	INDIAN SCHOOL AL WADI AL KABIR	
Class: XI	**Department: SCIENCE 2023-24** **SUBJECT: BIOLOGY**	**Date of submission:** **24.11.2023**
Worksheet: 11 with answers	**CHAPTER: PHOTOSYNTHESIS IN HIGHER PLANTS**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT	**CLASS & SEC:**	**ROLL NO.**

MULTIPLE CHOICE QUESTIONS (1M)

1. Photosynthetic pigments found in the chloroplasts occur in

a) Chloroplast envelope

b) Matrix

c) Plastoglobules

d) Thylakoid membranes

2. Which of the following pigments acts as a reaction-center during photosynthesis?

a) Cytochrome

b) P700

c) Carotene

d) Phytochrome

3. In photosynthesis, energy from light reaction to dark reaction is transferred in the form of

a) Chlorophyll

b) ATP

c) ADP

d) RuDP

4. In photosystem I, the first electron acceptor is

a) Plastocyanin

b) Cytochrome

c) Ferredoxin

d) An iron-Sulphur protein

5. In the leaves of C4 plants malic acid formation during carbon dioxide fixation occurs in the cells of

a) Mesophyll

b) Epidermis

c) Phloem

d) None of these

6. Stroma in the chloroplasts of higher plants contains

a) Light-independent reaction enzymes

b) Ribosomes

c) Chlorophyll

d) Light-dependent reaction enzymes

7. CAM helps the plant in

a) Reproduction

b) Disease resistance

c) Secondary growth

d) Conserving water

8. A process that makes an important difference between C3 and C4 plants is

a) Photorespiration

b) Photosynthesis

c) Transpiration

d) Glycolysis

9. Which element is located at the center of the porphyrin ring in chlorophyll?

a) Magnesium

b) Manganese

c) potassium

d) calcium

10. In Hatch and slack pathway, the primary carbon dioxide acceptor is

a) Phosphoenolpyruvate

b) Phosphoglyceric acid

c) Oxaloacetic acid

d) Rubisco

2 MARKS QUESTIONS

11. Write the significance of light reaction in photosynthesis.

12. How does Kranz anatomy favor C_4 plants?

13. How do photosynthetic bacteria such as Cyanobacteria conduct photosynthesis in the absence of chloroplasts?

14. Define accessory pigments. State their significance in photosynthesis.

15. Name the pigment that causes the red color in tomato and chilies. Is the pigment a photosynthetic pigment?

16. Explain why is the color of a leaf in the dark changes? Which pigment do you think is more stable?

3 MARKS QUESTIONS

17. Does photosynthesis occur in leaves only? If no, what are the other parts that can carry out photosynthesis? Justify.

18. List the location in the cell where the following reactions take place during the process of photosynthesis.

a) Synthesis of NADPH and ATP

b) Photolysis of water

c) CO_2 fixation

d) Synthesis of sugar molecule

e) Synthesis of starch

19. Name the pigment that is responsible for its ability to initiate the process of photosynthesis. The rate of photosynthesis is higher in the red and blue regions of the spectrum of light, why?

LONG ANSWER TYPE QUESTIONS (5Marks)

20. Does photosynthesis occur in leaves only? If no, what are the other parts that are capable of carrying out photosynthesis? Justify.

21. Why photorespiration does not take place in C4 plants?

CASE STUDY #1

Light reactions or the 'Photochemical' phase include light absorption, water splitting, oxygen release, and the formation of high-energy chemical intermediates, ATP, and NADPH. Several protein complexes are involved in the process. The pigments are organized into two discrete photochemical light harvesting complexes (LHC) within the Photosystem I (PS I) and Photosystem II (PS II). These are named in the sequence of their discovery, and not in the sequence in which they function during the light reaction. The LHC are made up of hundreds of pigment molecules bound to proteins. Each photosystem has all the pigments (except one molecule of chlorophyll a) forming a light harvesting system also called antennae. These pigments help to make photosynthesis more efficient by absorbing different wavelengths of light. The single chlorophyll a molecule forms the reaction centre. The reaction centre is different in both the photosystems. In PS I the reaction centre chlorophyll a has an absorption peak at 700 nm, hence is called P700, while in PS II it has absorption maxima at 680 nm and is called P680.

