



# BIOLOGY

## BOOKS - PRADEEP BIOLOGY (HINGLISH)

### RESPIRATION IN PLANTS

#### Ncert Exercises With Answers

1. By looking at a plant externally can you tell whether a plant is  $C_3$  or  $C_4$  ? Why and how?



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2. By looking at which internal structure of a plant can you tell whether a plant is  $C_3$  or  $C_4$ ? Explain.



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3. Even though a very few cells in a  $C_4$  plant carry out the biosynthetic – Calvin pathway,

yet they are highly productive. Can you discuss why?



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4. RuBisCo is an enzyme that acts both as a carboxylase and oxygenase. Why do you think RuBisCo carries out more carboxylation in  $C_4$  plants?



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5. Suppose there were plants that had a high concentration of Chlorophyll-b, but lacked chlorophyll-a, would it carry out photosynthesis? Then why do plants have chlorophyll-b and other accessory pigments?



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6. Why is the colour of a leaf kept in the dark frequently yellow, or pale green? Which pigment do you think is more stable?





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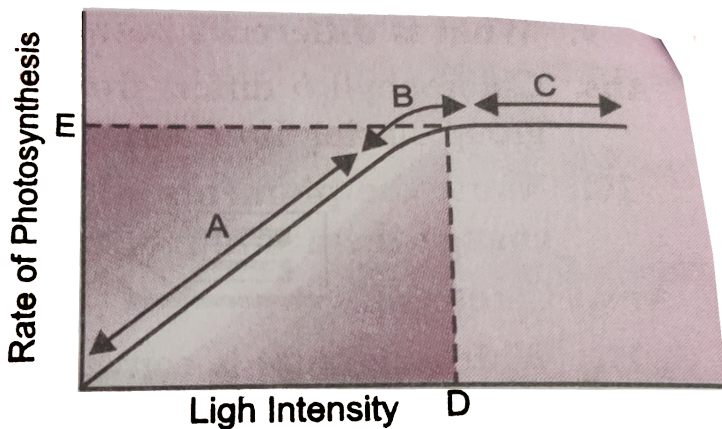
7. Look at leaves of the same plant on the shady side and compare it with the leaves on the sunny side. Or, compare the potted plants kept in the sunlight with those in the shade. Which of them has leaves that are darker green? Why? Answer



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8. Figure shows, the effect of light on the rate of photosynthesis Based on the graph, answer the following questions.

a) At which points (A,B or C) in the curve is light a limiting factor?



b) What could be the limiting factor/s in region A?

c) What do C and D represent on the curve?



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9. Give comparison between the following:

(a)  $C_3$  and  $C_4$  pathways

(b) Cyclic and non-cyclic photophosphorylation

(c) Anatomy of leaf in  $C_3$  and  $C_4$  plants



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[Additional Questions](#)   [Very Short Questions](#)   [Short Questions](#)   [Answer Questions](#)

1. Define photosynthesis.



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2. What is the concentration of gaseous  $CO_2$  in the atmosphere?



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3. In which form the water plants absorb carbon through their general body surface?



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4. Who discovered that green plants require sunlight for their nutrition?



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5. What do you understand by 'phlogiston' and 'dephlogiston'?



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6. Tick the correct answer:  $O_2$  evolved during photosynthesis is from i)  $CO_2$ , ii)  $H_2O$ .



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7. Who proposed 'Z' scheme and suggested that two photosynthesis operate in series?



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**8.** What are the actual sites of light reaction and dark reaction inside the chloroplasts?



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**9.** What is difference the structure of chlorophyll a and chlorophyll b?



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**10.** Name the pigmetns which pick up nascent oxygen, released during photo-oxidation of water, and change them into molecular state.



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**11.** Which pigment is converted to vitamin A by animals and human beings.



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**12.** What is difference between a quantum and a photon?



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**13.** Who demonstrated evolution of oxygen during photo-oxidation of water (photolysis of water)?



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**14.** What is quantum requirement?



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**15.** What conclusions have been drawn from Emerson Effects?



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**16.** Name the reaction centers of PS I and PS II.



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**17.** Which pigment system is not directly involved in photooxidation of water and evolution of molecular oxygen?



**Watch Video Solution**

**18.** Expand RuBisCo.



**Watch Video Solution**

**19.** Name the enzyme which splits ribuose-1, 5-bisphosphate into 3-phosphoglyceric acid and 2-phosphoglycolic acid.



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**20.** Name two photosynthetic pigments belonging to carotenoids.



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21. Write one anatomical feature of  $C_4$  plants.



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22. Which one is the most important limiting factor in photosynthesis?



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23. In which form are carbohydrates translocated from the place of manufacture to

other parts of plant body?



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24. When a plant is girdled (ringed), which part dies first-the root or the shoot?



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25. Which compound donates hydrogen to carbohydrates in Calvin cycle?



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26. The first stable product in  $C_4$  pathway is



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27. Where from do the chemoautotrophs derive energy for the synthesis of their food?



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28. Expand the term RUBP.



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29. Give single chemical equation of photosynthesis.



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30. Name any two  $C_4$  plants.



