

NCERT: Chapter 13
PHOTOSYNTHESIS IN HIGHER PLANTS

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INTRODUCTION

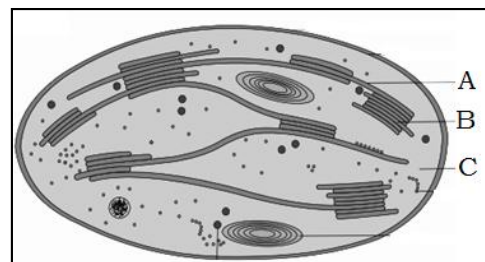
1. Robert Hill added _____ salt which is _____ a/an form.
 - 1) Ferrous, oxidized
 - 2) Ferrous, reduced
 - 3) Ferric, reduced
 - 4) Ferric, oxidized
2. Cyclic & non-cyclic Photophosphorylation was first suggested by:
 - 1) Van Niel
 - 2) Robert Hill
 - 3) Arnon
 - 4) Ruben & Kamen
3. Van Neil found that purple sulphur bacteria used hydrogen sulphide and released sulphur. Which of the following interpretations agrees with the above observations?
 - 1) Hydrogen which reduces CO₂ comes from H₂O which releases O₂.
 - 2) The sulphur which reduces CO₂ comes from H₂S which releases H₂.
 - 3) Photosynthesis consists of light and dark reaction.
 - 4) Photosynthesis does not require chlorophyll.
4. ____ is a chemoautotrophic sulphur bacterium.
 - 1) Chromatium
 - 2) Chlorobium
 - 3) Thiobacilli
 - 4) Ferrobacilli
5. What is common for photosynthetic protista & prokaryotes?
 - 1) Use chloroplast to synthesize food
 - 2) Metabolize H₂S
 - 3) Use chemical energy to synthesize food
 - 4) Use solar energy to synthesize food
6. _____ used the word assimilatory power for substances produced in light reaction.
 - 1) Arnon
 - 2) Ruben & Kamen
 - 3) Calvin
 - 4) R. Hill
7. Identify the false statement from the following –
 - 1) All autotrophs are self-sufficient
 - 2) All green plants are autotrophic
 - 3) All autotrophs are photosynthetic
 - 4) All photosynthetic autotrophs are chlorophyllous.
8. What is the difference between nitrifying bacteria & BGA?
 - 1) Former is chemosynthetic & latter photosynthetic
 - 2) Former is photosynthetic & latter chemosynthetic
 - 3) Former shows thylakoids & latter does not
 - 4) Former does not have chloroplast & latter does

9. Photosynthesis is _____.
- 1) Catabolic and reductive
 - 2) Catabolic and oxidative
 - 3) Anabolic and reductive
 - 4) Catabolic and exothermic
10. Van Niel observed that Green S. bacteria use _____ as a source of H_2 .
- 1) H_2O
 - 2) H_2S
 - 3) $NADPH_2$
 - 4) $NADH_2$
11. Find the odd one out –
- 1) Nitrosomonas
 - 2) Thiobacillus
 - 3) Chlorobium
 - 4) Ferrobacillus
12. Which of the following is not required for Hill reaction?
- 1) Sun light
 - 2) Chlorophyll
 - 3) Water
 - 4) Carbon dioxide
13. In the investigation and understanding of the photosynthetic reactions, the heavy isotopes ^{18}O and ^{14}C were used respectively by:
- 1) Robert Hill and Blackman
 - 2) Ruben, Kamen and Martin/ Calvin
 - 3) Emerson and Calvin
 - 4) Calvin and Arnon.
14. _____ is a photoautotrophic purple sulphur bacteria.
- 1) Chromatium
 - 2) Chlorobium
 - 3) Thiobacilli
 - 4) Ferrobacilli
15. Ruben & Kamen used _____ to confirm Hill's reaction.
- 1) O^{18}
 - 2) O^{16}
 - 3) C^{12}
 - 4) C^{14}

16. Alternative method of CO_2 fixation was 1st reported by –
- 1) Hatch & Slack
 - 2) Calvin
 - 3) Kortshak
 - 4) Hatch, slack & Kort-shak
17. Who confirmed the source of O_2 , liberated in Photosynthesis?
- 1) Hill
 - 2) Ruben and Kamen
 - 3) Arnon
 - 4) Blackman

SITE OF PHOTOSYNTHESIS

18. Identify A, B and C in given figure



- 1) A- Stroma wall, B- Grana, C- Stroma
 - 2) A- Stoma lamella, B- Grana, C- Stroma
 - 3) A- Stroma lamella, B- Stroma, C- Grana
 - 4) A- Starch grain, B- Stroma, C- Grana
19. Granum shows _____ reaction.
- 1) Biochemical
 - 2) Physical
 - 3) Photo chemical
 - 4) Dark reaction
20. (i) Chloroplast contains DNA
(ii) Chloroplast is self – replicating & semi – autonomous
- 1) (i) is true & (ii) is false
 - 2) (i) is false & (ii) is true
 - 3) (i) is reason for (ii)
 - 4) (ii) is reason for (i)
21. The organized units which bring about photophosphorylation in green plants are the:
- 1) Ribosomes
 - 2) Lysosomes
 - 3) Quantasomes
 - 4) Centrosomes

22. Which of the following is not correct?
- 1) Thylakoids contain quantasomes
 - 2) Thylakoids contain pigment systems I & II.
 - 3) Quantasome and photosystems are arranged alternate.
 - 4) PS I and PS II constitute quantasome.

PHOTOSYNTHETIC PIGMENTS

23. Molecular formula of chlorophyll a is –

- 1) $C_{55}H_{70}O_6N_4Mg$
- 2) $C_{55}H_{72}O_5N_4Mg$
- 3) $C_{40}H_{56}$
- 4) $C_{40}H_{56}O_2$

24. Typical chlorophyll molecule has _____ head.

- 1) Pyrrole
- 2) Porphyrin
- 3) Phytol
- 4) Pheophytin

25. In the grana of chloroplasts, the carotenoids –

- 1) Form part of PS-II only
- 2) Form part of PS-I only
- 3) Protect chlorophyll against photooxidation
- 4) Protect xanthophylls against light

26. _____ is a major carotene found in plant tissues which is orange yellow in colour.

- 1) β carotene
- 2) Lutein
- 3) α carotene
- 4) Phycocyanin

27. Identify true statement w.r.t. chlorophyll –

- 1) Activated chlorophyll goes to excited state
- 2) In excited state chlorophyll develops negative charge
- 3) It can remain in ionized state for minimum 10^{-9} sec.
- 4) All are false statements.

