



BIOLOGY

BOOKS - MODERN PUBLISHERS BIOLOGY (HINGLISH)

PHOTOSYNTHESIS IN HIGHER PLANTS

Practice Problems

1. Write the empirical formula of chlorophylls a and b.



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2. What is limiting factor ?



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3. What is the use of having more than pigment system molecule in a photocentre ?



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4. Define warburg effect ?



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5. What is forster transfer ?



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6. What are antenna molecules in photosynthesis ?

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Practice Problems Photosynthesis

1. Who first recognised the importance of chlorophyll for photosynthesis?

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2. Write the chemical formula of chlorophyll a.

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3. What does phenomenon of red drop refer to?

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4. What is the characteristic anatomical feature of C4 plants, known as?

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5. Why is chlorophyll necessary for photosynthesis?

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6. Why is it that the dark reaction is the rate limiting step in photosynthesis?



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7. What is the use of having more than pigment system molecule in a photocentre ?



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8. 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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9. What are the functions of chloroplast?



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10. Is photosynthesis only process of ATP (chemical energy) formation? Explain.

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11. If a green plant is placed in air free of O_2 would it live longer in light or in darkness?

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12. When do you expect an increase in the rate of photosynthesis in green, red or blue light?

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13. Trace the fate of a molecule of water after it reaches the mesophyll cells.

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14. Write two main functions of carotenoid pigments.

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15. Why is the overall rate of photosynthesis higher per unit light received in flashes than continuously?

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16. Why plants that consume more than usual 18 ATP to produce 1 molecule of glucose are favoured in tropical regions?

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17. What are the advantages of using Chlorella to study photosynthesis than a higher plant?

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18. Give a schematic pathway of TCA cycle as common pathway for oxidation of carbohydrates, fats and proteins.

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Ncert File Ncert Exercise Questions

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. Sugarcane shows high efficiency of CO₂ fixation because it performs



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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 given below shows the effect of light on the rate of photosynthesis. Based on the graph, answer the following questions



- (a) At which point/s (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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Ncert File Ncert Exemplar Problems A Multiple Choice Questions

1. Which metal ion is a constituent of chlorophyll?

- A. Iron
- B. Copper
- C. Magnesium
- D. Zinc

Answer: C



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2. 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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3. 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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4. Which light range is most effective in photosynthesis?

A. Blue

B. Green

C. Red

D. Violet

Answer: C



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5. Chemosynthetic bacteria obtain energy from

- A. Sun
- B. Infra red rays
- C. Organic substances
- D. Inorganic chemicals

Answer: D



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6. 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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7. 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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8. 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 cannot occur during day light
- D. It occurs more rapidly at night

Answer: A



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9. 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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10. 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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11. The correct sequency of flow of electons 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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12. The enzyme that is not found in a C_3 plant is

A. RuBP Carboxylase

B. PEP Carboxylase

C. NADP reductase

D. ATP synthase

Answer: B



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13. 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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14. When CO_2 is added to PEP. The first stable product synthesised is

- A. Pyruvate
- B. Glyceraldehyde-3-phosphate
- C. Phosphoglycerate
- D. Oxaloacetate

Answer: D



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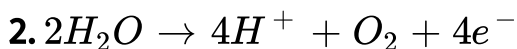
Ncert File Ncert Exemplar Problems B Very Short Answer Type Questions

1. Examine the figure



- Is this structure present in animal cell or plant cell?
- Can these be passed on to the progeny? How?
- Name the metabolic processes taking place in the places marked (1) and (2).

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Based on the above equation, answer the following questions

- Where does this reaction take place in plants ?
- What is the significance of this reaction ?

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

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4. (a) NADP reductase enzymes is located on

(b) Breakdown of proton gradient leads to release of

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

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6. $3CO_2 + 9ATP + 6NADPH + \text{water} \rightarrow \text{Glyceraldehyde 3-phosphate} + 9ADP + 6NADP + 8P_i$.

