# CHAPTER 13: PHOTOSYNTHESIS IN HIGHER PLANTS

**ONE MARK QUESTIONS:**

1. Define Photosynthesis. (K)
2. Which is the ultimate source of energy for all living organisms? (K)
3. Who provided the evidence to show that glucose is produced when plants grow?(K)
4. Where are the photosynthetic pigments located?(K)
5. Which is the hydrogen donor to reduce $co_2$ in green plants?(K)
6. Which is the hydrogen donor to reduce $co_2$ in purple and green sulphur bacteria?(K)
7. Who showed that the $o_2$ evolved by the green plants comes from water and not from $co_2$?(K)
8. Give the equation that represents the overall process of photosynthesis.(K)
9. Which is the site of photosynthesis in green plants?(K)
10. The chloroplasts align themselves along the walls of mesophyll cells. Why?(K)
11. Expand the abbreviation ATP(K)
12. Expand the abbreviation NADP(K)
13. Where does the light reaction of photosynthesis occur?(K)
14. Where does the dark reaction of photosynthesis occur?(K)
15. What is the membrane system of chloroplast called?(K)
16. Name the fluid filled region of chloroplast?(K)
17. Which is the chief photosynthetic pigment in higher plants?(K)
18. Give the wavelength of light at which maximum photosynthesis occurs. (K)
19. What do you mean by accessory pigments?(K)
20. Expand the abbreviation LHC(K)
21. Why the reaction centre of PSI is called P-700?(K)
22. Why the reaction centre of PS-II is called P-680?(K)
23. What is a reaction centre?(K)
24. What are antenna molecules?(K)
25. What are cytochromes?(K)
26. Which is the source of electrons for P-680of PS-II in the Z scheme of electron transport?(K)
27. What is a proton gradient?(K)
28. Which is the primary $co_2$ acceptor in dark reaction?(K)
29. Why calvin cycle is also called $c_3$-pathway?(K)
30. Which is the first stable compound produced in calvin cycle?(K)
31. How many $CO_2$ molecules are required to make one molecule of glucose through Calvin cycle? (K)
32. Expand the abbreviation PGA(K)
33. Name the key enzyme at $co_2$ reduction in calvin cycle.(K)
34. Expand the abbreviation RuBisCo. (K)
35. What is the type of anatomy found in the leaves of $c_4$ plants?(K)
36. What is the first stable compound in $c_4$ pathway?(K)
37. Why Hatch-slack pathway is also called $c_4$ pathway?(K)
38. Which is the primary carbon di oxide acceptor in $c_4$ pathway?(K)
39. By looking at which internal structure of a plant, one can tell whether it is $c_3$ or $c_4$ plant?(K)
40. What is photorespiration?(K)
41. Where do you find RuBisCo in the $c_4$ plants?(K)
42. Where does $C_3$ cycle occur in $C_4$ plants? (K)
43. State the Blackman's law of limiting factor (K)

44. How to identify $c_4$ plant?(K)
45. Name the enzyme responsible for carboxylation of PEP during $C_4$ cycle. (K)
46. Tomatoes and Bell peppers yield better when grown in greenhouses. Why?(A)
47. Engelmann in his experiment used *Cladophora*-a green alga and aerobic bacteria .What is the use of bacteria in the experiment? (U)
48. What are pigments?(K)
49. Which process helps in replacing the electrons removed from PSI to PSII?(U)
50. Name a simple procedure used to separate leaf pigments. (K)

**TWO MARKS QUESTIONS:**

1. Explain an experiment to show that photosynthesis takes place only in green parts of the plant.(U)
2. Draw a labelled diagram of a chloroplast. (S)
3. Mention the two main steps of photosynthesis. (K)
4. Mention the names of photosynthesis pigments. (K)
5. What is a photosystem? Mention its components(K)
6. Draw a neat labelled diagram of light harvesting complex. (S)
7. What is light harvesting complex? (K)
8. Explain how oxygen is evolved by splitting of water. (U)
9. Why ATP and NADPH are called reducting powers. (K)
10. Explain why non cyclic photophosphorylation (z-scheme) occurs only in grana lamellae but not in stroma lamellae. (U)
11. Only ATP molecules are produced in cyclic phosphorylation, but not NADPH. Why?(A)
12. What are the requirements for chemiosmosis to occur?(K)
13. Mention the end products of light reaction. (K)
14. Even though dark reaction is not light dependent, it is indirectly dependent on the light. Discuss(A)
15. RuBisCo is an enzyme that acts both as carboxylase and oxygenase. Justify(A)
16. How many molecules of ATP and NADPH are required to produce one molecule of Glucose? (K)
17. Name the two different carboxylase enzymes involved in $c_4$ pathway.(K)
18. RuBisCo has affinity towards both $co_2$ and $o_2$.Discuss (A)
19. Mention the internal factors that influence the rate of photosynthesis. (K)
20. Mention the external factors that influence the rate of photosynthesis. (K)
21. Photosynthesis is important for two reasons. What are they?
22. Name the hydrogen donor of green plants and purple and green sulphur bacteria. (K)
23. Most of the photosynthesis takes place in the blue and the red regions of the spectrum, however some photosynthesis does take place at other wavelengths of the visible spectrum. Explain(U)
24. List the events of photochemical phase. (K)
25. Write differences between PSI and PSII(U).
26. What is phosphorylation? Where does it take place?(K)
27. Write the functions of $F_0$ and $F_1$ of the ATPase enzyme. (K)