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**31.** What is the basis for designating  $C_3$  and  $C_4$  pathways of photosynthesis ?



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**32.** Which products formed during the light reaction of photosynthesis are used to drive the dark reaction ?



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**33.** Can girdling experiments be done in monocots ? If yes, How ? If no, why not ?



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Based on the above equation, answer the following questions

(a) Where does this reaction take place in plants ?

(b) What is the significance of this reaction ?





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**35.** (a) NADP reductase enzymes is located on  
.....

(b) Breakdown of proton gradient leads to  
release of .....



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## Additional Questions Short Answer Questions

**1. WHAT IS PHOTORESPIRATION?**



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2. The photosynthetic lamellae taken out from a chloroplast and suspended in a nutrient medium in the presence of  $CO_2$  and light. Will they synthesise glucose or not?



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3. Name the hormones which increase and decrease the rate of photosynthesis?







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4. Write the significance of  $C_4$  cycle.



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5. Write short note on 'Kranz' anatomy.



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6. Write what you know about assimilatory power.



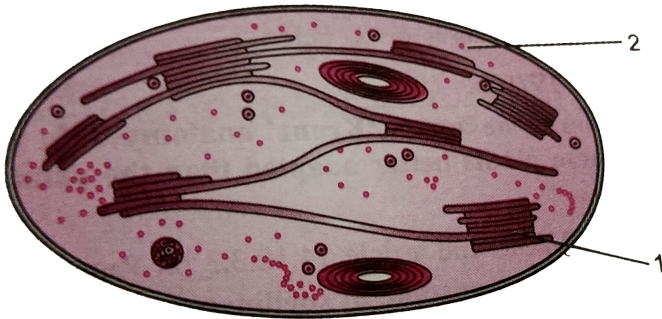
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7. Where to PGA and glycine gain entry respectively after being formed during photorespiration in plants. What happens to them immediately after?



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8. Examine the figure.



a) Is the structure present in animal cell or plant cells?

b) Can these be passed on to the progeny?  
How?

c) Name the metabolic process taking place in the part (1) and (2).



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9. Chlorophyll-'a' is primary pigment for the light reaction. What are accessory pigments ?  
What is their role in photosynthesis ?



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10. Fill in the blanks.

$CO_2$  combines with.....carbon compound  
Ribulose 1,5-bisphosphate, with the help of  
enzyme Ribulose 1, 5-biphophate carboxylase  
which is generally known as ..... It's also

known as ..... Because it can ..... The substrate and form ..... In  $C_4$  plant showing..... anatomy,  $CO_2$  reacts with ..... and form 4 carbon compound substrate and form..... In  $C_4$  plant showing .....anatomy,  $CO_2$  reacts with ..... and form 4 carbon compound ..... which reduces into.....



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**11.** Explain why photosynthesis is considered the most important process in the biosphere.



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**12.** Specify how a pentose phosphate is a  $CO_2$  acceptor in the dark reaction of photosynthesis?



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**13.** Write short notes on action spectra and absorption spectra.



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**14.** Describe the role of  $P_{700}$  in cyclic electron transport pathway.



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**15.** Chlorophyll-'a' is primary pigment for the light reaction. What are accessory pigments ?  
What is their role in photosynthesis ?



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**16.** How are photosynthesis and respiration related to each other ?



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**17.** What conditions enable RuBisCO to function as an oxygenase ? Explain the ensuing process.



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**18.** In what kind of plants do you come across 'Kranz' anatomy? To which conditions are those plants better adapted? How are these plants better adapted than the plants which lack this anatomy.





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## Additional Questions Long Answer Questions

1. What is photorespiration? Describe the process in detail and link it with the Calvin cycle.



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2. Describe the light dependent steps of photosynthesis. How are they linked to the

dark reaction?



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3. Calvin cycle consists of three phases. What are they? Explain the significance of each of them?



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4. What are the differences between  $C_3$  cycle and  $C_4$  cycle?



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5. Explain why photosynthesis is considered the most important process in the biosphere.



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6. Describe non-cyclic photophosphorylation in plants. Why is this process called so.



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7. Explain the process of biosynthetic phase of photosynthesis occurring in the chloroplast.



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8. What are the important events and end products of the light reaction?



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9. Why is the RuBisCo enzyme more appropriately called RUBP carboxylase-oxygenase and what important role does it play in photosynthesis ?



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10. Discuss the behaviour of the enzymes RUBISCO under high oxygen concentration and in presence of light in  $C_3$  plants.



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**11.** Correct the following sentences:

A)  $C_3$  cycle is also called Calvin cycle after its discover, Melvin Calvin, who was awarded Nobel Prize in 1951.

B) The oxygenase activity of the enzymes RUBISCO allows  $O_2$  to compare with  $CO_2$  for combining with RuMP.

c) The main purpose of light reaction is to generate assimilatory power in the form of ATP and NADPH.

D) Accessory pigments absorb light and

transfer it to pheophytin for conversion to electrical energy.



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**12.** A portion of cross section of leaf is shown in the diagram. Answer the following:-

A) Label 1 to 4.

B) What kind of anatomy is shown in the diagram ?

C) Write the structure and function of 2 and 4.