28. The head of chlorophyll is in protein part of:

- 1) Fret membrane
- 2) Fret channel

- 3) Thylakoid membrane
- 4) Stroma lamellae

29. Core complex of photosystem -II contains:

- 1) Chl-a 650
- 2) Chl-a 673
- 3) Chl-a 680
- 4) Chl-a 700

30. How many chlorophyll molecules are present in a reaction centre?

- 1) 1
- 2) 20
- 3) 50
- 4) 200

31. A typical chlorophyll molecule has _____ tail.

- 1) Pyrrole
- 2) Porphyrin
- 3) Phytol
- 4) Pheophytin

32. Energy content of photon is _____ to wavelength.

- 1) Directly proportional
- 2) Inversely proportional
- 3) Equal
- 4) Unpredictable

33. Photons are also known as light –

- 1) Quantasome
- 2) Quanta
- 3) Oblate particles
- 4) Waves

34. Carotenoids are _____.

- 1) Widely distributed in chloroplastids but sparsely in chromoplastids
- 2) Widely distributed in chromoplastids & sparsely distributed in chloroplastids
- 3) Soluble in organic solvents like alcohol & benzene
- 4) Orange & yellow coloured proteins

35. Which one of the following is not correct about chlorophyll?

- 1) The porphyrin head of chlorophyll molecule has a central atom of magnesium.
- 2) The phytol tail is hydrophobic.

- 3) The phytol tail is lipophobic.
 4) The head is embedded in the protein layer and tail is in the lipid layer.
36. The molecular formula of xanthophyll is _____.
- 1) $C_{40}H_{56}$
 - 2) $C_{40}H_{56}O_2$
 - 3) $C_{55}H_{72}O_5 N_4 Mg$
 - 4) $C_{55}H_{70}O_6 N_4 Mg$
37. Energy content of photon is _____ to wavelength.
- 1) Directly proportional
 - 2) Inversely proportional
 - 3) Equal
 - 4) Unpredictable
38. Little absorption of light takes place in –
- 1) Green
 - 2) Yellow, Orange
 - 3) Blue, Red
 - 4) Violet, Red
39. A number of carotenoids in LHC is –
- 1) 1
 - 2) 20
 - 3) 50
 - 4) 200
40. Visible spectrum is also called as _____.
- 1) PAR
 - 2) RAP
 - 3) ARP
 - 4) RAQ
41. $C_{55}H_{72}O_5N_4Mg$ is –
- 1) Absent in PS-II
 - 2) The reaction centre in PS-I and PS-II
 - 3) The reaction centre only in PS-I
 - 4) The accessory pigment in all photosynthetic organisms
42. In the thylakoid lamellae, the heads of the chlorophyll molecules extend into the aqueous protein layer because the heads –
- 1) Are proteolytic
 - 2) Have Mg in the centre of the porphyrin ring
 - 3) Are hydrophilic
 - 4) Are lipophilic.
43. PS II & PS I are represented by _____ & _____ respectively.
- 1) P_{700} ; P_{680}
 - 2) P_{680} ; P_{700}
 - 3) P_{390} ; P_{760}
 - 4) P_{760} ; P_{390}
44. Visible light ranges from _____ $m\mu$ to _____ $m\mu$.
- 1) 360, 790
 - 2) 390, 760
 - 3) 3600, 7900
 - 4) 3900, 7600
45. Molecular formula of carotene is –
- 1) $C_{55} H_{70} O_6 N_4 Mg$
 - 2) $C_{55} H_{72} O_5 N_4 Mg$
 - 3) $C_{40} H_{56}$
 - 4) $C_{40} H_{56} O_2$
46. Xanthophylls are _____ carotenes.
- 1) Hydrolysed
 - 2) Deoxygenated
 - 3) Oxygenated
 - 4) Oxidised
47. _____ are widely distributed in chloroplasts and chromoplasts.
- 1) Chlorophylls
 - 2) Carotenoids
 - 3) Phycobilins
 - 4) Anthocyanin
48. How many chlorophyll- a molecules are present in light harvesting complex?
- 1) 1
 - 2) 20
 - 3) 50
 - 4) 200
49. In chl.a long phytol tail is attached to _____ pyrrole ring.
- 1) 1st
 - 2) 2nd
 - 3) 3rd
 - 4) 4th
50. Molecular formula of Chlorophyll b is –

- 1) $C_{55} H_{70} O_6 N_4 Mg$
 2) $C_{55} H_{72} O_5 N_4 Mg$
 3) $C_{40} H_{56}$
 4) $C_{40} H_{56} O_2$
51. Choose the incorrect one –
 1) Chl a is blue green with $C_{55} H_{70} O_6 N_4 Mg$
 2) Chl a is blue green with $C_{55} H_{72} O_5 N_4 Mg$
 3) Chl. b is yellow green with $C_{55} H_{70} O_6 N_4 Mg$
 4) Xanthophyll is yellow with $C_{40} H_{56} O_2$
52. Choose the correct one –
 1) Chl.a is blue green with $C_{55} H_{70} O_6 N_4 Mg$
 2) Chl.a is blue green with $C_{55} H_{72} O_5 N_4 Mg$
 3) Chl.b is yellow green with $C_{55} H_{70} O_5 N_4 Mg$
 4) Xanthophyll is yellow with $C_{40} H_{56}$.
53. Phycobilins are found in –
 1) BGA and all algae
 2) BGA & green algae
 3) BGA & brown algae
 4) BGA & Red algae
54. Long non-polar phytol tail is a chain of alcohol attached to ____ pyrrole ring –
 1) 1st
 2) 2nd
 3) 3rd
 4) 4th
55. Centre of the head of chlorophyll molecule shows –
 1) Non-ionic Mg
 2) Ionic – Mg
 3) Non – ionic Mn
 4) Ionic – Mn
56. Identify true statement –
 1) The phytol tail is polar
 2) The phytol tail is a chain of alcohol
 3) The phytol tail is attached to 3rd pyrrole ring
 4) Chlorophyll b is the essential pigment
57. Core complex of photosystem -I contains--
 1) Chl-a 650
 2) Chl-a 673
 3) Chl-a 680

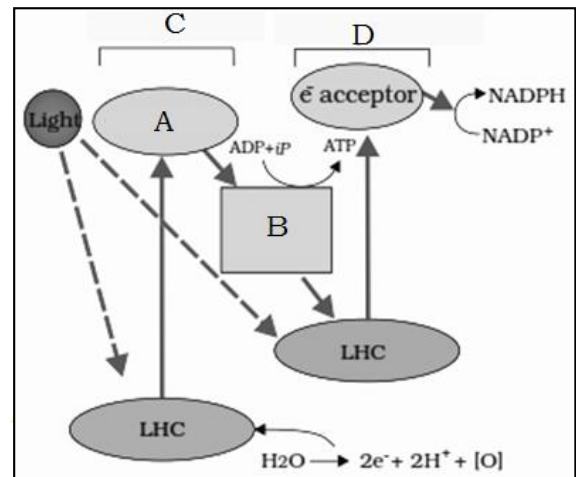
4) Chl-a 700

58. Chlorophyll a, c, d & e are found in –

- 1) Higher plants
 2) Protista
 3) Prokaryotes
 4) Algae

LIGHT REACTION

59. Identify A, B, C and D in the given diagram of z-scheme of light reaction and choose the correct option accordingly.



- 1) A- e⁻ acceptor, B- ETS, C- PS-II, D- PS-I
 2) A- e⁻ acceptor, B- ETS, C- PS-I, D- PS-II
 3) A- ETS, B- e⁻ acceptor, C- PS-I, D- PS- II
 4) A- ETS, B- e⁻ acceptor, C- PS-II, D- PS-I