1.) Identify the actions, which are not includes in light phase of photosynthesis

a.) Splitting of water molecule

b) Combustion of oxygen

c) ATP formation

d) Oxygen release

2.) Photosynthesis is _____

a) Destructive process

b) Energy releasing process

c) Energy trapping process

d) None of the above

3.) Name the pigment which is referred as reaction centre?

4.) Give reason – Why photosystem 1 is named as P700?

5.) Give reason – Why photosystem 2 is named as P680?

6.) Explain how photosynthetic pigments are arranged?

CASE STUDY #2

The splitting of water is associated with the PS II; water is split into 2H+, [O] and electrons. This creates oxygen, one of the net products of photosynthesis. The electrons needed to replace those removed from photosystem I are provided by photosystem II. Water splitting complex is associated with the PS II, which itself is physically located on the inner side of the membrane of the thylakoid.

Cyclic and Non-cyclic Photo-phosphorylation

Living organisms have the capability of extracting energy from oxidisable substances and store this in the form of bond energy. Special substances like ATP, carry this energy in their chemical bonds. The process through which ATP is synthesised by cells (in mitochondria and chloroplasts) is named phosphorylation. Photo-phosphorylation is the synthesis of ATP from ADP and inorganic phosphate in the presence of light. When the two photosystems work in a series, first PS II and then the PS I, a process called non-cyclic photo-phosphorylation occurs. The two photosystems are connected through an electron transport chain. Both ATP and NADPH + H+ are synthesised by this kind of electron flow.

When only PS I is functional, the electron is circulated within the photosystem and the phosphorylation occurs due to cyclic flow of electrons. A possible location where this could be happening is in the stroma lamellae. While the membrane or lamellae of the grana have both PS I and PS II the stroma lamellae membranes lack PS II as well as NADP reductase enzyme. The excited electron does not pass on to NADP+ but is cycled back to the PS I complex through the electron transport chain. The cyclic flow hence, results only in the synthesis of ATP, but not of NADPH + H+ . Cyclic photophosphorylation also occurs when only light of wavelengths beyond 680 nm are available for excitation.

1.) Photolysis of water or splitting of water molecule takes place in _____

a) Photosystem PS I

b) Photosystem PS II

c) Photosystem PS III

d) Both PS I and PS II

2.) Water molecule splits into_____ in presence of light.

a) Hydrogen, Nitrogen and Electrons

b) Hydrogen, Oxygen and Protons

c) Hydrogen, Oxygen and Neutrons

d) Hydrogen, Oxygen and Electrons

3.) By which mechanism two photosystem can be connected and work in series?

4.) Define phosphorylation and Photo-phosphorylation.

5.) Name the cell organelles in which the process of phosphorylation is carried out.

Answer key

1) d
2) b
3) b
4) d
5) a
6) a
7) d
8) a
9) a
10))
11) Produces assimilatory power – ATP and NADPH
12) Necessary for C4 pathway and thus avoids photorespiration.

A.13. They are prokaryotes containing photosynthetic pigments in a membranous form that are primitive in nature, that can trap and use solar energy. Hence they can carry out photosynthesis.

14. They are chlorophyll-b, xanthophyll, and carotenoids and are also referred to as photosynthetic pigments. They aid in accumulating solar radiations and passing them onto chlorophyll-a. They are not directly involved in the emission of excited electrons. While doing so, this pigment itself absorbs maximum radiations at regions – blue and green. Hence chlorophyll-a is the main pigment and other pigments are accessory pigments (chlorophyll-Ai, xanthophyll, and carotenoid)

15. Pigment lycopene imparts the red color to them. Because of the presence of chromoplasts in plants, it gives rise to different colors. It is a kind of plastid that develops different colored pigments that are not photosynthetic.