Analyse the above reaction and answer the following question.

(a) How many molecules of ATP and NADPH are required to fix one molecule of CO_2 ?

(b) Where in the chloroplast does this process occur ?

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7. Does moonlight support photosynthesis ? Find out .

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8. Some of these terms/chemicals are associated with the C_4 cycle. Explain.

(a) Hatch Slack pathway

(b) Calvin cycle

(c) PEP carboxylase (b) Bundle sheath cells

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9. Where is NADP reductase enzyme located in the chloroplast? What is the role of this enzyme in proton gradient development?

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10. ATPase enzyme consists of two parts. What are those parts ? How are they arranged in the thylakoid membrane ? Conformational change occur in which part of the enzyme ?

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

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12. What is the basis for designating C_3 and C_4 pathways of photosynthesis ?

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Ncert File Ncert Exemplar Problems C Short Answer Type Questions

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

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3. Do reaction of photosynthesis called ,as 'Dark Reaction' need light ? Explain

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4. How are photosynthesis and respiration related to each other ?

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5. If a green plant is kept in dark with proper ventilation, can this plant carry out photosynthesis ? Can anything be given as supplement to maintain its growth or survival ?

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6. Photosynthetic organisms occur at different depths in the ocean. Do they receive qualitatively and quantitatively the same light ? How do they adapt to carry out photosynthesis under these conditions.

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7. In tropical rain forests, the canopy is thick and shorter plants growing below it, receive filtered light. How are they able to carry out photosynthesis ?

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

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9. Why does the rate of photosynthesis decrease at higher temperatures ?

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10. Explain how during light reaction of photosynthesis, ATP synthesis is a chemiosmotic phenomenon.

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11. Find out how Melvin Calvin worked out the complete biosynthetic pathway for synthesis of sugar.

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12. Six turns of Calvin cycle are required to generate one mole of glucose. Explain.

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13. Complete the flow chart for cyclic photophosphorylation of the photosystem-I



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14. 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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15. A process is occurring throughout the day, in 'X' organism. Cells are participating in this process. During this process ATP, CO_2 and water are evolved. It is not a light dependent process.

(a) Name the process.

(b) Is it a catabolic or an anabolic process?

(c) What could be the raw material of this process?

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16. Tomatoes, carrot and chillies are red in colour due to the presence of one pigment. Name the pigment. Is it a photosynthetic pigments ?

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17. Why do we believe chloroplast and mitochondria to be semi-autonomous organelles?

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18. Observe the diagram and answer the following:

(a) Which group of plants exhibits these two types of cells?

(b) What is the first product of C_4 cycle?

(c) Which enzyme is there in bundle sheath cells and mesophyll cells?



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19. A cyclic process is occurring in C_3 plant, which is light dependent and needs O_2 . This process energy rather it consumes energy (a) Can you name the given process ?

(b) Is it essential for survival ?

(c) What are the end products of this process ?

(d) Where does it occur ?



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20. Suppose Euphorbia and Maize are grown in the tropical area.

(a) Which one of them do you think will be able to survive under such conditions?

(b) Which one of them is more efficient in terms of photosynthetic activity?

(c) What differences do you think are there in their leaf anatomy?

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Ncert File Ncert Exemplar Problems D Long Answer Type Questions

1. Is it correct to say that photosynthesis occurs only in leaves of a plant? Besides leaves, what are the other parts that may be capable of carrying out photosynthesis? Justify.

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2. The entire process of photosynthesis consists of a number of reactions. Where in the cell do each of these take place ?

(a) Synthesis of ATP and NADPH.....

(b) Photolysis of water

(c) fixation of CO_2

(d) Synthesis of sugar molecule

(e) Synthesis of starch.....

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3. Which property of the pigment is responsible for its ability to initiate the process of photosynthesis ? Why is the rate of photosynthesis higher in the red and blue regions of the spectrum of light ?