60. Match the following columns wrt chloroplast.

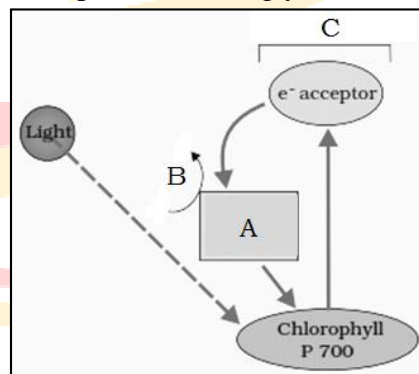
Column I Column II

- I. F_0 (i) Embedded in membrane
 (ii) Forms trans membrane channel
- II. F_1 (iii) Protrudes on the outer surface that face stroma
- 1) I (i)(iii), II (ii)
 2) I (i)(ii), II (iii)
 3) I (iii), II (i)(ii)
 4) I (ii), II (i)(iii)

61. ATP synthesis needs an enzyme –

- 1) ATPase
 2) NADP reductase
 3) Energase
 4) ATP synthatase

62. One of the following which is not the product of non-cyclic electron transport is –
- 1) O_2
 - 2) $NADPH_2$
 - 3) ATP
 - 4) CO_2
63. For photolysis of H_2O _____ is not involved.
- 1) Mn
 - 2) Ca
 - 3) Mg
 - 4) Cl
64. In the Z-scheme (noncyclic photophosphorylation) of electron transport in photosynthesis, the last electron donor is:
- 1) NADP
 - 2) PS-II
 - 3) Water
 - 4) Fd
65. In the cyclic photophosphorylation, the correct sequence of electron transport is –
- 1) $P_{700+} \rightarrow FRS \rightarrow Cyt.f \rightarrow Cyt.b6 \rightarrow PC \rightarrow P_{700}$
 - 2) $P_{700} \rightarrow FRS \rightarrow Fd \rightarrow Cyt.b6 \rightarrow Cyt.f \rightarrow PC \rightarrow P_{700+}$
 - 3) $P_{700} \rightarrow FRS \rightarrow Fd \rightarrow NADP \rightarrow PC \rightarrow P_{700+}$
 - 4) $P_{700} \rightarrow Fd \rightarrow FRS \rightarrow Cyt.b6 \rightarrow Cyt.f \rightarrow PC$
66. Photosystem I operate effectively at a wavelength of _____ and less ____.
- 1) 700 nm
 - 2) 600 nm
 - 3) 480 nm
 - 4) 680 nm
67. In photosynthesis, how many water molecules are actually involved in the release of $6O_2$?
- 1) $6H_2O$
 - 2) $10H_2O$
 - 3) $18H_2O$
 - 4) $24H_2O$
68. For photosynthesis, non-cyclic photophosphorylation is more important than the cyclic process because –
- 1) It releases O_2
 - 2) It produces ATP during the non-cyclic transfer of electrons
 - 3) It produces ATP and $NADPH_2$
 - 4) It releases CO_2
69. The colour of ferredoxin is _____.
- 1) blue
 - 2) red
 - 3) pink
 - 4) yellow
70. _____ mediates photolysis of H_2O .
- 1) P_{680}^+
 - 2) P_{680}
 - 3) P_{700}^+
 - 4) P_{680}^-
71. Identify A, B and C in the given figure of cyclic phosphorylation and choose the correct option accordingly.



- 1) A- ETS, B- $ADP + Pi \rightarrow ATP$, C- PS-II
- 2) A- ETS, B- $ADP + Pi \rightarrow ATP$, C- PS-I
- 3) A- $NADH_2$, B- $ADP + Pi \rightarrow ATP$, C- PS-I
- 4) A- $NADH_2$, B- $ADP - Pi \rightarrow ATP$, C- PS-II

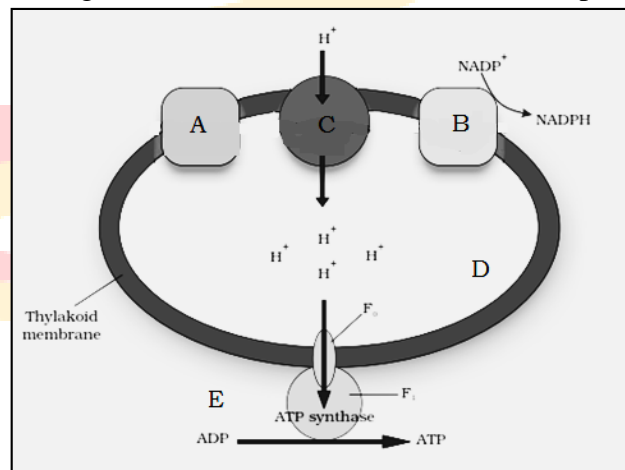
72. In eukaryotes chemiosmosis occurs in –
- 1) only mitochondria
 - 2) only chloroplast
 - 3) mitochondria as well as chloroplasts
 - 4) all cell organelles

73. Which is true statement?
- 1) One N.C.P.P. tosses one electron
 - 2) One C.P.P. tosses four electrons
 - 3) C.P.P. is more efficient than N.C.P.P. in terms of ATP formed.

