production of one molecule of one molecule of hexose sugar in C₄-plant.
- 2 (d)
Movement of protons across the membrane to stroma.
Proton gradient is important because it is the break down of this gradient that leads to release of energy. The gradient is broken down due to movement of protons across the membrane to the stroma through the transmembrane channel of the F₀ of the ATPase. The energy released during the breaking down of proton gradient is used in formation of ATP
- 3 (d)
Chemical equation for photosynthesis can be shown as
$$\text{CO}_2 + 2\text{H}_2\text{O} \xrightarrow[\text{Chlorophyll}]{\text{Light energy (hv)}} (\text{CH}_2\text{O})_n + \text{H}_2\text{O} + \text{O}_2\uparrow$$

or
$$6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Chlorophyll}]{\text{(hv)}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2\uparrow$$

Glucose
- 4 (c)
Thylakoid membrane
- 5 (d)
RuBP carboxylase/ oxygenase (RUBISCO) is an enzyme present in the stroma of chloroplast. This enzyme is responsible for primary carboxylation in C₃-plants as a 5C sugar RuBP acts as carbon dioxide acceptor in the presence of this enzyme and produces 6C unstable compound which then splits into two molecules of 3-phosphoglyceric acid (3C compound), the first stable product of C₃-cycle.
- 6 (d)
Law of limiting factor was proposed by **F F Blackman** (1905). It stated that 'when a process is conditioned as to its rapidity by a number of separate factors, the rate of the process is limited by the pace of the slowest factor' (*i.e.*, factor present minimum amount).
- 7 (c)
Assimilation and reduction of carbon dioxide takes place during Calvin cycle. This cycle takes in only one carbon (as CO₂) at a time so it takes six turns to produce a hexose or glucose molecule (6 carbon). In Calvin cycle, for formation of one mole of hexose sugar

(glucose) 18 ATP and 12 NADPH₂ are used. The assimilatory power (NADPH₂ and ATP) are generated in light reaction of photosynthesis.

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(a)

In stroma, enzymatic reactions incorporate CO₂ into the plant leading to the synthesis of sugar, which in turn forms the starch

9

(b)

The process of photosynthesis in C₄-plants and CAM (crassulacean Acid Metabolism) is same. But instead of spatial separation of initial PEP case fixation and final RUBISCO fixation of carbon dioxide, the two steps occurs in the same cells but at different times, night and day, *e.g.*, *Opuntia*, pineapple, *Vanilla*. **PEP** (Phosphoenol Pyruvic Acid) is the first acceptor of carbon dioxide in CAM-plants like C₄-plants.

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(d)

PEP carboxylase or pepco is the special enzyme, which is found in the mesophyll cells of C₄-plant. Pepco is capable of fixing CO₂ more efficiently in C₄-plant than Rubisco, even in low CO₂ concentration

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(a)

Law of limiting factor was proposed by **Blackman** in 1905. He stated that when a process is conditional as to its rapidly by a number of separate factors, then the rate of the process is determined by the pace of slowest factor. Carbon dioxide is usually a limiting factor in photosynthesis under field conditions particularly on clear summer days under adequate water supply.

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(c)

PS or Photosystem is made of a reaction centre and an antenna molecule

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(a)

Chloroplasts are the green plastids which take part in photosynthesis and temporary or permanent storage of starch. These are discoid (disc-shaped) in higher plants with diameter of 4-6 μm and thickness of 2-4 μm.

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(b)

RuBPfixes one CO₂ molecule in C₃ plants with the help of enzyme Rubisco.

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(b)

Cyclic photophosphorylation involves only photo system-I and a few electron carriers. During cyclic photophosphorylation, ATP is formed but NADPH does not formed.

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(b)

Photosynthesis involves the conversion of light energy to chemical energy by photosynthetic pigments using water and carbon dioxide and producing carbohydrate.

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(c)

Plastoquinone transfer electron from photo system-II to photo system-I. Electrons released from P₇₀₀ or photo system-I moves through Fe-S, plastoquinone, cytochrome and plastocyanin and are recycled to P₇₀₀. In this process, only ATP is produced but no oxygen produced.

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(d)

The fact that C₃-plants respond to higher CO₂ concentration by showing increased rates of

photosynthesis leading to higher productivity has been used for some greenhouse crops such as tomatoes and bell pepper.

They are allowed to grow in carbon dioxide enriched atmosphere that leads to higher yields

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(a)

Copper is component or activator of plastocyanin, cytochrome oxidase, RuBP carboxylase and many other enzymes. It has major role in electron transfer, maintenance of carbohydrate, nitrogen balance and chlorophyll synthesis.

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	D	D	D	C	D	D	C	A	B	D
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	C	A	B	B	B	C	A	D	A