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4. What can we conclude from the statement that the action and absorption spectrum of photosynthesis overlap? At which wavelength do they show peaks?

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5. Under what condition are C_4 plants superior to C_3

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6. In the figure given below, the black line (upper) indicates action spectrum for photosynthesis and the lighter line (lower) indicates the absorption spectrum of chlorophyll a, answer the following:

(a) What does the action spectrum indicate? How can we plot an action spectrum? Explain with an example. (B) how can we derive an absorption spectrum for any substance ?



(c) If chlorophyll a is responsible for light reaction of photosynthesis , why do the action spectrum and absorption spectrum not overlap ?

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

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8. In the diagram shown below label A, B, C. What type of phosphorylation is possible in this?



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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. What special anatomical features are displayed by leaves of C_4 plants ?

How do they provide advantage over the structure of C_3 plants ?

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11. Name the two important enzymes of C_3 and C_4 pathway, respectively. What important role do they play in fixing CO_2 ?

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12. Why is RuBisCo enzyme the most abundant enzyme in the world ?

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13. Why does not photorespiration take place in C_4 plants ?

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Hots Higher Order Thining Skills Brain Twisting Very Short Answer

1. Name the source of O_2 during photosynthesis.

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2. Does moonlight support photosynthesis ? Find out .

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3. What is the basis for designating C_3 and C_4 pathways of photosynthesis ?

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4. What are the major conditions for PS-I functioning ?

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5. Where NADP reductase enzyme is located ?

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6. Which system in O_2 is oxygen evolving complex ?

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7. Why is lumen of thylakoids is acidic and stroma is alkaline in nature ?

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Hots Higher Order Thining Skills Brain Twisting Short Answer Questions

1. What are the major requirements be Chemiosmosis to occurs ?

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2. How photosynthesis is carried out by cyanobacteria while they donot have chloroplasts ?

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3. Why photosynthesis is essential for sustaining life on earth ?

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4. What are the characteristic features of C_4 leaf anatomy ?

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5. Dark reactions are dependent on light still are called as dark reactions. Why?

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6. How water affects the rate of photosynthesis ?

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7. 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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8. Differentiate between C_4 mesophyll chloroplasts and C_4 bundle sheath chloroplasts.

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9. Differentiate between grana and stroma.

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Hots Higher Order Thining Skills Brain Twisting Long Answer Questions

1. Discuss the importance of photosynthesis.

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2. What is hill reaction ? How it can be demonstrated ?

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3. Differentiate between carboxylation and oxygaenation .

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Quick Memory Test A Say True Or False

1. Chloroplast is differentiated into two structural components i.e. grana and stroma.

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2. C_3 plants are more efficient than C_4 plants due to absence of photorespiration

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3. Photosystem II has the trap centre known as P_{680}

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4. The principle of limiting factors was proposed by:-

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5. C_4 plants have a specialised type of anatomy in leaves called Kranz type.

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Quick Memory Test B Complete The Missing Links

1. Photosynthesis is processed by which green plants trap energy and convert it into

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2. RuBP carboxylase. In the presence of high concentration of act as oxygenase.

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3. In C_4 pathway pyruvic acid is generated in the cells and is transferred back to

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4. All the pigments are located in membrane of chloroplast .

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5. The radioactive spots of chromatogram can be located by

.....



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6. Biochemical mechanism for photo respiration is also called metabolism.



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Quick Memory Test C Choose The Correct Alternative

1. Chlorophyll a bears methyl/formyl group at carbon 3.



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2. In photosystem I chlorophyll to carotenoid ratio is 25:1/5:1.

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3. In cyclic/non-cyclic photophosphorylation ATP and NADPH is formed.

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4. C_3/C_4 is a biochemical pathway where double fixation of CO_2 takes place with first stable product being a 4-carbon dicarboxylic acid.

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5. In C_4 chloroplasts CO_2 is fixed by Rubisco/PEP carboxylase.