- 4) N.C.P.P. is more efficient than C.P.P. in terms of ATP formed
74. What is the source of oxygen present in the molecule of $C_6H_{12}O_6$?
- 1) CO_2
 - 2) Both CO_2 and H_2O
 - 3) H_2O
 - 4) Atmosphere O_2
75. _____ is an enzyme needed for chemiosmosis.
- 1) ATP synthase
 - 2) ATP reductase
 - 3) ATP oxygenase
 - 4) ATP carboxylase
76. Which of the following acts as proton donor in the formation of $NADPH_2$ in light reaction?
- 1) PS – I
 - 2) PS – II
 - 3) Hill's reagent
 - 4) H_2O
77. In photosynthetic bacteria –
- 1) Only cyclic photophosphorylation can take place
 - 2) Only non cyclic photophosphorylation can take place
 - 3) Dark reaction does not take place
 - 4) Krebs's cycle does not take place
78. The immediate source of electrons in the formation of reduced coenzyme-II in photosynthesis is -
- 1) P_{700}
 - 2) P_{680}
 - 3) H_2O
 - 4) Hill reaction
79. During non-cyclic photophosphorylation, how many electrons are involved in the liberation of one molecule of O_2 ?
- 1) 2
 - 2) 4
 - 3) 8
 - 4) 6
80. _____ is assimilatory power.
- 1) ATP & $NADH_2$
 - 2) ATP & $NADPH_2$
 - 3) ATP & $FADH_2$
 - 4) ATP & H_2O
81. One cyclic photophosphorylation (C.P.P.) produces _____ ATP.
- 1) One
 - 2) Two
 - 3) Four
 - 4) No
82. Twelve electrons will produce _____ $NADPH_2$ in NCPP.
- 1) Nil
 - 2) Four
 - 3) Six
 - 4) Two
83. One of the following is not represented correctly regarding the transfer of electrons in the light reaction of photosynthesis. Identify. Initial electron donor Final electron acceptors -
- 1) Chl.a 700 $\xrightarrow{e^-}$ NADP
 - 2) $Chl.a\ 680^+ \xrightarrow{e^-} Chl.a\ 700$
 - 3) Water $\xrightarrow{e^-}$ $Chl.a\ 680^+$
 - 4) $Chl.a\ 680 \xrightarrow{e^-} Chl.a\ 700^+$
84. The first known electron acceptor in PS – II is:
- 1) FRS
 - 2) Cyt. b_6
 - 3) Fd
 - 4) PQ
85. In the non-cyclic photophosphorylation, net flow of photo induced electron transport is correctly represented as –
- 1) Water $\xrightarrow{e^-}$ PS-II $\xrightarrow{e^-}$ PS-I $\xrightarrow{e^-}$ NADP
 - 2) PS-I \longrightarrow NADP \longrightarrow PS-II \longrightarrow Water
 - 3) Water \longrightarrow PS-I \longrightarrow PS-II \longrightarrow NADP
 - 4) PS-I \longrightarrow NADP \longrightarrow Water \longrightarrow PS-II
86. N.C.P.P. occur during following conditions:
- 1) Anaerobic, high CO_2 conc. & enough light
 - 2) Anaerobic, low CO_2 conc. & low light
 - 3) Aerobic, high CO_2 conc. & less H_2O

- 4) Aerobic, high CO_2 conc. & sufficient H_2O
87. In the non-cyclic process, NADP is reduced to NADPH_2 . This is because NADP receives:
- 1) H_2 from photolysis of water
 - 2) Electrons from PS-I
 - 3) Electrons from PS-I and protons from photolysis of water
 - 4) Electrons from photolysis of water and H_2 from PS-I
88. According to old concept –
- (i) CO_2 & O_2 are gases
 - (ii) O_2 evolved comes from CO_2
- 1) (i) is true & (ii) is false
 - 2) (i) is false & (ii) is true
 - 3) (i) is the reason for (ii)
 - 4) (ii) is the reason for (i)
89. In the cyclic photophosphorylation, the last electron acceptor is –
- 1) PC
 - 2) Cyt.f
 - 3) FRS
 - 4) P_{700}^+
90. Photolysis of water is also known as –
- 1) Hill reaction
 - 2) Light reaction
 - 3) Conversion of light energy into chemical energy
 - 4) Dark reaction
91. Oxygen liberated during photosynthesis comes from _____.
- 1) CO_2
 - 2) Glucose
 - 3) H_2O
 - 4) Fructose
92. In photosynthesis which one of the following serves as the electron acceptor _____.
- 1) O_2
 - 2) NADPH_2
 - 3) CO_2
 - 4) NADP
93. Formation of ATP from ADP in light reaction is referred to as –
- 1) Oxidative phosphorylation
 - 2) Reductive phosphorylation
 - 3) Phosphorylation
 - 4) Photophosphorylation
94. The O_2 evolved at photosynthesis comes from :
- 1) CO_2
 - 2) starch
 - 3) sugars
 - 4) water
95. In photosynthesis, chemiosmosis occurs across:
- 1) outer membrane of chloroplast
 - 2) inner membrane of chloroplast
 - 3) intermembrane space
 - 4) membrane of thylakoid
96. In photosynthesis the source of hydrogen atoms for the synthesis of glucose is _____.
- 1) H_2O
 - 2) FADH_2
 - 3) NADPH_2
 - 4) nCH_{20}
97. The initial donor and final acceptor of H^+ in the non-cyclic photophosphorylation respectively are –
- 1) PS-I and PS-II
 - 2) Chl-a 680 and NADP
 - 3) H_2O and NADP
 - 4) Chl-a P_{700} and atmospheric oxygen
98. Splitting of water occurs by strong _____ agent.
- 1) Oxidizing
 - 2) Reducing
 - 3) Hydrolytic
 - 4) Chlorinating
99. Identify false statement –
- 1) Photolysis of H_2O is also called photo-oxidation of H_2O
 - 2) Photosynthesis is a redox reaction.
 - 3) Photolysis involves reduction of H_2O & Oxidation of CO_2 .

- 4) Photolysis involves both the photosystems
100. The light reactions of photosynthesis take place in _____.
- 1) Grana of the chloroplast
 - 2) Stroma of the chloroplast
 - 3) Entire chloroplast
 - 4) Mitochondria
101. In the cyclic photophosphorylation, the initial electron donor and the final electron acceptor are respectively –
- 1) P_{700} and PC
 - 2) P_{700} and P_{700}^+
 - 3) P_{700} and NADP
 - 4) Chl.a 680 and PC
102. Which one of the following gives correct sequence of electron transport during non-cyclic process?
- 1) Chl. a 680 $\xrightarrow{e^-}$ PQ $\xrightarrow{e^-}$ b_6
 $\xrightarrow{e^-}$ f $\xrightarrow{e^-}$ PC $\xrightarrow{e^-}$ P_{700}^+
 - 2) P_{700}^+ $\xrightarrow{e^-}$ Fd $\xrightarrow{e^-}$ FRS $\xrightarrow{e^-}$ NADP
 - 3) H_2O $\xrightarrow{e^-}$ Cyt $\xrightarrow{e^-}$ Chl. a680
 - 4) Chl.a680 $\xrightarrow{e^-}$ FRS $\xrightarrow{e^-}$ Fd
 $\xrightarrow{e^-}$ b_6 $\xrightarrow{e^-}$ PC $\xrightarrow{e^-}$ P_{700}
103. Synthesis of ATP occurs in N.C.P.P. when –
- 1) Reduced cyt.- b_6 oxidized cyt.-f
 - 2) Reduced cyt.- b_6 reduces cyt.f
 - 3) Oxidized cyt.- b_6 reduces cyt.-f
 - 4) Oxidized cyt.- b_6 oxidizes cyt.-f
104. In the light-induced electron transport of the non-cyclic type, the reaction centers and also all the co-enzymes act alternately on both electron acceptors as well as electron donors. Only one of them is an exception to this. Point out this exception from the following:
- 1) PQ
 - 2) NADP
 - 3) PC
 - 4) chl.a 680
105. When protons move from area of higher concentration to area of lower concentration, the process involved is –
- 1) diffusion
 - 2) osmosis
 - 3) reverse osmosis
 - 4) chemiosmosis
106. Non-cyclic photophosphorylation is the main photochemical reaction in green plants because –
- 1) It utilizes H_2O
 - 1) The path of electrons is unidirectional
 - 3) It involves both PS-I and PS-II
 - 4) It produces assimilatory power and O_2 .
107. ___ part of PGAL formed is used for regeneration.
- 1) $1/6^{th}$
 - 2) $2/6^{th}$
 - 3) $5/6^{th}$
 - 4) Half
108. Identify A, B, C, D and E from the given figure and choose the correct option



accordingly.