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## Analytical Questions With Answers

1. Why are chloroplasts generally located at the outer margins of mesophyll cells? Explain.



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2. Why does 'chlorophyll a' occur in different forms?



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3. Why is photorespiration considered as a wasteful process? Explain.



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4. How is  $CO_2$  fixed in photosynthesis in  $C_4$  plants? Explain.



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5. Cynobacteria and some other photosynthesis bacteria don't have chloroplasts. How do they conduct photosynthesis ?



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6. "Photosynthesis protects us from harmful ultraviolet radiation of sun". Comment on the statement.



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7. Succulents are known to keep their stomata closed during the day to check transpiration. How do they meet their photosynthetic  $CO_2$  requirements ?



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8. A) What is pheophytin?

B) What is the significance of  $C_4$  cycle?



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9. All life on earth is "bottled sun's energy".

Justify.



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10. Why does chlorophyll appear red in reflected light and green in transmitted light?

Explain the significance of these phenomena in terms of photosynthesis.



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**11.** What is warburg effect? In which kind of plants is it mostly observed?



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**12.** What is the remarkable property of RuBisCO? What conditions enable RubisCo to function as an oxygenase? Explain.



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**13.** Which pigments are collectively termed as accessory pigments? Why?



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**14.** Select any three organelles from the following list which are involved in photorespiration chloroplast, mitochondria, ribosomes, lysosome, glyoxysome, peroxysome, endoplasmic reticulum



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**15.** Select a plant from the following which is photosynthetically more efficient? Give any two reasons in support of your answer:

Pea, Soyabean, Sugar cane, Mustard, Ground nut



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**16.** What is anabolism? Do you agree that photosynthesis is an anabolic process? Give reasons in support of your answer.





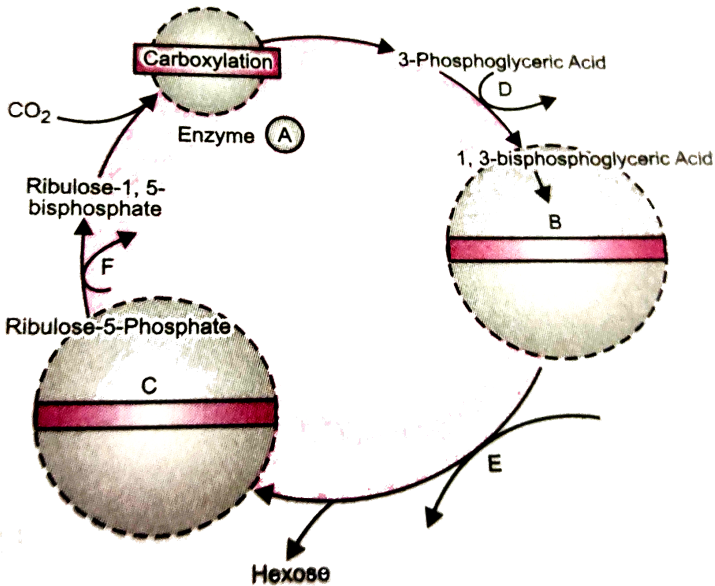
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**17.** The diagram given below shows stages in the light-independent reactions of photosynthesis.

Answer the following:

- a) At which stage NADPH is oxidised?
- b) What are A,B and C?

c) At what stages ATP is converted into ADP?



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18. What is the most important function of PS

II?



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**19.** What are the two components of ATPase complex? Where are these located and what are their functions?



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**20.** A group of plants lacks photorespiration. Answer the following questions based on these plants:

a) Which cells in the plant have Rubisco?

b) Does photorespiration occur in these plants?

c) In which cells the  $CO_2$  fixation initially occurs.



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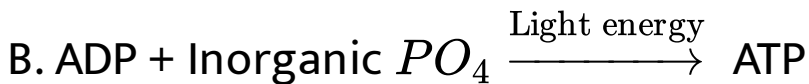
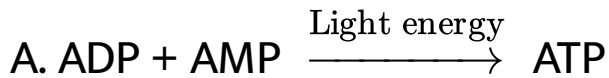
21. Which technique was used to prove that  $O_2$  comes from water and not from  $CO_2$ ?



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## Practice Questions Multiple Choice Questions

1. Which one of the following concerns photophosphorylation?



**Answer: B**



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2. Acid concentration in CAM plants is more at

A. night

B. daytime

C. down

D. dusk

**Answer: A**



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3. In PS-II, first known electron acceptor is

A. Cytochrome

B. PQ

C. FRS

D. Ferredoxin

**Answer: B**



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4. In  $C_4$  plants

A. Grana present in mesophyll cells and absent in bundle sheath cells.

B. Grana absent in mesophyll cells and present in bundle sheath cells.

C. Grana present in both mesophyll and bundle sheath cells.

D. Grana absent in both mesophyll and bundle sheath cells.

**Answer: A**



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5. Emerson effects explain the phenomenon of

A. Transpiration

B. Absorption of water by roots.

C. Photosynthesis

D. Respiration

**Answer: C**



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6. Photorespiration in  $C_3$  plants starts from

