CLASS XI BIO CH-11

MCQ Set 2: Photosynthesis in Higher Plants

1. Who performed experiments revealing the essential role of air in the growth of green plants?
a) Jan Ingenhousz
b) Joseph Priestley
c) Julius von Sachs
d) Melvin Calvin

2. Ingenhousz identified the bubbles formed around green parts of aquatic plants in bright sunlight as:
a) Carbon dioxide
b) Oxygen
c) Nitrogen
d) Hydrogen

3. Julius von Sachs provided evidence for the production of which sugar when plants grow?
a) Fructose
b) Sucrose
c) Glucose
d) Maltose

4. The first action spectrum of photosynthesis was described by:
a) T.W Engelmann
b) Julius von Sachs
c) Joseph Priestley
d) Jan Ingenhousz

5. The empirical equation for photosynthesis given in the text is:
a) $CO_2+H_2O+\text{Light} \rightarrow [CH_2O]+O_2$
b) $C_6H_{12}O_6+6O_2 \rightarrow 6CO_2+6H_2O$
c) $6CO_2+6H_2O \rightarrow C_6H_{12}O_6+6O_2$
d) $CO_2+H2O \rightarrow \text{Carbohydrates}$

6. Who demonstrated that photosynthesis is a light-dependent reaction where hydrogen reduces CO_2 to carbohydrates?
a) Melvin Calvin
b) Cornelius van Niel
c) Joseph Priestley
d) Jan Ingenhousz

7. The correct equation for photosynthesis, as proved by radioisotopic techniques, shows that the $O2$ released comes from:
a) Carbon dioxide
b) Water
c) Glucose
d) Minerals

8. In green plants, photosynthesis takes place in:
a) Roots only
b) Leaves only
c) All green parts
d) Stem only

9. Within the chloroplast, the membrane system includes:
a) Grana and stroma
b) Grana, stroma lamellae, and stroma
c) Stroma only
d) Thylakoid only

10. The division of labor within the chloroplast involves the membrane system trapping light energy and synthesizing:
a) Sugars
b) ATP and NADPH
c) Proteins
d) Lipids

11. The pigments are organized into light-harvesting complexes within:
a) Mitochondria
b) Photosystem I and II
c) Stroma
d) Grana only

12. Which pigment is yellow green in the chromatogram?
a) Chlorophyll a
b) Chlorophyll b
c) Xanthophylls
d) Carotenoids

13. The wavelengths at which chlorophyll a shows maximum absorption are:
a) Green and yellow
b) Blue and red
c) Violet and orange
d) Yellow and red

14. Accessory pigments enable a wider range of wavelength to be utilized for photosynthesis and:
a) Increase water absorption
b) Protect chlorophyll a from photo-oxidation
c) Enhance CO_2 fixation
d) Reduce photorespiration

15. Light reactions do NOT include:
a) Water splitting
b) Oxygen release
c) Sugar synthesis
d) ATP formation

16. The reaction centre in PS I is called:
a) P680
b) P700

c) P650
d) P750

17. The reaction centre in PS II is called:
a) P680
b) P700
c) P650
d) P750

18. The electron transport chain in light reaction consists of:
a) Ribosomes
b) Cytochromes
c) ATP synthase
d) RuBisCO

19. The Z scheme describes the:
a) Path of carbon fixation
b) Transfer of electrons
c) Synthesis of ATP
d) Regeneration of RuBP

20. The splitting of water produces:
a) H^+, O_2, , and electrons
b) H_2 and O_2
c) H_2O and CO_2
d) ATP and NADPH

21. The products of light reaction used in the biosynthetic phase are:
a) ATP and NADPH
b) ATP and O_2
c) NADPH and O_2
d) CO_2 and H_2O

22. The synthesis of ATP in the presence of light is called:
a) Photolysis
b) Photophosphorylation
c) Photorespiration
d) Phosphorylation

23. Non-cyclic photophosphorylation involves:
a) Only PS I
b) Only PS II
c) Both PS I and PS II
d) Neither PS I nor PS II

24. Cyclic photophosphorylation results in the synthesis of:
a) ATP only
b) NADPH only
c) Both ATP and NADPH
d) Sugars

25. The chemiosmotic hypothesis involves the creation of a proton gradient across the:
a) Mitochondrial membrane

b) Thylakoid membrane
c) Nuclear membrane
d) Plasma membrane

26. The proton gradient is broken down by the movement of protons through:
a) Cytochrome
b) ATP synthase
c) RuBisCO
d) PEPcase

27. The biosynthetic phase is dependent on the products of the light reaction, namely:
a) ATP and NADPH
b) ATP and O_2
c) NADPH and O_2
d) CO_2 and H_2O

28. The first CO_2 fixation product in the Calvin cycle is:
a) 3-phosphoglyceric acid
b) Oxaloacetic acid
c) Ribulose bisphosphate
d) Phosphoenol pyruvate