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6. Oxygenation takes place during photorespiration/carboxylation.

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Revision Exercises Very Short Answer Questions

1. Expand RuBP.

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2. Main difference between chlorophyll a and chlorophyll b is

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3. Which element occurs in chlorophyll and haemoglobin?

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4. How many ATP molecules are required for synthesis of one molecule of glucose in : (i), pathway (ii) pathway?

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5. How many molecules of ATP and how many molecules of NADPH are spent to fix three molecules of CO_2 in Calvin cycle?

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6. 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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7. Name any two plants which employ C_4 pathway of photosynthesis.

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8. Name any one accessory pigment and one essential pigment in photosynthetic plants.

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9. Name two photosynthetic pigments belonging to carotenoids.

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10. Give one point of difference between Chlorophyll a and Chlorophyll b.

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

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12. Name the only natural process by which oxygen is liberated for use of respiration.

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13. What would happen to the rate of photosynthesis in C_3 plants if the CO_2 concentration level almost doubles from its present level in the atmosphere?

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

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

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Revision Exercises Short Answer Questions

1. Expand PS I, PS II, PQ, PC, RuBP, RuDP, Rubisco.



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2. Name the different types of chlorophylls found in plants.

Differentiate between Chlorophyll a and Chlorophyll b.



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



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4. Describe briefly what was demonstrated in the reaction named after its discoverer Robin Hill?

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5. Photorespiration poses threat to plants yet it occurs in angiosperms. Why?

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6. Describe structure of chlorophyll a.

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7. Explain the compensation point.

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8. State Blackman's law of limiting factor.

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9. What do you mean by Kranz anatomy? Give two examples.

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10. Show supramolecular complexes in the form of well labelled diagram only of thylakoid membranes in chloroplast.

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11. An important difference between C_3 and C_4 plants is photorespiration. Explain how photorespiration occurs in plants.

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12. Define Blackman's law of limiting factors and identify any two important factors which influence the rate of photosynthesis in plants.

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13. 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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14. 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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15. 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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16. 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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17. Compare the chemiosmotic pathway in chloroplast and mitochondria.

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18. Why does rate of photosynthesis decrease at higher light intensities? What plays a protective role in such situations?

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19. When and why does photorespiration take place in plants? How does this process result in loss to the plant?

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20. Write the structure and functions of chloroplast.

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21. What is the law of limiting factors? How could the rate of photosynthesis be affected if the soil water becomes limiting? Explain.

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22. Two groups (A and B) of bean plants of similar size and same leaf area were placed in identical conditions. Group A was exposed to light of wavelength of 400-450 nm and group B to light of wavelength 500-550 nm. Compare the photosynthetic rate of the two groups giving reason.

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1. Explain non-cyclic photophosphorylation in plants. Why is this process called so?

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2. Differentiate between photophosphorylation and photorespiration.

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3. What is meant by photophosphorylation? Discuss the cyclic photophosphorylation with the help of schematic sketches.

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4. Describe C_4 cycle in plants for CO_2 fixation. Name atleast two C_4 plants.

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5. What is carbon fixation in plants? Explain three phases of Calvin cycle.

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Competition File Objective Type Questions A Multiple Choice Questions Mcqs

1. Energy released during movement of electrons through the photosystems in photosynthesis is used to drive protons across the membrane against concentration gradient. As a result the protons accumulate in

- A. Thylakoid lumen
- B. Stroma
- C. Intrathylakoid space
- D. Stromal lamella

Answer: A



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2. The first event in photosynthesis is

- A. Photoexcitation of chlorophyll and electron emission
- B. Photolysis of water
- C. Release of oxygen
- D. Synthesis of ATP

Answer: A

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3. Rubisco is the most abundant enzyme in the world and present in very high concentration in chloroplasts. It is required in very high concentration for photosynthesis because it :

A. is a very slow acting enzyme

- B. Also acts as an oxygenase
- C. Catalyses a reversible reaction
- D. Is degraded very rapidly