- 1) A-PS-I, B-PS-II, C- cytochrome-b and c, D- Lumen stroma, E- Stroma
- 2) A-PS-I, B-PS-II, C- cytochrome-b and c, D- Stroma, E- Lumen
- 3) A-PS-II, B-PS-I, C- cytochrome-b and c, D- Stroma, E- Lumen
- 4) A-PS-II, B-PS-I, C- cytochrome-b and c, D- Lumen, E- Stroma

109. Photo system II operates effectively at a wavelength of _____ and less.
- 1) 700 nm
 - 2) 480 nm

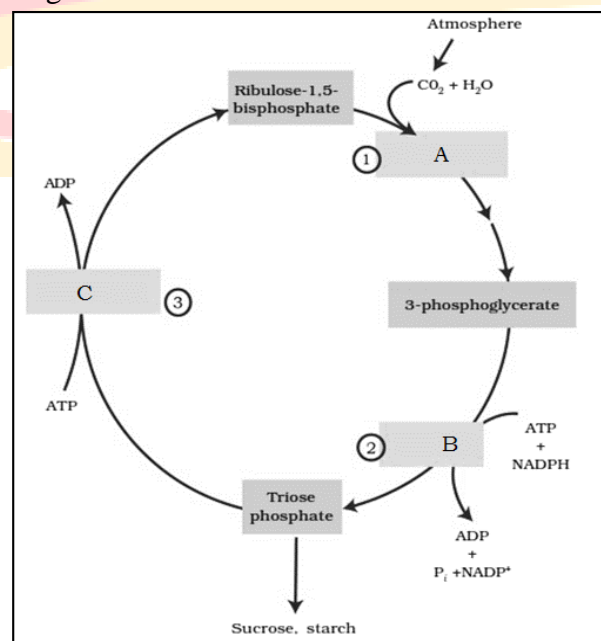
- 3) 600 nm
4) 680 nm
110. The process of photosynthesis begins with –
1) Photolysis of water
2) Synthesis of assimilatory power
3) Photoexcitation of chlorophyll – a
4) Reduction of CO₂
111. In photosynthesis oxygen is liberated due to _____.
1) Hydrolysis of carbohydrates
2) Breakdown of chlorophyll
3) Photolysis of water
4) Reduction of CO₂.
112. In the cyclic photophosphorylation, the last electron acceptor is –
1) PC
2) Cyt.f
3) FRS
4) P₇₀₀⁺
113. NADP means –
1) Nicotinamide adenosine diphosphate
2) Nicotinamide adenine dinucleotide phosphate
3) Nicotinamide adenosine dinucleotide phosphate
4) Nicotinamide adenine dicarboxy phosphate
114. In photosynthesis, water is oxidized and CO₂ is reduced. The hydrogen removed from water is first –
1) Accepted by CO₂ to form carbohydrate
2) Accepted by a co-enzyme to form reduced compound
3) Released from chloroplast into cytoplasm where it is used for the synthesis of carbohydrate from CO₂.
4) Released as free hydrogen in the stroma of chloroplast.
115. Core complex is made up of –
1) Chlorophyll a + other chlorophyll + accessory pigments
2) Chlorophyll a + 40 to 50 other pigment molecules + carriers
3) Chlorophyll a + accessory pigments
- 4) Other chlorophylls (except 1) + accessory pigments
116. **Assertion:** Cyclic pathway of photosynthesis first appeared in some eubacterial species. (2)
Reason: Oxygen started accumulating in the atmosphere after the non-cyclic pathway of photosynthesis evolved.
1) Both assertion & reason are true. Reason is the correct explanation of assertion.
2) Both assertion & reason are true. But reason is not a correct explanation of assertion
3) Assertion is true but reason is false
4) Both assertion & reason is false

DARK REACTION

117. Photorespiration takes place –

- 1) at night
- 2) during day
- 3) continuously during day & night
- 4) in twilight

118. Identify A, B and C in the given figure and choose the correct option from the set (A-3) given below.



- 1) A-Reduction, B-Carboxylation, C-Regeneration
- 2) A- Reduction, B- Regeneration, C-Carboxylation
- 3) A- Carboxylation, B- Reduction, C-Regeneration

- 4) A- Carboxylation, B- Regeneration, C- Reduction

119. **Assertion:** I Biosynthetic phase in photosynthesis is also called dark phase.

Reason: Biosynthetic phase in photosynthesis is also called Blackman's reaction.

- 1) Assertion is correct and Reason is incorrect.
- 2) Reason is correct and Assertion is incorrect
- 3) Both are correct
- 4) Both are incorrect

120. Calvin cycle begins with the fixation of CO₂ by RuDP (5-3). What will be the number of CO₂ molecules required to produce one 6-c fructose or glucose molecule?

- 1) 1
- 2) 12
- 3) 3
- 4) 6

121. The compound getting diffused into peroxisome is –

- 1) PGA
- 2) phosphoglycolate
- 3) glycolate
- 4) glycine

122. Write the sequence of phase in C-3 cycle.

- 1) Carboxylation, Reduction, Regeneration, Synthesis
- 2) Carboxylation, Synthesis, Reduction, Regeneration
- 3) Carboxylation, Reduction, Synthesis, Regeneration
- 4) Reduction, carboxylation, Regeneration, synthesis

123. Dark reaction was 1st established by –

- 1) M. Calvin
- 2) R. Hill
- 3) Arnon
- 4) Blackmann

124. Phosphoglycolate is _____ carbon compound.

- 1) 2

- 2) 3
- 3) 4
- 4) 5

125. The oxidation of RUBISCO produces-

- 1) phosphoglycolate & glycolate
- 2) PGA & glycolate
- 3) phosphoglycolate & PGA
- 4) phosphoglycolate & glycine