16. The color of leaf stored in dark changes from green to pale green or yellow in color. This is mainly because of the absence of sunlight and chlorophyll pigment. In the dark or during the absence of light, photosynthesis does not take place, therefore there is no synthesis of starch and chlorophyll pigment. The most stable pigment is chlorophyll a.

A.17. The process of photosynthesis primarily occurs in leaves of all green plants. The leaves are designed in such a way that they capture sunlight and convert solar energy into chemical energy effectively. However, in some plants, modified parts other than leaves carry out photosynthesis. In some plants, roots develop chlorophyll and initiate photosynthesis, they are referred to as assimilatory roots. Example – Tinospora, Trapa. The stem in some plants such as the Opuntia gets modified and adapts to perform the functions of leaves, be turning thick, succulent and flattened, performing photosynthesis, these structures are referred to as phylloclade. In Australian Acacia, the petiole takes the shape and function of photosynthesis when stamina of leaf fails.

A.18.a) Outer side of the thylakoid membrane

b) The inner side of the thylakoid membrane

c) Stroma of chloroplast

d) Chloroplast

e) Cytoplasm

A.19. The thylakoid membranes contain the chlorophyll pigments which have the property of excitability and emits e– in the excited stage, though it is replaced and transferred by the e– produced from splitting of water molecules. Chlorophyll pigments absorb the maximum energy possessed by the red and blue light, thereby getting excited and initiating photosynthesis. Its wavelength lies between the PAR (Photosynthetic Active Radiation). Hence the rate is higher in the red and blue regions.

A.20. The process of photosynthesis primarily occurs in leaves of all green plants. The leaves are designed in such a way that they capture sunlight and convert solar energy into chemical energy effectively. However, in some plants, modified parts other than leaves carry out photosynthesis. In some plants, roots develop chlorophyll and initiate photosynthesis, they are referred to as assimilatory roots. Example – Tinospora, Trapa. The stem in some plants such as the Opuntia gets modified and adapts to perform the functions of leaves, be turning thick, succulent and flattened, performing photosynthesis, these structures are referred to as phylloclade. In Australian Acacia, the petiole takes the shape and function of photosynthesis when stamina of leaf fails.

A.21. Photorespiration is related to C_3 cycle, where plants lose carbon dioxide fixation because of the increase in the concentration ion of oxygen and modification in the nature of the activity of RuBP carboxylase oxygenase. C_4 plants have developed a mechanism to avoid the loss of carbon dioxide. There is not a direct contact of RuBP carboxylase oxygenase as C_3 cycle functions in bundle sheath cells. The enzyme PEP carboxylase in mesophyll cells carries out carbon dioxide fixation, wherein oxaloacetate is formed which is converted to

Answer key for Case Study #1

1) b

2) c

3.) Chlorophyll – a pigment is referred as reaction centre.

4.) In PS I the reaction centre chlorophyll a has an absorption peak at 700 nm, hence it is named as P700.

5.) In PS II the reaction centre chlorophyll a has an absorption maxima at 680 nm, hence it is named as P680.

6.) The pigments are organised into two discrete photochemical light harvesting complexes (LHC) within the Photosystem I (PS I) and Photosystem II (PS II). The LHC are made up of hundreds of pigment molecules bound to proteins. Each photosystem has all the pigments (except one molecule of chlorophyll a) forming a light harvesting system also called antennae.

Answer key for Case Study #2

1.) b

2.) d

3.) The two photosystems are connected through an electron transport chain, which makes them work in series.

4.) Phosphorylation is the process through ATP molecules are synthesised by cells.

5.) Photo-phosphorylation is the synthesis of ATP from ADP and inorganic phosphate in the presence of light.

6.) Mitochondria and chloroplasts are the cell organelles in which the process of phosphorylation is carried out. malic acid which is passed to bundle sheath cells where carbon dioxide is utilized in the Calvin cycle that functions in bundle sheath cells of C_3 plants.

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