Answer: A

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4. The enzyme, sucrose synthase, catalyses the synthesis of sucrose from:

- A. UDPG + fructose
- B. UDPF + glucose
- C. UDPG + glucose-6-phosphate
- D. UDPG + fructose-6-phosphate

Answer: D



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5. Light reaction of photosynthesis occurs inside

A. Stroma

B. Grana

C. Endoplasmic reticulum

D. Cytoplasm

Answer: B



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6. A reduction in the quantity of oxygen evolution during photosynthesis may be observed at

- A. Light having wave length more than 680 nm
- B. Light having wave length less than 680 nm
- C. Light having wave length 560 nm
- D. Light having wave length less than 360 nm

Answer: D



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7. Plants requiring low light intensity for optimum photosynthesis is called:

A. Heliophytes

B. Pteridophytes

C. Sciophytes

D. Bryophytes

Answer: C



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8. Sunken stomata are usually found in

A. C_3 plants

B. CAM plants

C. Insectivorous plants

D. Phanerogams

Answer: B



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9. Select the incorrect matched pair with regard to C_4 cycle :

- (a) Primary CO_2 fixation product – PGA
- (b) Site of initial carboxylation – mesophyll cells
- (c) Primary CO_2 acceptor – PEP
- (d) C_4 plant – maize
- (e) Location of enzyme Rubisco – Bundle sheath cells



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10. In C_3 cycle for the fixation of every CO_2 molecule, the reduction and regeneration steps require :

A. 3 ATP and 2 $NADPH_2$

B. $2ATP$ and $2NADPH_2$

C. $2ATP$ and $3NADPH_2$

D. $3ATP$ and $3NADPH_2$

Answer: A



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11. Which of the following is formed during photorespiration ?

A. Sugar

B. Phosphoglycolate

C. NADPH

D. ATP

Answer: B



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12. Which of the following statements is true with regard to the light reaction of photosynthesis

- A. In PSII the reaction centre chlorophyll a has an absorption peak at 700 nm, hence is called P 700
- B. In PSI the reaction centre chlorophyll a has an absorption maxima at 680 nm and is called P 680
- C. The splitting of water molecule is associated with PS I
- D. Photosystems I and II are involved in Z scheme

Answer: D



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13. 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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14. 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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15. During Calvin cycle the total number of CO_2 ATP and NADPH molecules utilised and glucose, ADP and NADP molecules generated is

A. 31

B. 36

C. 61

D. 67

Answer: D



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16. Melvin Calvin was professor of

- A. Botany
- B. Plant physiology
- C. Chemistry
- D. Biochemistry

Answer: C



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17. 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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18. Non-cyclic photophosphorylation results in production of

A. ADP

B. ATP

C. NADPH

D. ATP and NADPH

Answer: D



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19. Photosynthetically active radiation (PAR) represents the following range of wavelength

A. 500-600 nm

B. 450-950 nm

C. 340-450 nm

D. 400-700 nm

Answer: D



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20. Which elements are essential for the photophosphorylation?

A. Mg and P

B. Zn and I

C. K and Cl

D. Mn and Cl

Answer: D



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21. Kranz anatomy is usually associated with

A. C_3 plants

B. C_4 plants

C. CAM plants

D. $C_3 - C_4$ intermediate plants

Answer: B

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22. Which of the following statements regarding C_4 pathway is false

A. The primary CO_2 acceptor is phosphoenol pyruvate

B. The enzyme responsible for CO_2 fixation is PEP case

C. The mesophyll cells lack RubisCO enzyme

D. The bundle sheath cells contain the enzyme PEP case .

Answer: D



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23. Consider the following statements with respect to photosynthesis (A) The first carbon dioxide acceptor in C_4 cycle is PGA

(B) In C_3 plants, the first stable product of photosynthesis during dark reaction is RuBP

