BIOLOGY

NEET

CRASH COURSE

PHOTOSYNTHESIS IN HIGHER PLANTS

SMART ACHIEVERS

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PHOTOSYNTHESIS IN HIGHER PLANTS

1. Green plants make their own food by photosynthesis.
2. During this process carbon dioxide from the atmosphere is taken in by leaves through stomata and used for making carbohydrates, principally glucose and starch.
3. Photosynthesis takes place only in the green parts of the plants, mainly the leaves.
4. Within the leaves, the mesophyll cells have a lame number of chloroplasts that are responsible for CO_2 fixation.
5. Photosynthesis has two stages: the light reaction and the carbon fixing reactions.
6. Within the chloroplasts, the membranes are sites for tile light reaction, while the chemosynthetic pathway occurs in the stroma.
7. In the light reaction the light energy is absorbed by the pigments present in the antenna and funnelled to special chlorophyll a molecules called reaction centre chlorophylls.
8. There are two photosystems, PS I and PS II.
9. PS I has a 700 nm absorbing chlorophyll a P_{700} molecule at its reaction centre, while PS II has a P_{680} reaction centre that absorbs red light at 680 nm.
10. After absorbing light, electrons are excited and transferred through PS II and PS I and finally to NADP forming NADPH.
11. During this process a proton gradient is created a cross the membrane of the thylakoid.
12. The breakdown of the protons gradient due to movement through the F_0 part of the ATPase enzyme releases enough energy for synthesis of ATP.
13. Splitting of water molecules is associated with PS II resulting in the release of O_2, protons and transfer of eledrons to PS II.
14. In the carbon fixation cycle, CO_2 is added by the enzyme, RuBisCO, to a 5-carbon compound RuBP that is converted to 2 molecules of 3-carbon PGA, This is then converted to sugar by the Calvin cycle and the RuBP is regenerated.
15. During this process ATP and NADPH synthesised in the light reaction are utilised.
16. RuBisGO also catalyses a wasteful oxygenation reaction in C_3 plants: photorespiration.
17. Some tropical plants show a special type of photosynthesis called C_4 pathway.
18. In these plant the first product of CO_2 fixation that takes place in the mesophyll, is a 4-carbon compound.
19. In the bundle sheath cells the Calvin pathway is carried out for the synthesis of carbohydrates.

EXERCISE

Q.1 Of the total amount of water absorbed by the plant, its actual percentage used during photosynthesis is
(1) 50% (2) 90% (3) 1% (4) 25%

Q.2 Oxygen during photosynthesis comes from water was proved by O^{18} experiment :-
(1) Ruben and Kamen (2) Hill (3) Warburg (4) Blackman

Q.3 Name of the scientist who pointed out the importance of different wavelengths of light using a green algae and aerobic bacteria :–
(1) Priestley (2) Ingen-Housz (3) K.V. thimann (4) Engleman

Q.4 Which of the following category of photosynthetic plants posses minimum transpiration ratio (TR).
(1) C_3-Plants (2) C_4-Plants (3) CAM-Plants (4) All the above

Q.5 The most effective wavelength of visible light in photosynthesis in the region of which of the following?
(1) Green (2) Yellow (3) Red (4) Violet

Q.6 Which step of non cyclic photophosphorylation is blocked by DCMU?
(1) Flow of e^- between PS I to Fd (2) Flow of e^- between cyto b_6 to cyto. f
(3) Flow of e^- between PC to PS I (4) Flow of e^- between PS II to PQ

Q.7 How many quanta are required to reduce one molecule of CO_2 and produce one molecule of O_2 in green plant photosynthesis?
(1) 1 (2) 8 (3) 16 (4) 32

Q.8 Photosynthesis is
(1) Oxidative, exergonic, catabolic (2) Redox-reaction, endergonic, anabolic
(3) Reductive, exergonic, anabolic (4) Reductive, endergonic, catabolic

Q.9 Which of the following carries out non-oxygenic photosynthesis?
(1) Cyanobacteria (2) Crab grass (3) Bacteria (4) Wheat plant

Q.10 Wavelength of light responsible for emerson's enhancement effect :–
(1) only 680 nm↑ (2) only 680 nm↓
(3) infra red wavelength (4) Both 680 nm↑ and 680 nm↓

Q.11 The "red - drop" phenomenon is due to the disruption of the photo chemical activity of
(1) PS - I (2) PS-I & PS-II both (3) PS - II (4) Carotenoids

Q.12 During photosynthesis, oxygen is evolved from :-
(1) H_2S (2) H_2O (3) CO_2 (4) HCO_3

Q.13 The process of photo-phosphorylation take place in
(1) Chloroplast (2) Ribosomes (3) Mitochondria (4) Cell-wall