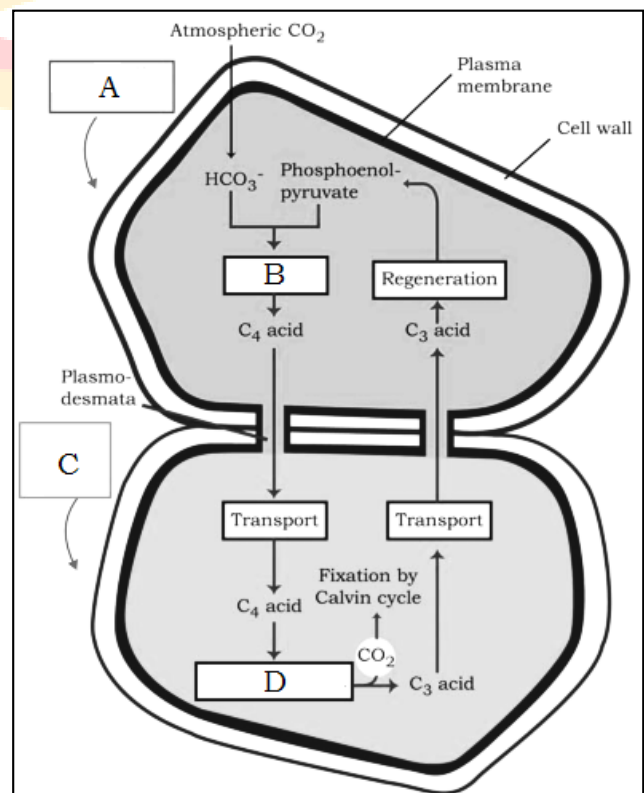
126. In the dark reaction of photosynthesis, how many ATP and NADPH₂ molecules are required for the formation of each C₆H₁₂O₆ molecule?

- 1) 12 ATP and 12 NADPH₂
- 2) 12 ATP AND 18 NADPH₂
- 3) 18 ATP and 12 NADPH₂
- 4) 6 ATP and 6 NADPH₂

127. The name of Melvin Calvin is associated with _____.

- 1) Synthesis of ATP during photosynthesis
- 2) Release of water during photosynthesis
- 3) Carbon fixation during photosynthesis
- 4) Capture of light energy during photosynthesis.

128. Identify A, B, C and D in the given figure and choose the correct option



accordingly.

- 1) A- Mesophyll cell, B- Fixation, C- Bundle sheath cell, D- Decarboxylation
- 2) A- Mesophyll cell, B- Decarboxylation, C- Bundle sheath cell, D- fixation
- 3) A- Chloroplast, B- Decarboxylation, C- Bundle sheath cell, D- fixation
- 4) A- Chloroplast, B- Fixation, C- Bundle sheath cell, D- Decarboxylation

129. Study the following columns and choose the correct option.

Column I**Column II**

- | | |
|----------------------------|---|
| I. Oxygen evolving complex | (i) Potassium ferric oxalate |
| II. Proton gradient | (ii) High oxygen concentration |
| III. Hill reaction | (iii) ATP synthesis |
| IV. Photorespiration | (iv) RuBisCO
(v) Photolysis of water |

- 1) I (v), II (iii), III (i), IV (ii)
- 2) I (i), II (ii), III (iv), IV (v)
- 3) I (v), II (i), III (iv), IV (ii)
- 4) I (iii), II (iv), III (v), IV (i)

130. In photosynthesis, the reduced co-enzyme is used up in the -

- 1) Thylakoids
- 2) Stroma
- 3) Grana
- 4) Fret channels

131. **Assertion:** Photorespiration decreases the rate of photosynthesis.

Reason: Rate of respiration in C₃ and C₄ is same.

- 1) Both assertion & reason are true. Reason is the correct explanation of assertion.
- 2) Both assertion & reason are true. But reason is not a correct explanation of assertion
- 3) Assertion is true but reason is false
- 4) Both assertion & reason is false

132. C₃ plants can show photosynthesis in -

- 1) High light intensity

3) Scarcity of water

2) High temperature

4) Minimum 50 ppm of CO₂

133. How much % of C₃ is lost during oxygenation of RuBP?

- 1) 10%
- 2) 25%
- 3) 50%
- 4) 75%

134. The oxidation of RUBISCO is impossible at:

- 1) high CO₂ concentration
- 2) high temperature
- 3) low CO₂
- 4) high light intensity

135. The dark reaction occurs in -

- 1) Stroma
- 2) DNA
- 3) Quantasomes
- 4) Ribosomes

136. The energy derived from light reactions that drives the Calvin cycle is in the form of -

- 1) ATP and NADP (re4)
- 3) ADP and NADP (ox)
- 2) ATP and NADP (ox)
- 4) ADP and NADP (re4)

137. The hydrogen donor during the dark reaction of photosynthesis is -

- 1) H₂O in all green plants
- 2) H₂O in C₃ plants and NADH₂ in C₄ plants
- 3) NADPH₂ in C₃ plants and H₂O in C₄ plants
- 4) NADPH₂ in all green plants

138. In DAR reaction glucose is produced from RuBP in _____ seconds.

- 1) 60
- 2) 90
- 3) 120
- 4) 150

139. The number of carbon atoms in phosphoglycolate are -

- 1) 1

- 2) 2
3) 3
4) 6
140. In C-3 cycle the CO₂ acceptor is –
1) RUMP
2) RUBP
3) 3 – PGA
4) unstable keto acid
141. _____ part of PGAL formed is used for regeneration.
1) 1/6th
2) 2/6th
3) 5/6th
4) Half
142. The first stable molecule of C₃ pathway is –
1) Glucose
2) PGA
3) fructose
4) PGAL
143. In photorespiration serine is formed by _____ molecules of glycine.
1) 1
2) 2
3) 3
4) 4
144. The steps of Calvin cycle which are just opposite to glycolysis of respiration are –
1) Synthesis of 6-ribulose diphosphate, 1, 3-diphosphoglyceric acid
2) Synthesis of 3-phosphoglyceric acid, 3-phosphoglyceraldehyde
3) Synthesis of 3-phosphoglyceraldehyde, 6-ribulose phosphate
4) Synthesis of 6-ribulose phosphate, 6-ribulose diphosphate
145. Prior to carboxylation in Calvin's cycle _____ ATP & _____ NADPH₂ are required.
1) 6, 0
2) 6, 6
3) 12, 12
4) 18, 12
146. RUBISCO gets oxidised at –
- 1) high light intensity & low CO₂ concentration
2) high light intensity & high CO₂ concentration
3) low light intensity & low CO₂ concentration
4) low light intensity & high CO₂ concentration
147. The biochemical phase of photosynthesis is called dark reaction because –
1) It was discovered by Blackman
2) It is not light dependent
3) It occurs during night (in darkness)
4) It is not photosynthesis in nature
148. In dark reaction which of the following is not correct?
1) NADPH₂ is the hydrogen donor in the Calvin cycle.
2) Light is the source of energy for photosynthesis in C-3 and C-4 plants.
3) H₂O is the hydrogen donor in Calvin, HSK.
4) ATP is the source of energy in the Calvin Cycle
149. The Calvin cycle ends with –
1) Synthesis of glucose
2) Formation of PGAL
3) Regeneration of RuBP
4) Formation of PGA
150. The amino acid diffusing into peroxisome is--
1) cysteine
2) glycine
3) serine
4) methionine
151. How many carbon atoms are there in one molecule of glycine & one molecule of serine?
1) 2 each
2) 3 each
3) 2 & 3 respectively
4) 2 & 4 respectively
152. In the Calvin cycle, the assimilatory power is used during –

