

Photosynthesis in Higher Plants

1. **Assertion (A):** In photosynthesis there is synthesis of glucose but it is stored in form of starch.
Reason (R): Glucose is osmotically active while starch is osmotically inactive.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false
2. **Assertion (A):** When *Cladophora* is placed on suspension of aerobic bacteria, bacteria accumulate in region of red and blue light of split spectrum.
Reason (R): In *Cladophora* there is maximum absorption of Blue and red light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false
3. **Assertion (A):** Biosynthetic phase of photosynthesis is known as dark reaction.
Reason (R): It takes place in absence of light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false
4. **Assertion (A):** Nomenclature of pigment systems as PS-I and PS-II is based on their functioning during light reaction.
Reason (R): During light reaction PS-II works first and PS-I works later.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false
5. **Assertion (A):** The whole scheme of transfer of electrons starting from PS-II to NADP^+ is called z-scheme.
Reason (R): When all the carriers of this scheme are placed in sequence on a redox potential scale. They appear like Z.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false
6. **Assertion (A):** Both PS-I and PS-II are located on same face of thylakoid membrane.
Reason (R): Photolysis of water and reduction of NADP^+ takes place in stroma site.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false
7. **Assertion (A):** Like respiration in Photosynthesis too, ATP synthesis is linked to development of proton gradient across a membrane.
Reason (R): Proton gradient is the strongest source of potential energy which can be used in joining of ADP and P_i .
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false
8. **Assertion (A):** Biosynthetic phase of photosynthesis is also termed as dark reaction.
Reason (R): Biosynthetic phase is not directly dependent on light but it is supported by products of light reactions.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false



9. **Assertion (A):** In all photosynthetic plants first fixation product during biosynthetic phase of photosynthesis is PGA.
Reason (R): PGA is the most stable product and is synthesized from both RuBP and PEP, whenever they act as first CO₂ accepting substance.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
10. **Assertion (A):** To make one molecule of glucose 6 turns of Calvin cycle are required.
Reason (R): In each turn of Calvin cycle there is fixation of one CO₂ only while 6CO₂ are required for each glucose.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
11. **Assertion (A):** C₄ plants can tolerate high temperature conditions.
Reason (R): Enzyme pepcase and PPDK work only on high temperature.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
12. **Assertion (A):** In C₄ plants there is no photorespiration.
Reason (R): In C₄ plants photolysis of H₂O and Rubisco activity show space differentiation..
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
13. **Assertion (A):** In mesophyll cells of C₄ plants there is no sugar formation after fixation of CO₂.
Reason (R): In mesophyll cells there is no Rubisco so C₃ cycle events can not operate.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
14. **Assertion (A):** The basic pathway that results in formation of sugars, the Calvin path way is common to the C₃ and C₄ plants.
Reason (R): C₃ path is the only biosynthetic path which yields sugar from CO₂.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
15. **Assertion (A):** Photorespiration is one of the wasteful processes.
Reason (R): In Photo respiration there is no synthesis of ATP and NADPH.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
16. **Assertion (A):** In C₄ plants Rubisco selectively shows carboxylase activity no oxygenase activity.
Reason (R): In C₄ bundle sheath cell malic acid is broken down to increase intracellular CO₂ concentration.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false