A. Phosphoglycerate

B. Phosphoglycolate

C. Glycerate

D. Glycine

**Answer: B**



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7. Hill reaction occurs in

A. High altitude plants

B. Total darkness

C. Absence of water

D. Presence of ferricyanide

**Answer: D**



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8. Which of the following statements is true with regard to light reaction of photosynthetic mechanism in plants

A. chlorophyll a occurs with peak absorption at 680 nm in photosystem I and at 700 nm in photosystem II.

B. magnesium and sodium ions are associated with photolysis of water molecules.

C.  $O_2$  is evolved during cyclic photophosphorylation.

D. photo systems I and II are both involved in non-cyclic photophosphorylation.

**Answer: D**



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**9. The Calvin cycle proceeds in three stages**

(1) Reduction, during which carbohydrate is formed at the expense of the photochemically made ATP and NADPH

(2) Regeneration, during which the carbon dioxide acceptor ribulose-1,5-biphosphate is formed

(3) Carboxylation during which carbon dioxide

combines with ribulose-1,5-biphoshate is formed

A. 3 – 1 – 2

B. 3 – 2 – 1

C. 1 – 2 – 3

D. 2 – 1 – 3

**Answer: A**



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**10.** The first acceptor of electrons from an excited chlorophyll molecule of photosystem II is

A. Iron Sulphur protein

B. Ferredoxin

C. Quinone

D. Cytochrome

**Answer: C**



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11. In the leaves of  $C_4$  plants, malic acid formation during  $CO_2$  fixation occurs in the cells of

A. Bundle sheath

B. Phloem

C. Epidermis

D. Mesophyll

**Answer: D**



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12.  $NH_3$  released from

A. Photorespiration

B. Dark respiration

C. CAM

D. All of these

**Answer: A**



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13. The type of  $CO_2$  fixation seen in many succulent plant species is

- A.  $C_4$  pathway
- B.  $C_2$  pathway
- C. CAM pathway
- D.  $C_3$  pathway

**Answer: C**



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14. Photosynthesis is maximum in

A. Green light

B. Blue followed by red light

C. Red followed by blue light

D. Blue light

**Answer: B**



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15. The movement of electron from chlorophyll molecule to NADP occur in

- A. Photosystem I
- B. Photophosphorylation
- C. Photorespiration
- D. Photosystem II

**Answer: D**



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16. Calvin cycle leads to reduction of

A.  $CO_2$

B.  $O_2$

C. RUBP

D. RUMP

**Answer: A**



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17. Which chlorophyll does not possess phytol

A. Chl a

B. Chl b

C. Chl c

D. Chl d

**Answer: C**



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**18. Calvin cycle is**

A. Reductive carboxylation

B. Oxidative carboxylation

C. Reduction

D. Oxidation

**Answer: A**



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**19.** Number of thylakoids in a granum is

A. 5 – 10

B. 2 – 100

C. 100 – 150

D. 150 – 200

**Answer: B**



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**20.** The first stable product in  $CAM/C_4$  plants is

A. Oxaloacetic acid

B. Phosphoenol pyruvate



C. Ribulose 1,5 diphosphate

D. Malic acid

**Answer: A**



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**21.** Consider the following statements regarding photosynthesis

(A) ATP formation during photosynthesis is termed as photophosphorylation

(B) Kranz anatomy pertains to leaf

(C) Reduction of  $NADP^+$  to NADPH occurs during Calvin cycle

(D) In a chlorophyll molecule manganese is present in phytol tail

A. A and B are correct

B. C and D are correct

C. A and C are correct

D. A and D are correct.

**Answer: A**



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**22.** Consider the following statements

(A) The portion of the spectrum between 500nm and 800 nm is also referred to as photosynthetically active radiation (PAR)

(B) Magnesium, calcium and chloride ions play prominent roles in the photolysis of water

(C) In cyclic photophosphorylation, oxygen is not released (as there is no photolysis of water) and NADPH is also not produced

A. a) is true, but b) and c) are false

B. a) and b) are false, but c) is true

C. b) is true, but a) and c) are false

D. a) and b) are true, but c) is false.

**Answer: B**



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**23.** Which of the following statements with regards to photosynthesis is/are correct

(A) In  $C_4$  plants, the primary  $CO_2$  acceptor is

PEP

(B) In the photosynthetic process PS II absorbs energy at or just below 680nm

(C ) The pigment that is present in the pigment system I is  $P_{683}$

A. b and c only

B. a) only

C. c) only

D. a) and d) only

**Answer: D**



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24. In the leaves of  $C_4$  plants, malic acid formation during  $CO_2$  fixation occurs in the

- A. Bundle sheath
- B. Guard cells
- C. Epidermal cells
- D. Mesophyll cells.

**Answer: D**



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25. Electrons from excited chlorophyll molecule of photosystem II are accepted first by

- A. Quinone
- B. Ferredoxin
- C. Cytochrome-b
- D. Cytochrome-7

**Answer: A**



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**26.** Which metal ion is a constituent of chlorophyll?

A. Iron

B. Copper

C. Magnesium

D. Zinc

**Answer: C**



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27. Which pigment acts directly to convert light energy to chemical energy?