- 1) Formation of 3-c PGA.
 - 2) Conversion of 3-c PGA to 3-c PGAL
 - 3) Formation of fructose 1, 6 diphosphate from PGAL.
 - 4) Formation of glucose from fructose diphosphate.
153. During dark phase of photosynthesis –
- 1) O₂ is released
 - 2) PGAL is synthesized
 - 3) Hydrogen is released
 - 4) ATP is produced
154. In the Calvin cycle, the 3-C PGA is converted into 3-C PGAL in presence of NADPH₂ and ATP. What is the nature and the sequence of the reactions involved?
- 1) Phosphorylation and reduction
 - 2) Phosphorylation and reductive dephosphorylation
 - 3) Dephosphorylation and oxidation
 - 4) Reduction followed by phosphorylation
155. Sedoheptulose – 7 – PO₄ is _____ carbon compound.
- 1) 7C
 - 2) 5C
 - 3) 3C
 - 4) 6C
156. In plants photorespiration is initiated in -
- 1) all the cell organells of mesophyll
 - 2) mitochondria
 - 3) chloroplast
 - 4) all the cell organelles of vascular tissue
157. During photosynthesis –
- 1) Glucose is produced during light reaction and ATP during dark reaction.
 - 2) Glucose is produced during dark reaction and ATP during light reaction
 - 3) Both glucose and ATP are produced during both light and dark reactions
 - 4) Both glucose and ATP are produced only during dark reaction.
158. Calvin discovered the correct path of carbon using.
- 1) Tracer technique + chromatography
 - 2) Tracer technique + radiography
 - 3) Chromatography + radiography
 - 4) Tracer technique + chromatography + radiography
159. In the dark reaction of photosynthesis, carbohydrate is synthesized by using CO₂ and _____.
- 1) H₂O 2) NADH₂
 - 3) NADPH₂
 - 4) Atmosphere
160. PEPA and RUDP are the –
- 1) Hydrogen acceptors in light reaction
 - 2) CO₂ acceptors in C₄ pathway
 - 3) Enzymes in photosynthesis
 - 4) Dark reactions enzymes
161. From the following, identify the step which occurs during photosynthesis but not during respiration –
- 1) Glucose 6-ph. → Fructose – 6-ph
 - 2) Fructose 1, 6 diph → PGAL + DHAP
 - 3) Fructose 1, 6 diph → Fructose -6-ph
 - 4) Malic acid → Oxalo acetic acid
162. The most abundant enzyme in the world is –
- 1) PEPCO
 - 2) RUBISCO
 - 3) ATPsynthatase
 - 4) DNAase
163. Sugar phosphate interconversions occur in _____ phase.
- 1) Carboxylation
 - 2) Regeneration
 - 3) Reduction
 - 4) Synthesis
164. Enzyme associated with formation and hydrolysis of unstable keto acid is –
- 1) RUBISCO
 - 2) PEPA
 - 3) Aldolase
 - 4) Phosphorylase
165. 4-C compound is produced in _____ phase.
- 1) Carboxylation

- 2) Reduction
- 3) Synthesis
- 4) Regeneration

C₄ PATHWAY

166. Malic acid is generated from OAA by the process of--

- 1) reduction
- 2) oxidation
- 3) decarboxylation
- 4) isomerisation

167. The 1st CO₂ fixation in C- 4 plants occurs in:

- 1) Bundle sheath
- 2) RUBISCO
- 3) Agranal chloroplast
- 4) Presence of H₂O

168. C₄ pathway was first studied in _____ leaves.

- 1) Sugarcane
- 2) Maize
- 3) Jowar
- 4) Banana

169. In HSK pathway, what is the product of the decarboxylation of malic acid in bundle sheath chloroplasts?

- 1) PGA
- 2) RuDP
- 3) Pyruvic acid
- 4) PEPA

170. One of the following is common in the dark reaction in C-3 plants, C-4 plants. Identify.

- 1) C-3 cycle reactions during day time
- 2) CO₂ fixation by PEPA
- 3) First CO₂ fixation by OAA
- 4) Night CO₂ fixation

171. Identify the incorrect statement.

- 1) diurnal fluctuation of acid is the characteristic of CAM plants.
- 2) Kranz Anatomy is speciality of CAM plants
- 3) In CAM plants transpiration through stomata is absent during day time
- 4) CAM plants are succulents & grow in dry condition.

172. What is peculiarity of Bundle sheath cells of C₄ plants?

- 1) Show dimorphic chloroplast
- 2) Show stromal chloroplast
- 3) Chloroplast is smaller
- 4) Show many chloroplast

173. Dicarboxylic acid pathway represents –

- 1) A set of reactions in phase-II of anaerobic respiration
- 2) Biochemical reactions in dark phase of all green plants
- 3) Dark reaction of photosynthesis in C-4 plants
- 4) Light reaction

174. The dark reaction occurs in –

- 1) Stroma
- 2) DNA
- 3) Quantasomes
- 4) Ribosomes

175. In Crassulacean Acid metabolism, OAA is reduced in presence of--

- 1) oxaloacetate dehydrogenase
- 2) PEP dehydrogenase
- 3) pyruvate dehydrogenase
- 4) malate dehydrogenase

176. Find the odd plant out –

- 1) Maize
- 2) Amaranthus
- 3) Oat
- 4) Sorghum

177. What is false about photosynthesis?

- 1) All organisms depend directly on it.
- 2) It helps to balance O₂ & CO₂ levels in atmosphere.
- 3) Fossil fuels are products of it.
- 4) It helps to purify air.

178. In CAM plants, acid concentration---

- 1) remains unchanged
- 2) increases during day
- 3) increases at night
- 4) increases when stomata are closed irrespective of day & night time