Q.14 Photophosphorylation means synthesis of
(1) ATP from ADP (2) NADP (3) ADP from ATP (4) PGA

Q.15 Chlorophyll contains
(1) Fe (2) Mg (3) K (4) Mn

Q.16 The main site for dark reaction of photosynthesis is
(1) Stroma (2) Grana (3) Intergrana (4) Mitochondria

Q.17 What will be left if chlorophyll is burnt?
(1) Magnesium (2) Manganese (3) Iron (4) Sulphur

Q.18 Bacteriochlorophyll differs from chlorophyll 'a' in having
(1) One pyrrole nucleus with one hydrogen (2) One pyrrole nucleus with two hydrogen
(3) One pyrrole nucleus with three hydrogen (4) One pyrrole nucleus with four hydrogen

Q.19 In blue-green algae photosynthesis takes place in –
(1) Chloroplasts (2) Lamellisome (3) Heterocysts (4) Carotene

Q.20 The number of pigment molecules in quantasome is:
(1) 250 - 400 (2) 300 - 900 (3) 500 - 600 (4) 50 -100

Q.21 The main difference between chlorophyll 'a' and 'b' is:
(1) Chlorophyll 'a' is a linear chain compound and 'b' is branched chain
(2) Chlorophyll 'a' has no Mg^+ ion in center of molecule
(3) In chlorophyll 'a' there is $–CH_3$ group whereas in 'b' it is –CHO group
(4) All of the above

Q.22 In pigment system -I active chlorophyll is
(1) P-600 (2) P-680 (3) P-700 (4) P-720

Q.23 Basic structure of all chlorophyll comprises of
(1) Cytochrome system (2) Flavoproteins
(3) Porphyrin system (4) Plastocyanin

Q.24 What is the by product of bacterial photosynthesis?
(1) O_2 (2) H_2O (3) S (4) H_2S

Q.25 Photosynthetic bacteria do not contain
(1) PS - I (2) PS - II (3) PS - I or PS-II (4) Quantasome

Q.26 Photosynthetic units are referred as
(1) Quantasome (2) Oxysome (3) Phycobilisome (4) F_1 – particles

Q.27 Rubisco constitutes
(1) 4% of the chloroplast protein (2) 11% of the chloroplast protein
(3) 16% of the chloroplast protein (4) 25% of the chloroplast protein

Q.28 Splitting of water in photosynthesis is called :–
(1) Dark reaction (2) Photolysis (3) Electron transfer (4) Phototropism

Q.29 The product of hill reaction are :–
(1) ATP and $NADPH_2$ in chloroplast
(2) ATP and $NADPH_2$ in mitochondria
(3) Only oxygen
(4) A reduced substance $NADPH_2$, ATP and O_2 in chloroplast

Q.30 $NADPH_2$ is also called
(1) Real power (2) Oxidising agent
(3) Power house of energy (4) Reducing power

Q.31 In cyclic photophosphorylation which one of the following is formed
(1) NADP & ATP (2) ATP (3) $NADH_2$ and O_2 (4) $NADPH_2$, ATP and O_2

Q.32 Fixation of 1 CO_2 requires :–
(1) 6$NADPH_2$ & 3ATP (2) 2$NADPH_2$ & 3ATP
(3) 4 $NADPH_2$ & 3ATP (4) 5 $NADPH_2$ & 3ATP

Q.33 Which pigment system ultimately donates e^- for the reduction of NADP.
(1) PS II (2) PS I (3) CO_2 (4) Plastoquinone

Q.34 Photo - oxidation of chlorophyll is called
(1) Intensification (2) Chlorosis (3) Solarization (4) Defoliation

Q.35 The by product of photosynthesis is
(1) CO_2 (2) Oxygen (3) Energy (4) Sugar

Q.36 Pigment system–II occurs in
(1) Grana (2) Stroma (3) Matrix (4) Oxysomes

Q.37 Connecting link between light phase and dark phase of photosynthesis.
(1) Only ATP (2) Only $NADH_2$ (3) Only $NADPH_2$ (4) Both (1) and (3)

Q.38 Who proposed Z-scheme of light reaction
(1) Arnon (2) Calvin and Bensen
(3) Emmerson and Arnon (4) Blackman

Q.39 Which one of the following is a C_4 plant :–
(1) Papaya (2) Potato (3) Maize (4) Pea

Q.40 Carbon refixation in C_4 plants occurs in chloroplasts of :–
(1) Palisade tissue (2) Spongy Mesophyll (3) Bundle sheath cells (4) Gaurd cells

Q.41 "Kranz" type of Anatomy is found in :–
(1) C_4 plant (2) C_3 plant (3) Succulents (4) None of the above