- A. Chlorophyll a
- B. Chlorophyll b
- C. Xanthophyll
- D. Carotenoid

**Answer: A**



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28. Which range of wavelength (in nm) is called photosynthetically active radiation (PAR)?

A. 100-390

B. 390-430

C. 400-700

D. 760-100,00

**Answer: C**



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29. Which light range is most effective in

A. Blue

B. Green

C. Red

D. Violet

**Answer: C**



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30. Chemosynthetic bacteria obtain energy from

A. Sun

B. Infra red rays

C. Organic substances

D. Inorganic chemicals

**Answer: D**



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**31.** Energy required for ATP synthesis in PSII comes from

- A. Proton gradient
- B. Electron gradient
- C. Reduction of glucose
- D. Oxidation of glucose

**Answer: A**



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32. During light reaction in photosynthesis the following are formed.

A. ATP and sugar

B. Hydrogen,  $O_2$  and sugar

C. ATP, hydrogen donor and  $O_2$

D. ATP, hydrogen and  $O_2$  donor

**Answer: C**



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**33.** Dark reaction in photosynthesis is called so because

- A. It can occur in dark also
- B. It does not depend on light energy
- C. It can not occur during day light
- D. It occurs more rapidly at night.

**Answer: A**



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34. PEP is primary  $CO_2$  acceptor in

A.  $C_4$  plants

B.  $C_3$  plants

C.  $C_2$  plants

D. Both  $C_3$  and  $C_4$  plants

**Answer: A**



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**35.** Splitting of water is associated with

A. Photosystem I

B. Lumen of thylakoid

C. Both Photosystem I and II

D. Inner surface of thylakoid membrane

**Answer: D**



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**36.** The correct sequence of flow of electrons in the light reaction is

A. PSII, plastoquinone, cytochromes, PSI, ferredoxin

B. PSI, plastoquinone, cytochromes, PSII, ferredoxin

C. PSI, ferredoxin, PSII,

D. PSI, plastoquinone, cytochromes, PSII, ferredoxin

**Answer: A**



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**37.** The enzyme that is not found in a  $C_3$  plant is

A. RuBP Carboxylase

B. PEP Carboxylase

C. NADP reductase

D. ATP synthetase

**Answer: B**



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**38.** The reaction that is responsible for the primary fixation of  $CO_2$  is catalysed by

A. RuBP Carboxylase

B. PEP Carboxylase

C. RuBP carboxylase and PEP carboxylase

D. PGA synthase

**Answer: C**



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**39.** When  $CO_2$  is added to PEP. The first stable product synthesised is

A. Pyruvate

B. Glyceraldehyde-3-phosphate

C. Phosphoglycerate

D. Oxalacetate

**Answer: D**



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**40.**  $C_4$  plants are more efficient in photosynthesis than  $C_3$  plants due to

A. lower rate of photorespiration

B. higher leaf area

C. presence of larger number of chloroplasts in leaf cells

D. presence of thin cuticle.

**Answer: C**



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**41.** Kranz anatomy is one of the characteristics of the leaves of

A. Sugrcane

B. Wheat

C. potato

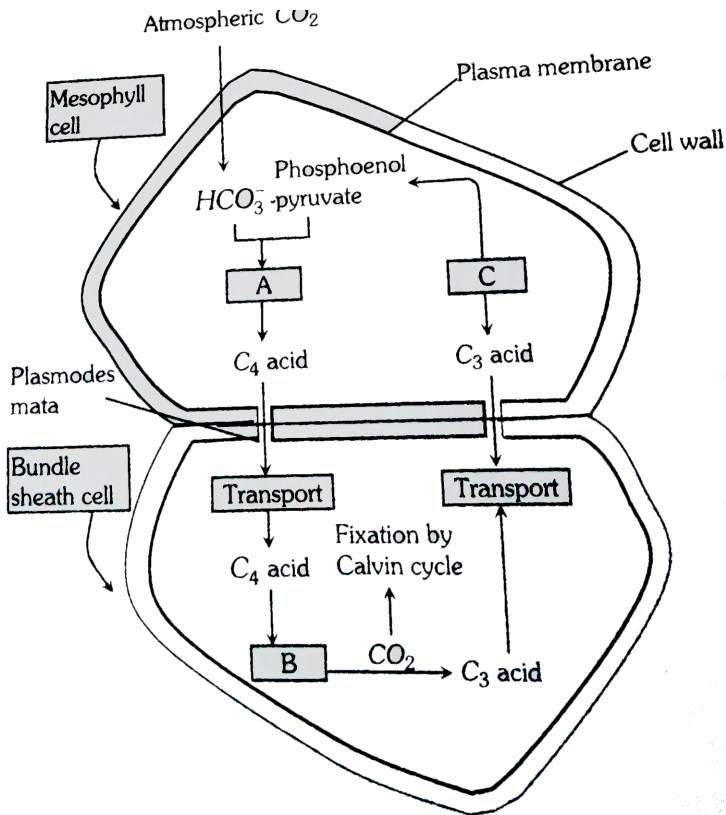
D. mustard

**Answer: A**



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42.