29. The primary CO_2 acceptor in the Calvin cycle is:
a) PEP
b) RuBP
c) PGA
d) OAA

30. The enzyme that catalyzes the carboxylation of RuBP is:
a) PEPcase
b) RuBisCO
c) ATP synthase
d) Cytochrome

31. For each CO_2 molecule fixed in the Calvin cycle, the number of ATP and NADPH required are:
a) 2 ATP and 2 NADPH
b) 3 ATP and 2 NADPH
c) 2 ATP and 3 NADPH
d) 3 ATP and 3 NADPH

32. To produce one molecule of glucose, the Calvin cycle must turn how many times?
a) 2
b) 6
c) 8
d) 12

33. C_4 plants are adapted to:
a) Temperate regions
b) Dry tropical regions
c) Aquatic regions
d) Arctic regions

34. The special leaf anatomy in C_4 plants is characterized by:
a) Palisade cells
b) Spongy mesophyll
c) Kranz anatomy
d) Vascular bundles

35. The primary CO_2 acceptor in C_4 plants is:
a) RuBP
b) PEP
c) PGA
d) OAA

36. The enzyme that fixes CO_2 in the mesophyll cells of C_4 plants is:
a) RuBisCO
b) PEPcase
c) ATP synthase
d) Cytochrome

37. Photorespiration is prevalent in:
a) C_3 plants
b) C_4 plants
c) Both C_3 and C_4 plants
d) Neither

38. RuBisCO can bind to:
a) CO_2 only
b) O_2 only
c) Both CO_2 and O_2
d) Neither CO_2 nor O_2

39. Blackman's Law of Limiting Factors states that the rate of a process is determined by the factor which is:
a) At its maximum value
b) Nearest to its minimal value
c) Always light
d) Always temperature

40. The major limiting factor for photosynthesis under normal conditions is:
a) Light
b) Temperature
c) CO_2 concentration
d) Water

41. Light saturation for photosynthesis occurs at what percentage of full sunlight?
a) 5%
b) 10%
c) 50%
d) 100%

42. C_4 plants achieve saturation at a CO_2 concentration of about:
a) 180 $\mu l L^{-1}$
b) 360 $\mu l L^{-1}$

c) 450 µlL⁻¹
d) 500 µlL⁻¹

43. C_4 plants have a temperature optimum that is:
a) Lower than C_3 plants
b) Higher than C_3 plants
c) The same as C_3 plants
d) Not related to temperature

44. Water stress affects photosynthesis by:
a) Directly inhibiting the light reactions
b) Causing stomatal closure
c) Denaturing enzymes
d) Breaking down chlorophyll

45. The first product of CO_2 fixation in C_4 plants is:
a) PGA
b) OAA
c) RuBP
d) PEP

46. In C_4 plants, the Calvin cycle takes place in the:
a) Mesophyll cells
b) Bundle sheath cells
c) Epidermal cells
d) Guard cells

47. The number of carbon atoms in the primary CO_2 acceptor in C_3 plants is:
a) 3
b) 4
c) 5
d) 6

48. The number of carbon atoms in the primary CO_2 fixation product in C_4 plants is:
a) 3
b) 4
c) 5
d) 6

49. Photorespiration leads to the release of:
a) O_2
b) CO_2
c) N_2
d) H_2O

50. The most abundant enzyme on Earth is:
a) PEPcase
b) ATP synthase
c) RuBisCO
d) Cytochrome

Answer Key for Set 2

1. b) Joseph Priestley
2. b) Oxygen
3. c) Glucose
4. a) T.W Engelmann
5. a) $CO_2+H_2O \rightarrow Light[CH_2O]+O_2$
6. b) Cornelius van Niel
7. b) Water
8. c) All green parts
9. b) Grana, stroma lamellae, and stroma
10. b) ATP and NADPH
11. b) Photosystem I and II
12. b) Chlorophyll b
13. b) Blue and red
14. b) Protect chlorophyll a from photo-oxidation
15. c) Sugar synthesis
16. b) P700
17. a) P680
18. b) Cytochromes
19. b) Transfer of electrons
20. a) H^+ , O_2 , and electrons
21. a) ATP and NADPH
22. b) Photophosphorylation
23. c) Both PS I and PS II
24. a) ATP only
25. b) Thylakoid membrane
26. b) ATP synthase
27. a) ATP and NADPH
28. a) 3-phosphoglyceric acid
29. b) RuBP
30. b) RuBisCO
31. b) 3 ATP and 2 NADPH
32. b) 6
33. b) Dry tropical regions
34. c) Kranz anatomy
35. b) PEP
36. b) PEPcase
37. a) C_3 plants
38. c) Both CO_2 and O_2
39. b) Nearest to its minimal value
40. c) CO_2 concentration
41. b) 10%
42. b) 360 $\mu l L^{-1}$
43. b) Higher than C_3 plants
44. b) Causing stomatal closure
45. b) OAA
46. b) Bundle sheath cells
47. c) 5
48. b) 4

49. b) CO_2
50. c) RuBisCO