17. **Assertion (A):** In Aquatic conditions usually CO_2 concentration regulates the rate of photosynthesis.
Reason (R): In Aquatic conditions generally CO_2 is available at suboptimal level.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
18. **Assertion (A):** In terrestrial conditions CO_2 usually acts as main determining factor of photosynthesis.
Reason (R): Usually CO_2 is available at sub optimal level in terrestrial conditions.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
19. **Assertion (A):** C_4 Plants were evolved to adapt for low atmospheric CO_2 concentration.
Reason (R): C_4 plants have minimum CO_2 compensation point.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
20. **Assertion (A):** C_3 plants donot show rise in photosynthesis at higher temperature.
Reason (R): Enzymes of C_3 plants are high temperature sensitive as compared to low temperature sensitive enzymes of C_4 plants.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
21. **Assertion (A):** Indirectly water stress leads to decrease in photosynthesis.
Reason (R): Water stress leads to wilt to leaves and minimize their surface area.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
22. **Assertion (A):** Photorespiration decreases the rate of photosynthesis.
Reason (R): RUBISCO can also behave as an oxygenase.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
23. **Assertion (A):** During photophosphorylation light energy is utilized to produce the proton gradient that is required for ATP synthesis
Reason (R): Oxidative phosphorylation results as the energy of oxidation-reduction is utilized for phosphorylation.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
24. **Assertion (A):** Chief photosynthetic pigment is chlorophyll a but plants evolved some other pigments also.
Reason (R): Photosynthetic efficiency is increased due to absorptions of variety of wavelengths.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false



25. **Assertion (A):** Higher rate of photosynthesis is seen when plants are of wavelengths of visible light.
Reason (R): There is maximum absorption by chlorophyll a in the blue and the red regions of the visible light.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
26. **Assertion (A):** Cyclic photophosphorylation results only in the synthesis of ATP, but not of $\text{NADPH} + \text{H}^+$.
Reason (R): Cyclic photophosphorylation occurs only when light of wavelengths beyond 680 nm are available for excitation.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
27. **Assertion (A):** The protons or hydrogen ions that are produced by the splitting of water accumulate within the lumen of the thylakoids.
Reason (R): The primary acceptor of electron which is located towards the outer side of the membrane transfers its electron not to an electron carrier but to an H carrier.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
28. **Assertion (A):** The primary acceptor of carbon dioxide in C_3 plants is a 2-carbon compound.
Reason (R): The first product of carbon dioxide fixation in these plants is a C_3 acid.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
29. **Assertion (A):** The light-independent reactions do not require light, but they are most likely to occur day.
Reason (R): NADPH and ATP from the light-dependent reactions are used in the light-independent reactions.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
30. **Assertion (A):** Except for plants in shade or in dense forests, light is rarely a limiting factor for photosynthesis in nature.
Reason (R): Increase in incident light beyond a point causes the breakdown of chlorophyll and a decrease in photosynthesis.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
31. **Assertion (A):** Current availability of CO_2 levels is limiting to the C_3 plants.
Reason (R): Carbon dioxide is the major limiting factor for photosynthesis.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false
32. **Assertion (A):** Plants that do not use PEP-carboxylase in carbon 3 plants.
Reason (R): The primary carboxylation reaction in C_3 plants, catalyzed by RuBisCO, produces the three carbon 3-phosphoglyceric acids directly in the Calvin Benson cycle.
 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 (3) (A) is true but (R) is false
 (4) Both (A) and (R) are false



33. Assertion (A): ATP acts as the energy currency of the cell.

Reason (R): ATP is a ribonucleoside triphosphate.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

34. Assertion (A): It is possible to make calculations of the net gain of ATP for every glucose molecule oxidised; but in reality this can remain only a theoretical exercise.

Reason (R): These calculations can be made only on certain assumptions that are not really valid in a living system.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

35. Assertion (A): The alignment of the chloroplasts along the walls of the mesophyll cells vary depending on the amount of incident light.

Reason (R): The alignment of the chloroplasts along the walls of the mesophyll cells is such that they get the optimum quantity of the incident light.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

36. Assertion (A): Accessory photosynthetic pigments in higher plants enable a wider range of wavelength of incoming light to be utilised for photosynthesis.

Reason (R): Accessory pigments protect chlorophyll a from photo-oxidation.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

37. Assertion (A): The protons and O_2 formed by photolysis of water are released in the thylakoid lumen.

Reason (R): The water splitting complex is associated with the PS I, which itself is physically located on the outer side of the membrane of the thylakoid.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

38. Assertion (A): Electron transport via cytochrome b6f is responsible for creating the proton gradient that drives the synthesis of ATP in chloroplasts.