In which of the following option correct words for all the three blanks A, B and C are indicated

	A	B	C
(a)	Decarboxylation	Reduction	Regeneration
(b)	Fixation	Transamination	Regeneration
(c)	Fixation	Decarboxylation	Regeneration
(d)	Carboxylation	Decarboxylation	Reduction



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**43.** Read the following four statements A,B,C and D and select the right option having both correct statements.

statements

(a) Z scheme of light reaction takes place in presence of PS I only .

(B ) Only PS I is functional in cyclic photophosphorylation

(c ) Cyclic photophosphorylation results into synthesis of ATP and  $NADPH_2$

(D ) Stroma lamellae lack PSII as well as NADP

A. B and C

B. A and B

C. B and D

D. C and D

**Answer: C**



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**44.** According to Steward's starch hydrolysis theory, which one of the following is the

principle reason for the opening of stomata  
during daytime

A. Efflux of  $K^+$  ions from guard cells  
under the influence of ABA hormone.

B. Photosynthetic utilization of  $CO_2$  in  
guard cells

C. Influx of  $K^+$  ions into guard cells under  
the influence of ABA hormone.

D. Conversion of sugar into starch in guard  
cells.

**Answer: B**



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**45.** In  $C_4$  pathway,  $CO_2$  fixation in mesophyll cells is carried out by the enzyme

A. pyruvate dehydrogenase

B. pyruvate decarboxylase

C. PEP carboxylase

D. RUBISCO

**Answer: C**



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**46.** Which one of the following statements about the events of non-cyclic photophosphorylation is correct.

- A. photolysis of water takes place
- B.  $O_2$  is released
- C. Only one photosystem participates.
- D. ATP & NADPH are produced

**Answer: C**



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**47. Thylakoids occur inside**

A. Mitochondria

B. Chloroplast

C. Golgiapparalus

D. Endoplasmic reticulum

**Answer: B**



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48. Chloroplast dimorphism is a characteristic feature of

A. plants with calvin cycle

B.  $C_4$  plants

C. all plants

D. only in algae

**Answer: B**





**49.** Stomatal opening and closing is due to

A. change in the turgidity of guard cells

B. the inner walls of each guard cells is thick and elastic.

C. cellulose microfibrils of guard cells are oriented radially.

D. all of these

**Answer: D**



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50. Loss of water in  $C_4$  plants as compared to  $C_3$  plants for the same amount of  $CO_2$  fixed is

- A. half
- B. one third
- C. one fourth
- D. double

**Answer: B**



51. The creation of proton gradient across the thylakoid membrane is a result of

- A. decrease in proton number in stroma
- B. accumulation of protons in the lumen
- C. decrease in pH in the lumen.
- D. all of the above

**Answer: D**



52. For every  $CO_2$  molecule entering the calvin cycle, the number of ATP and NADPH required is

A.  $2ATP + 2NADPH$

B.  $2ATP + 3NADPH$

C.  $3ATP + 2NADPH$

D.  $3ATP + 3NADPH$

**Answer: C**



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53. The primary acceptor , during  $CO_2$  fixation in  $C_3$  plants , is

A. RuBP

B. Oxaloacetate

C. Phosphoglyceralyde

D. PEP

**Answer: A**



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54. Which one of the following ions is essential for photolysis of water?

A. Manganese

B. Zinc

C. copper

D. boron

**Answer: A**



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55. During Calvin cycle the total number of  $CO_2$ , ATP and NADPH molecules utilized and glucose, ADP and NADP molecules generated is

A. 31

B. 36

C. 61

D. 67

**Answer: D**



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56. The major pigments in rhodospirillum rubrum are

A. chlorophyll a and b

B. chlorophyll a,c and fucoxanthin

C. chlorophyll a,d and phycoerythrin

D. none of the above

**Answer: C**



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57. Melvin Calvin was professor of

A. Botany

B. Plant physiology

C. Chemistry

D. Biochemistry

**Answer: C**



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58. The essential element needed for water splitting in photosynthesis leading to  $O_2$  evolution is

A. Mo

B. Mn

C. Mg

D. K

**Answer: B**



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59. In the overall process of photosynthesis , the number of  $CO_2$  water , sugar and  $O_2$  molecules utilized and produced is

A. 12

B. 13

C. 19

D. 31

**Answer: D**



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60. A process that makes important difference between  $C_3$  and  $C_4$  plants is

A. Transpiration

B. Glycolysis

C. Photosynthesis

D. Photorespiration

**Answer: D**



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61. The correct sequence of cell organelles during photorespiration is

A. Chloroplast,-Golgibodies, -mitochondria

B. Chloroplast,-RoughEndoplasmic

reticulum, Dictyosomes.