**THREE MARKS QUESTIONS:**

1. Explain half leaf experiment to show the necessity of $c0_2$ for photosynthesis(U)
2. During Priestley's experiment , when he kept only the mouse and the burning candle, mouse died and candle extinguished after sometime. why? (A)

3. During Priestly's experiment , whe he kept a mint plant with the mouse and the burning candle ,mouse stayed alive and the candle continued to burn.Why?(A)
4. Explain the experiment of Jon Ingenhousz to show to liberation of oxygen during photosynthesis(U)
5. Explain the experiment of T.W Engelmann to show that plants absorb blue and red light for photosynthesis(U)
6. Explain the necessity of presence of pigments other than chlorophyll-a even though they are not directly involved in the light reaction (A)
7. During Chemiosmotic method of ATP synthesis along with the protons released from water , additional protons from the matrix are transported to the lumen of the thylakoids.Dicuss (A)
8. Explain "KRANZ" anatomy found in the leaves of $c_4$ plants(U)
9. Photorespiration doesnot occur in c4 plants .why?(K)
10. Photorespiration occurs only in $c_3$ plants but not in $c_4$ plants.why?(K)
11. $C_4$ plants shows chloroplast dimorphism .Discuss(A)
12. Productivity of $c_4$ plants is more than $c_3$ plants. How? (K)
13. Even though only few mesophyll cells involve in bio synthetic calvin pathway among $c_4$ plants they are more productive.Discuss (A)
14. Suppose a plant has high concentrations of chlorophyll-b, xanthophylls and carotenoids. It lack chlorophyll-a, can it carry out photosynthesis. Then why do the plants have these pigments?
15. List the events of 'Z' scheme(K)
16. Name the two parts of ATPase enzyme. What are their roles?(U)
17. The possible location of cyclic photophosphorylation is stroma lamellae. Justify with reasons.(U)

**FIVE MARKS QUESTIONS:**

1. Explain the bell jar experiment of Priestly to demonstrate the role of air in growth of green plants(U)
2. Explain the Z scheme of light reaction(U)
3. Give the schematic representation of the Z scheme(S)
4. Explain the non cyclic photophosphorylation(U)
5. Explain the cyclic photophosphorylation(U)
6. Mention the differences between cyclic and non cyclic photophosphorylations(U)
7. Explain the chemiosmotic hypothesis of ATP-synthesis(U)
8. Give the schematic representation to show ATP –synthesis through chemiosmosis.(S)
9. What is a proton gradient? How is it formed between the lumen of the thylakoid and stroma of the chloroplast?(U)
10. Give the schematic representation of calvin cycle or Give the schematic representation of $c_3$ cycle (S)
11. Explain Calvin cycle or $c_3$ cycle(U)
12. Give the schematic representation of $c_4$ pathway or hatch-slack pathway (S)
13. Explain $c_4$ pathway or Hatch-slack pathway of $co_2$ reduction(U)
14. In $c_4$ pathway carboxylation occurs twice .Discuss(A)
15. The $c_3$ pathway occurs in the bundle sheath cells of $c_4$ plants but not in the mesophyll cells.Discuss(A)
16. Explain the differences between $c_3$and $c_4$ plants(U)
17. $C_4$ plants are more efficient photosynthetically than $c_3$ plants-Justify (A)
18. Explain the Blackman's law of limiting factor by taking the example of light as one of the factor (U)
19. Explain the factors influencing the rate of photosynthesis(U)
20. Calvin pathway occurs in all the mesophyll cells of $c_3$ plants. In the $c_4$ plants, it does not take place in the mesophyll plants but only in the bundle sheath cells. Justify (U)