Q.42 Carbon dioxide acceptor in C_4 plants is :–
(1) Phosphoenol pyruvic acid (PEP) (2) Ribulose-1, 5-di phosphate
(3) NADP (4) Ribulose-5 - phosphate

Q.43 Ribulosediphosphate carboxylase enzyme, catalyse the carboxylation reaction between
(1) CO_2 and ribulose-1, 5-diphosphate (2) Oxalloacetic acid and acetyl Co–A
(3) PGA and dihydroxyacetone phosphate (4)Ribulosediphosphate and phosphate glycerldehyde

Q.44 Which of the following is C-4 plants
(1) Maize (2) Atriplex (3) Sugarcane (4) All of the above

Q.45 C-4 plants are adapted to
(1) Hot and dry climate (2) Temperate climate
(3) Cold and dry climate (4) Hot and Humid climate

Q.46 In dark reaction, first reaction is the
(1) Carboxylation (2) Decarboxylation (3) Dehydrogenation (4) Deamination

Q.47 In addition to the 12 molecules of $NADP.H_2$ the energy required for the synthesis of one mole of hexose by C_3 and C_4 pathway is
(1) 18 molecules of ATP (2) 30 molecules of ATP
(3) 18 & 30 molecules of ATP respectively (4) 30 & 18 molecules of ATP respectively

Q.48 The first stable product of calvin cycle and HSK-cycle are
(1) 4-C and 3-C compounds (2) 4-C and 6-C compounds
(3) 3-C and 4-C compounds (4) 5-C and 4-C compounds

Q.49 Solarisation is a process in which :–
(1) Sugar are formed with the help of solar energy
(2) Chlorophyll is formed
(3) Destruction of chlorophyll and ultimate death of protoplasmic components
(4) Mobilization of light energy.

Q.50 Photorespiration in C_3 plants starts from :–
(1) Phosphoglycerate (2) Glycerate (3) Glycine (4) Phosphoglycolate

Q.51 Substrate for photorespiration is
(1) Serine (2) Glycolate (3) Indole acetic acid (4) Malic acid

Q.52 Photorespiration is favoured by
(1) Low light intensity (2) Low O_2 and high CO_2
(3) Low temperature (4) High O_2 and Low CO_2

Q.53 Drocera is a photosynthetic plant but still captures insects why ?
(1) Grown in N_2 rich soil
(2) Grown in N_2 deficient soil.
(3) It is connecting plant between plants and animals
(4) Insects helps in its pollination.

Q.54 Photorespiration does not occurs in
(1) C-4 plants (2) C-3 plants (3) C-2 plants (4) None of these

Q.55 Photosynthetic bacteria differ from green plants in
(1) Nature of their pigments (2) Type of electron donors
(3) Photosynthetic process being non oxygenic (4) All of the above

Q.56 In C_3 plants, the first stable product of photosynthesis during the dark reaction is
(1) Phosphoglycereldehyde (2) Malic acid
(3) Oxaloacetic acid (4) 3–phosphoglyceric acid

Q.57 In chloroplasts, chlorophyll is present in the
(1) Stroma (2) Outer membrane (3) Inner membrane (4) Thylakoids

AIIMS Special

Instructions for following questions (Q.58 to Q.82).

(1) If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

(2) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).

(3) If Assertion is true statement but Reason is false, then mark (3).

(4) If both Assertion and Reason are false statements, then mark (4).

Q.58 **Assertion :** In C_4 plants chloroplasts of bundle sheath cells are granai.
Reason : PS II is mostly found in appressed part of granum.

Q.59 **Assertion :** Dark reactions of photosynthesis are temperature controlled processes.
Reason : Most of the reactions are enzymatic in nature.

Q.60 **Assertion :** Dark acidification c.cytoplasm occurs in CAM plants.
Reason : Organic acids are decarboxylated during night.

Q.61 **Assertion :** Assimila tory power in photosynthesis is generated in ETS occuring in thylakoid membrane.
Reason : They are needed for CO_2 reduction.

Q.62 **Assertion :** Light harvesting complexes (LHC) on thylakoid membrane broaden the range of light absorption.
Reason : They transfer e^- to reaction centre.

Q.63 **Assertion :** Photorespiration is a wasteful phenomenon in C_3-plants.
Reason : Decrease in photosynthetic productivity due to photorespiration.

Q.64 **Assertion :** For evolution of O_2 in photosynthesis, PS-II is required.
Reason : O_2 is released in photosynthesis, of Chromatium.

Q.65 **Assertion :** O_2 is not released in photosynthesis of bacteria.
Reason : Photolysis of water is absent in bacterial photosynthesis.

Q.66 **Assertion :** All plants are not photosynthetic.
Reason : Leaves are large in all types of plants.