(C) Cyclic photophosphorylation results in the formation of ATP

(D) Oxygen which is liberated during photosynthesis comes from water

A. A and B alone are correct

B. A and C alone are correct

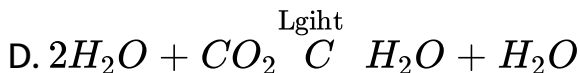
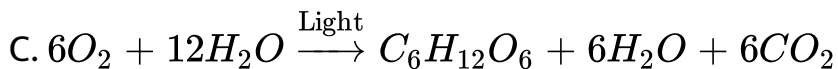
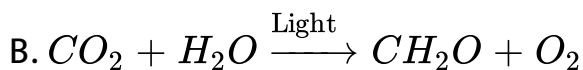
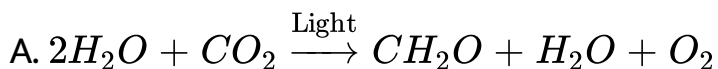
C. B and C alone are correct

D. B and D alone are correct

Answer: C

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24. Which reaction is given by Cornelius Van Niel:



Answer: A



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25. Extrusion of electron from reaction centre of PS II leaves a hole which is filled by electron released from

- A. Chlorophyll
- B. CO_2
- C. H_2O
- D. Light

Answer: C



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26. Bundle sheath cells

- A. Lack RuBisCO
- B. Lack both RuBisCO and PEP carboxylase
- C. Are rich in PEP carboxylase
- D. Are rich in RuBisCO.

Answer: D



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27. Synthesis of one glucose molecule requires- reduced NADP molecules

- A. 6

B. 12

C. 18

D. 24

Answer: B



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28. Chlorophyll molecules are located in

A. Thylakoid membrane

B. Thylakoid lumen

C. Stroma

D. Inner chloroplast membrane.

Answer: A



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29. The enzyme responsible for primary carboxylation in C_3 plants is

- A. Pyruvate Carboxylase
- B. Succinic dehydrogenase
- C. Hexokinase
- D. RuBP Carboxylase Oxygenase

Answer: D



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30. In C_3 -plants the first stable compound formed after CO_2 fixation is

- A. Oxaloacetic acid
- B. Malic acid
- C. Phosphoglyceraldehyde
- D. 3 - phosphoglycerate

Answer: D

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31. Chloroplasts in higher plants are-----shaped

- A. Kidney

B. Lens

C. Beam

D. Dome

Answer: B



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32. In photosynthesis, the light-independent reactions take place in

A. Photosystem - II

B. Stromal matrix

C. Thylakoid lumen

D. Photosystem-I

Answer: B



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33. Chromatophores take part in

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

Answer: C



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34. 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_3

B. C_4

C. CAM

D. Nitrogen fixer

Answer: B



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35. Phytochrome is

- A. Lipoprotein
- B. Chromoprotein
- C. Flavoprotein
- D. Glycoprotein

Answer: B



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

- A. Photorespiration

B. Respiration

C. Glycolysis

D. Calvin cycle

Answer: A

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

A. Increasing atmospheric CO_2 concentration upto 0.05% can enhance CO_2 – fixation rate.

B. C_3 plants respond to high 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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38. Phosphoenol pyruvate (PEP) is the primary CO_2 acceptor in

A. C_4 plants

B. C_2 plants

C. C_3 and C_4 plants

D. C_3 plants

Answer: A



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Competition File Objective Type Questions B Cbse Pmt Main Examination Questions

1. Fill in the blanks.

CO_2 combines with.....carbon compound Rubulose 1,5-bisphosphate, with the help of enzyme Ribulose 1, 5-

biphosphate 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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Competition File Objective Type Questions D Assertion Type Questions

1. Assertion : Photorespiration retards the products of light reaction in photosynthesis.

Reason: Chlorophyll fails to absorb light in photorespiration.

- A. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If both Assertion and Reason are false.

Answer: D

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2. Assertion : Action spectrum of Chl.a follow the absorption spectrum in photosynthesis.