179. What is peculiarity of Bundle sheath cells of C_4 plants-
- 1) Show dimorphic chloroplast
 - 2) Show stromal chloroplast
 - 3) Chloroplast is smaller
 - 4) Show many chloroplast
180. What is common between C_3 & C_4 plants?
- 1) Both show photorespiration
 - 2) Both show dark reaction
 - 3) Assimilatory power need is in same quantity.
 - 4) The 1st stable compound formed after atmospheric CO_2 fixation is same.
181. What is true for C_4 plants?
- 1) Show photorespiration
 - 2) Grow only in tropical region
 - 3) Secondary CO_2 acceptor is PEP
 - 4) Optimum temp. for C_4 - $30^\circ C$ to $45^\circ C$
182. In photosynthesis, the (DC1) Dicarboxylic acid is the –
- 1) Phosphoenol pyruvic acid
 - 2) Pyruvic acid
 - 3) Oxaloacetic acid
 - 4) Malic acid
183. In CAM plants, _____ occurs during night.
- 1) C_4 pathway
 - 2) C_3 pathway
 - 3) Light reactions
 - 4) Photolysis of water
184. In CAM plants CO_2 is trapped--
- 1) continuously through out day & night
 - 2) only during day time
 - 3) only at night
 - 4) only in twilight
185. Which of the following statements is correct? In C-4 plants –
- 1) Mesophyll chloroplasts have no grana.
 - 2) Bundle sheath chloroplasts have no stroma
 - 3) Calvin cycle enzymes are absent in mesophyll chloroplasts
 - 4) C-4 cycle enzymes are absent in mesophyll chloroplasts.
186. (i) RUBP carboxylase has less affinity for CO_2 .
(ii) CO_2 fixation occurs at high conc. (50 ppm)
- 1) Both are true
 - 2) Both are false
 - 3) (i) is reason for (ii)
 - 4) (ii) is reason for (i)
187. Pyruvic acid is formed by _____ process in C_4 pathway.
- 1) Phosphorylation
 - 2) Reduction
 - 3) Oxidation
 - 4) Decarboxylation
188. The first CO_2 acceptor in CAM plants accepts CO_2 in presence of--
- 1) RUBISCO
 - 2) PEP carboxylase
 - 3) Malate dehydrogenase
 - 4) OAA carboxylase
189. Chloroplasts in mesophyll cells of C_4 plants are called _____ chloroplasts.
- 1) Granal
 - 2) Agranal
 - 3) Krinal
 - 4) Akrinal
190. In CAM plants, carboxylation occurs--
- 1) once
 - 2) twice
 - 3) thrice
 - 4) never
191. Identify correct equation.
- 1) $PEPA + CO_2 + H_2O \xrightarrow[\text{Carboxylase}]{PEP} OAA + H_3 PO_4$
 - 2) $PEPA + ATP \square Pyruvate + ADP$
 - 3) $OAA + NADPH_2 \xrightarrow[\text{d e h y d r a s}]{O x a b e t a} Malic\ acid + NADP$
 - 4) $PEPA + CO_2 + NH_3 \square OAA$
192. Optimum temperature for growth of C_4 plants.
- 1) $30-45^\circ C$

- 2) 20-30°C
3) 10-20°C
4) 50-60°C
193. In CAM plants decarboxylation of malic acid takes place--
1) continuously through out day & night
2) only during day time
3) only at night
4) only in twilight
194. Dimorphic chloroplasts are present in –
1) CAM Plant
2) C-4 plants
3) C-3 plants
4) Plants showing photosynthetic activity day-night
195. Find the odd plant out –
1) Wheat
2) China rose
3) Portulaca
4) Oat
196. In HSK pathway, the first stable compound formed after CO₂ fixation is 4-C OAA. Hence it is also called -
1) Dicarboxylation pathway
2) Dicarboxylic acid pathway
3) HSK pathway
4) EMP pathway
197. C₄ plants, mesophyll cells do not show photorespiration because _____.
1) RuBISCO is absent
2) RuBISCO is nonfunctional
3) ↑ Conc. Of CO₂
4) ↓ temp of environment
198. In succulents Calvin's cycle takes place--
1) continuously through out day & night
2) only during day time
3) only at night
4) only in twilight
199. NADPH₂ is formed when _____ converts to _____.
1) Malate, pyruvate
2) Oxaloacetate, Malate
3) Pyruvate, PEPA
4) PEPA, Oxaloacetate
200. The 1st CO₂ fixation in C-4 plants occurs in / with –
1) Bundle sheath
2) RUBISCO
3) Agranal chloroplast
4) Presence of H₂O
- SIGNIFICANCE OF PHOTOSYNTHESIS**
201. Which of the following is not an external factor affecting the rate of photosynthesis?
1) light
2) CO₂ concentration
3) chlorophyll content
4) temperature
202. Water stress causes all of these except --
1) closure of stomata
2) makes enzymes of dark reaction inactive
3) loss of turgidity in leaves
4) wilting
203. At a time, how many limiting factors control the rate of photosynthesis?
1) always one
2) 2
3) 3
4) many
204. At a given time, the rate of photosynthesis depends upon--
1) all the factors controlling it.
2) any one factor which is highest
3) any one factor which is lowest
4) any 2 factors which are at optimum level
205. If a chemical process is affected by more than one factors, then the rate will be determined by--
1) sum total of all factors
2) factor which is away from its minimum value

- 3) factor which is nearest to its minimal value
4) average value of all factors

206. The % of CO₂ concentration, which has damaging effect on the rate of photosynthesis is--

- 1) 0.03%
2) 0.04%
3) 0.05%
4) >0.05%

EXTRA MCQS

207. Peristomium is chemically composed of –

- 1) Lipids
2) Proteins
3) Glycoprotein
4) Lipoproteins

208. PS I comprises of _____ as antenna pigment.

- 1) One P₆₈₀
2) 200 Chl.₆₇₀
3) 200 Chl.₆₈₃
4) Many Chl-b

209. Space between two membranes of chloroplast is _____ nm thick.

- 1) 4 to 6
2) 10 to 30
3) 40 to 60
4) 100 to 300

210. _____ shows various shapes of chloroplast.

- 1) Photosynthetic protista
2) Photosynthetic BGA
3) Photosynthetic algae
4) All photosynthetic organisms

211. Light Harvesting complex is made up of –

- 1) Chlorophyll a + other chlorophyll + accessory pigments
2) Chlorophyll a + 40 to 50 other pigment molecules + carriers
3) Chlorophyll a + accessory pigments
4) Other chlorophylls (except 1) + accessory pigments

212. Chlorenchyma cells have _____ chloroplast.

- 1) 10 to 50
2) 20 to 100
3) 50 to 500
4) infinite

213. Pigment protein complex comprises of –

- 1) Core complex & light harvesting complex
2) Core complex & Fret channel
3) Fret channel & Light Harvesting complex
4) Fret channel & Fret membrane

214. Xanthophylls < carotenes –

- 1) PS-I
2) PS-II
3) CC
4) PPC

215. The peristomium is _____ nm thick.

- 1) 4 to 6
2) 10 to 30
3) 40 to 60
4) 100 to 300

216. PSI is located –

- 1) On the inner surface of thylakoid
2) In the grana
3) In the stroma
4) On the outer surface of thylakoid

217. Match the column –

- | | |
|------------------|---------------|
| I) Proteins | (i) 50 – 60% |
| II) Lipids | (ii) 20 – 30% |
| III) Chlorophyll | (iii) 5 – 10% |
| IV) RNA | (iv) 2 – 3% |
- 1) I (i), II (ii), III (iv) IV (iii)
2) I (ii), II (i), III (iv), IV (iii)
3) I (i), II (ii), III (iii), IV (iv)
4) I (ii), II (i), III (iii), IV (iv)

218. In the Z-scheme (noncyclic photophosphorylation) of electron transport in photosynthesis, the last electron donor is :

- 1) NADP

- 2) PS-II
- 3) Water
- 4) Fd

- 1) PS-I
- 2) PS-II
- 3) CC
- 4) PPC

219. Carotenes < Xanthophylls is true for –

-X-X-X-X-X-X-X-X-

PHOTOSYNTHESIS IN HIGHER PLANTS

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