Q.67 **Assertion :** The first product of CO_2 fixation in C_4 plants is OAA.
Reason : Oxaloacetic acid is formed in agranal chloroplast.

Q.68 **Assertion :** Daily preodicity of stomatal movement is not character of CAM plants.
Reason : In CAM plants stomata are closedat night and day.

Q.69 **Assertion :** Amaranthus and sugarcane are called as Hatch and Slack plants.
Reason : One glucose forms by fixation of $6CO_2$ in these plants.

Q.70 **Assertion :** Mangnese is important for Hill reaction.
Reason : Photolysis of water occurs in the presence of manganese.

Q.71 **Assertion :** Bacterial photosynthesis occurs in presence of oxygen.
Reason : Bacteria has only PS-II.

Q.72 **Assertion :** Photosynthetically C_4 plants are better than C_3 plants.
Reason : Photorespiration absent in C_4 plants.

Q.73 **Assertion :** Red drop occur above 680 nm light.
Reason : PS-II becomes inactive above 680 nm of light.

Q.74 **Assertion :** C_4-plants are more efficient than C_3-plants.
Reason : C_4-plants are photorespiratory plants.

Q.75 **Assertion :** Oxygen does not release in bacterial photosynthesis.
Reason : e^- donar is CO_2 in bacterial photosynthesis.

Q.76 **Assertion :** Photosynthetic bacteria do not release oxygen gas in photosynthesis.
Reason : Photosynthetic bacteria do not absorb light energy.

Q.77 **Assertion :** C_3-plants photosynthetically more efficient than C_4-plants.
Reason : CO_2 inhibits photosynthesis in C_3 plants.

Q.78 **Assertion :** Evolution of O_2 is not linked with bacterial photosynthesis.
Reason : Bacteria absorb the I-R spectrum.

Q.79 **Assertion :** C_4-plants are most efficient photosynthetic plants of todays.
Reason : Photorespiration does not occurs in C_4-plants.

Q.80 **Assertion :** Photophosphorylation is the only process of generation of ATP in plants.
Reason : Light energy converted into stable chemical energy during photophos-phorylation.

Q.81 **Assertion :** Photorespiration is also known as glyoxilate cycle.
Reason : Substrate for photorespiration is glyoxylic acid.

Q.82 **Assertion :** The only product of light reaction, required in dark reaction are $NADPH_2$ and ATP.
Reason : Dark reaction occurs in night only.

Q.14 With reference to factors affecting the rate of photosynthesis, which of the following statements is not correct? **[AIPMT 2017]**
(1) Light saturation for CO_2 fixation occurs at 10% of full sunlight.
(2) Increasing atmospheric CO_2 concentration up to 0.05% can enhance CO_2 fixation rate
(3) C_3 plants respond to higher temperatures with enhanced photosynthesis while C_4 plants have much lower temperature optimum.
(4) Tomato is a greenhouse crop which can be grown in CO_2 enriched atmosphere for higher yield.

Q.15 Which of the following facilitates opening of stomatal aperture? **[AIPMT 2017]**
(1) Contraction of outer wall of guard cells
(2) Decrease in turgidity of tuard cells
(3) Radial orientation of cellulose microfibrils in the cell wall of guard cells
(4) Longitudinal orientation of cellulose microfibrils in the cell wall of guard cells

ANSWER KEY

Q.1	3	Q.2	1	Q.3	4	Q.4	3	Q.5	3	Q.6	4	Q.7	2
Q.8	2	Q.9	3	Q.10	4	Q.11	3	Q.12	2	Q.13	1	Q.14	1
Q.15	2	Q.16	1	Q.17	1	Q.18	2	Q.19	2	Q.20	1	Q.21	3
Q.22	3	Q.23	3	Q.24	3	Q.25	2	Q.26	1	Q.27	3	Q.28	2
Q.29	4	Q.30	4	Q.31	2	Q.32	2	Q.33	2	Q.34	3	Q.35	2
Q.36	1	Q.37	4	Q.38	1	Q.39	3	Q.40	3	Q.41	1	Q.42	1
Q.43	1	Q.44	4	Q.45	1	Q.46	1	Q.47	3	Q.48	3	Q.49	3
Q.50	4	Q.51	2	Q.52	4	Q.53	2	Q.54	1	Q.55	4	Q.56	4
Q.57	4	Q.58	4	Q.59	1	Q.60	3	Q.61	2	Q.62	3	Q.63	1
Q.64	3	Q.65	1	Q.66	3	Q.67	3	Q.68	4	Q.69	2	Q.70	1
Q.71	4	Q.72	1	Q.73	1	Q.74	3	Q.75	3	Q.76	3	Q.77	4
Q.78	2	Q.79	1	Q.80	4	Q.81	4	Q.82	3				