C. Chloroplast,-mitochondria,-peroxisome

D. Chloroplast, -vacuole,-peroxisome

**Answer: C**



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62. For its activity, carboxypeptidase requires

A. zinc

B. iron

C. niacin

D. copper

**Answer: A**



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**63.** Read the following four statements (A-D)

(A) Both, photophosphorylation and oxidative phosphorylation involve up hill transport of protons across the membrane

(B) In dicot stems, a new cambium originates from the cells of pericycle at the time of secondary growth

(C) Stamens in flowers of *Gloriosa* and *Petunia* are polyandrous

Symbiotic nitrogen-fixers occur in the free-living state also in soil

How many of the above statements are right

A. Two

B. Three

C. Four

D. One

**Answer: A**



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**64.** Anoxygenic photosynthesis is characteristic of



A. Rhodospirillum

B. Spirogyra

C. Chlamydomonas

D. Ulva

**Answer: A**



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**65.** Which of the following set of elements are essential for the photosynthesis to occur

A. Cu,Co,Fe

B. Cu,Mo,Zn

C. Mg,Co,Mn

D. Mg,Fe,Mn,Cu,Cl,P

**Answer: D**



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**66.** The  $C_4$ -plants are different from the  $C_3$ -plants with reference to the

A. substrate that acceptors  $CO_2$  in carbon assimilation

B. type of end product

C. type of pigment involved in photosynthesis

D. number of ATP that are consumed in preparing sugar.

**Answer: A**



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**67.** The colour in the brown fat is due to

- A. its larger capacity for generating heat
- B. large number of mitochondria present
- C. a high concentration of iron containing cytochrome pigments.
- D. presence of chromatophores.

**Answer: C**



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68. The oxygen evolved during photosynthesis comes from water molecules . Which one of the following pairs of elements is involved in this reaction ?

A. Magnesium and Chlorine

B. Manganese and Chlorine

C. Manganese and Potassium

D. Magnesium and Molybdenum

**Answer: B**



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69. Chromatophores take part in

- A. Respiration
- B. Photosynthesis
- C. Growth
- D. Movement

**Answer: B**



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70. In photosynthesis, light independent reactions take place at

- A. Stromal matrix
- B. Thylakoid lumen
- C. Photosystem-I
- D. Photosystem -II

**Answer: A**



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71. The blue-green algae are so called as they have in addition to green pigment chlorophyll, a blue pigment known as

- A. phycocyanin
- B. cytochrome-c
- C. chlorophyll-b
- D.  $\beta$ -carotene

**Answer: A**



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72. In kranz anatomy, the bundle sheath cells have

A. thin walls, many intercellular spaces and

no chloroplast

B. thick walls, no intercellular spaces and

large number of chloroplasts

C. thin walls, no intercellular spaces and

several chloroplasts

D. thick walls, many intercellular spaces and  
few chloroplasts.

**Answer: B**



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**73.** Which one of the following ions is essential  
for photolysis of water?

A. Manganese

B. Zinc

C. copper

D. Boron

**Answer: A**



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**74.** A plant in your garden avoids photorespiratory losses, has improved water use efficiency shows high rates of photosynthesis at high temperatures and has improved efficiency of nitrogen utilisation. In

which of the following physiological groups  
would you assign this plant

A.  $C_4$

B. CAM

C. Nitrogen fixer

D.  $C_3$

**Answer: A**



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75. Emerson's enhancement effect and red drop have been instrumental in the discovery of

A. Two photosynthesis operating simultaneously

B. Photophosphorylation and cyclic electrons transport.

C. Oxidative phosphorylation

D. Photophosphorylation and non-cyclic electrons transport

**Answer: A**



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**76.** In chloroplast, the highest number of protons are found in

- A. Lumen of thylakoids
- B. Inter membrane space
- C. Antennae complex
- D. Stroma

**Answer: A**



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**77.** Water vapour comes out from the plant leaf through the stomatal opening. Through the same stomatal opening carbon dioxide diffuses into the plant during photosynthesis. Reason out the above statements using the following options.

- A. Both process can happen together because the diffusion coefficient of water and  $CO_2$  is different.
- B. The above processes happen only during night time.
- C. One process occurs during day time, and the other at night.
- D. Both processes cannot happen simultaneously.

**Answer: A**





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78. The process which makes major difference between  $C_3$  and  $C_4$  plants is

- A. Glycolysis
- B. Calvin cycle
- C. Photorespiration
- D. Respiration

**Answer: C**



79. With reference to factors affecting the rate of photosynthesis, which of the following statements is not correct ?

A. Increasing atmospheric  $CO_2$  concentration up to 0.05% can enhance  $CO_2$  fixation rate

B.  $C_3$  plants respond to higher temperature with enhanced

photosynthesis while  $C_4$  plants have much lower temperature optimum.

C. Tomato is a greenhouse crop which can be grown in  $CO_2$  -enriched atmosphere for higher yield

D. Light saturation for  $CO_2$  fixation occurs at 10 % of full sunlight.

**Answer: B**



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80. Phosphoenol pyruvate (PEP) is the primary  $CO_2$  acceptor in

A.  $C_4$  plants

B.  $C_2$  plants

C.  $C_3$  plants and  $C_4$  plants

D.  $C_3$  plants

**Answer: A**



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**81.** Which of the following is not a product of light reaction of photosynthesis

A. ATP

B. NADH

C. NADPH

D. Oxygen

**Answer: B**



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# Additional Questions Assertion Reason Types Questions

1. Assertion: Photorespiration interferes with the successful functioning of Calvin cycle,

Reason: Photorespiration oxidises the pentose phosphate which is acceptor of  $CO_2$  in Calvin cycle

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: A**



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2. Assertion: Dark reaction occurs at night in the stroma of chloroplast.