Reason (R): Cytochrome b6f complex functions to mediate the transfer of electrons and of energy between Photosystem II and Photosystem I, while transferring protons from the chloroplast stroma across the thylakoid membrane into the lumen.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

39. Assertion (A): Breakdown of proton gradient across the thylakoid membrane leads to the synthesis of ATP.

Reason (R): The gradient is broken down due to the movement of protons across the membrane to the stroma through the transmembrane channel of the CF₀ of the ATP synthase.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false



40. Assertion (A): Immediately after light becomes unavailable, the biosynthetic process continues for some time, and then stops.

Reason (R): The biosynthetic phase of photosynthesis depends on the products of the light reaction.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

41. Assertion (A): The enzyme that catalyses carboxylation of RuBP in Calvin cycle would be more correctly called RuBisCO rather than RuBP carboxylase.

Reason (R): This enzyme also has an oxygenation activity apart from a carboxylase activity.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false



Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

- (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) If Assertion is true but Reason is false.
- (d) If both Assertion and Reason are false.

42. **Assertion:** Chloroplasts mostly occur in mesophyll cells along their walls inside the leaves.

Reason : The membrane system of chloroplast is responsible for trapping the light energy and also for the synthesis of ATP and NADPH.

43. **Assertion:** Cyclic pathway of photosynthesis first appeared in some eubacterial species.

Reason : Oxygen started accumulating in the atmosphere after the non-cyclic pathway of photosynthesis evolved.

44. **Assertion :** Each molecule of ribulose-1, 5-bisphosphate fixes one molecule of CO₂.

Reason : Three molecules of NADPH and two ATP are required for fixation of one molecule of CO₂.

45. **Assertion :** Oxidative phosphorylation requires oxygen.

Reason : Oxidative photophosphorylation occurs in mitochondria.

46. **Assertion:** The stroma lamellae have both PS I and PS II.

Reason : The grana lamellae lack PS II as well as NADP reductase enzyme.

47. **Assertion:** The splitting of water is associated with PS II.

Reason : Water is split into H⁺, O₂ and electrons.

48. **Assertion :** Rate of photosynthesis is dependent of duration of exposure of light.

Reason : At higher light intensities gradually rate of photosynthesis do not show further increase.

49. **Assertion :** The atmospheric concentration of CO₂ at which photosynthesis just compensates for respiration is referred to as CO₂ compensation point.

Reason : The CO₂ compensation point is reached when the amount of CO₂ uptake is less than that generated through respiration because the level of CO₂ in the atmosphere is more than that required for achieving CO₂ compensation point.

50. **Assertion :** Mitochondria helps in photosynthesis

Reason : Mitochondria have enzymes for dark reaction.

51. **Assertion :** Dark reaction is not entirely enzymatic reaction.

Reason : It occurs only in absence of light.

52. **Assertion :** Dark reaction occurs only at night in the stroma of chloroplast.

Reason : CO₂ fixation occurs only during C₃ cycle.

53. **Assertion:** The C₄ plants have a special type of leaf anatomy called Kranz anatomy.

Reason : Chloroplasts of bundle sheath cells have well developed grana and starch grains.

54. **Assertion:** The bundle sheath cells are rich in an enzyme phosphoenol pyruvate carboxylase (PEP case) in C₄ plants.

Reason : In C₄ plants, the mesophyll cells are rich in an enzyme Ribulose bisphosphate carboxylase-oxygenase (RuBisCO).

ANSWER KEY																				
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	2	3	4	1	4	1	1	4	1	1	1	1	1	1	1	4	1	1	1
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	1	1	2	1	1	2	2	4	1	2	2	2	1	1	2	3	1	2	1	1

42.	43.	44.	45.	46.	47.	48.	49.	50.	51.	52.	53.	54.				
b	b	c	b	d	b	a	c	d	a	d	c	d				