Reason: All the enzymes responsible for  $CO_2$  fixation remain inactive in presence of light.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation



of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: D**



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3. Assertion. Submerged plants get carbon dioxide in the form of carbonates and bicarbonates.

Reason. Stomata are not present in submerged plants

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation

of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: A**



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4. Assertion: Plants possessing  $C_4$ - pathway of carbon fixation have a higher net primary productivity than the  $C_3$ -pathway possessing plants.

Reason: For each unit weight of fixed carbon,  $C_4$ -pathway possessing plants require less water than  $C_3$  pathway possessing plants.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: B**



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5. Assertion:  $C_4$  plants are better adapted in tropical and desert areas.

Reason:  $C_4$  plants can perform a high rate of photosynthesis even when the stomata are nearly closed.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: A**



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**6. Assertion.** Lysosomes help in the process of photorespiration.

**Reason.** Lysosomes contain basic enzymes.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.



C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: D**



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7. Assertion: Action spectra for photosynthesis help to identify the pigment involved in the process.

Reason: Because these spectra often closely match the absorption spectra of the pigments that participate in the process.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: A**



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**8. Assertion :** Water and mineral uptake by root hairs from the soil occurs through apoplast until it reaches endodermis.

**Reason :** Casparian strips in endodermis are suberized.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: C**



**Watch Video Solution**

9. Assertion:  $C_4$  photosynthetic pathway is more efficient than the  $C_3$  pathway.

Reason : Photorespiration is suppressed in  $C_4$  plants.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation

of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: B**



**Watch Video Solution**

**10. Assertion:**  $C_4$  photosynthetic pathway is more efficient than the  $C_3$  pathway.

**Reason :** Photorespiration is suppressed in  $C_4$  plants.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.



C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: A**



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**11. Assertion (A)** Under condition of high light intensity and limited  $CO_2$  supply, photorespiration has a useful role in protecting the plants from photooxidative damage.

**Reason (R)** If enough  $CO_2$  is not available to utilize light energy for carboxylation to proceed, the excess energy may not cause damage to plants.

A. If both Assertion and Reason are true and the Reason is a correct explanation

of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: C**



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**12. Assertion:** Photosynthetically  $C_4$  plants are less efficient than  $C_3$  plants.

**Reason:** The operation of  $C_4$  pathway requires the involvement of only bundle-sheath cells.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. both are false.

**Answer: D**



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**13.** Assertion: Mitochondria help in photosynthesis.

Reason: Mitochondria have enzymes for dark reaction.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. both are false.

**Answer: D**



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**14. Assertion:** Photosynthetically  $C_4$  plants are less efficient than  $C_3$  plants.

Reason: The operation of  $C_4$  pathway requires the involvement of only bundle-sheath cells.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of



the Assertion.

D. both are false.

**Answer: D**



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**15. Assertion:** Presence of photorespiration is considered as a wasteful and energy consuming process in crop plants, ultimately leads to reduction in yield.

**Reason:** During  $C_3$  synthesis upto 50%  $CO_2$

fixed may have to pass through photorespiratory process to form carbohydrate such as sucrose.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: A**



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**16. 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.

A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation

of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: C**



**Watch Video Solution**

17. Assertion (A) Under condition of high light intensity and limited  $CO_2$  supply, photorespiration has a useful role in protecting the plants from photooxidative damage.

Reason (R ) If enough  $CO_2$  is not available to utilize light energy for carboxylation to proceed , the excess energy may not cause damage to plants.

A. If both Assertion and Reason are true and the Reason is a correct explanation

of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

D. If Assertion is true but the Reason is false.

**Answer: A**



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**18.** Assertion: Chlorine is absorbed as  $Cl^-$  ions. Its precise role is not well known. However, with  $Na^+$  and  $K^+$ , it helps in determining solute concentration and anion-cation balance in cells.

Reason: Chlorine plays an important role in photosynthesis and takes part in the water splitting reaction, thus releasing  $O_2$ .



A. If both Assertion and Reason are true and the Reason is a correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not a correct explanation of the Assertion.

C. If Assertion is false but the Reason is true .

D. If Assertion is true but the Reason is false.

**Answer: A**



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## Notable Questions

1. How much photosynthetically active radiation is received by plants from the sun?



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2. Can photosynthesis occur under the light of ordinary fluorescent lamps?



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3. Succulents have their stomata closed during the day time. How do they get  $CO_2$  for photosynthesis?



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4. Can photosynthesis occur in a land plant if it is totally submerged in water?



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## Curiosity Questions

1. Why photosynthesis is called transformation of photonic energy into chemical energy?



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2. Why do photosynthesis occur in plant cell but not in animal cells?



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3. Why light reaction is called photochemical reaction and dark reaction is called thermochemical reaction?



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4. Can photosynthesis occur if a plant contains single molecule of chlorophyll a?



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5. is it true that light reaction occurs during the day time and dark reactions at night?



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6. Why Calvin used Chlorella as an experimental organism?



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7. Why sugarcane leaves have Kranz anatomy?



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