Reason: Chlorophyll can convert light energy into chemical energy.

- A. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If both Assertion and Reason are false.

Answer: B



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3. Assertion : The role of phycobilins in photosynthesis is to absorb and transfer energy to chlorophyll

Reason: Phycobilins act as necessary pigments and transfer energy to primary pigments i.e chlorophyll

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

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

C. If Assertion is true but Reason is false.

D. If both Assertion and Reason are false.

Answer: A



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4. Assertion : In photosynthesis oxygen evolved comes from water.

Reason: The evolution of oxygen and reduction of CO_2 during photosynthesis takes place due to photolysis of water

- A. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If both Assertion and Reason are false.

Answer: C



5. Assertion : Red and blue light support the highest rate of synthesis.

Reason: These are the only wavelengths reaching from the sun.

- A. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If both Assertion and Reason are false.

Answer: C

6. Assertion : Algae float in water during daytime and sink during night because they become light due to consumption of food in respiration.

Reason: The first stable product of carbon assimilation in C_3 plants is 3- phosphoglyceraldehyde.

- A. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If both Assertion and Reason are false.

Answer: B



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7. Assertion : The dark reaction in photosynthesis is called because it does not require light energy.

Reason: Dark reaction occurs more rapidly in night.

- A. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If both Assertion and Reason are false.

Answer: C



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8. Assertion : C_4 plants form food more rapidly more efficiently in photosynthesis than C_3 plants.

Reasons : C_4 plants have a shorter CO_2 fixation cycle.

- A. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If both Assertion and Reason are false.

Answer: A



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9. Assertion : In C_4 plants end product of CO_2 fixation is oxalo-acetic acid.

Reason: Oxalo-acetic acid is formed in bundle sheath chloroplasts.

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

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

C. If Assertion is true but Reason is false.

D. If both Assertion and Reason are false.

Answer: C



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10. Assertion : In all C_4 plants, photorespiration takes place.

Reason: In C_4 plants , respiration does not occur in dark.

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

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

C. If Assertion is true but Reason is false.

D. If both Assertion and Reason are false.

Answer: D



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11. Assertion : Chlorophyll is soluble in ethyl ether and acetone.

Reasons : Ethyl ether and acetone are organic solvents.

- A. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If both Assertion and Reason are false.

Answer: C



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12. Assertion : Etiolated plants are formed due to lack of light.

Reason: In absence of light, plants show more elongation and even chlorosis to show etiolation.

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

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

C. If Assertion is true but Reason is false.

D. If both Assertion and Reason are false.

Answer: A



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13. Assertion : The sequence of dark reaction of photosynthesis was discovered by Robin Hill

Reason: The principle of limiting factor was proposed by Calvin.

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

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

C. If Assertion is true but Reason is false.

D. If both Assertion and Reason are false.

Answer: D

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14. Assertion : CO_2 is utilized in dark reaction of photosynthesis.

Reason : CO_2 as one of the raw material enters the leaves through stomata.

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

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

C. If Assertion is true but Reason is false.

D. If both Assertion and Reason are false.

Answer: B

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15. Assertion : The role of chlorophyll in photosynthesis is absorption of light and photolysis of water.

Reason : The function of solar energy is assimilation of CO_2

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

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

C. If Assertion is true but Reason is false.

D. If both Assertion and Reason are false.

Answer: C

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16. Assertion : photosynthetic pathway is more efficient than the C_3 pathway.

Reason : Photorespiration is suppressed in C_3 plants.

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

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

C. If Assertion is true but Reason is false.

D. If both Assertion and Reason are false.

Answer: A

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17. Assertion. The atmospheric concentration of CO_2 at which photosynthesis just compensates for respiration is referred to as CO_2 compensation point.

Reason. CO_2 -compensation point is reached when the amount of CO_2 uptake is less than that generated through

respiration because the level of CO_2 is more than that required for achieving CO_2 -compensation point.

- A. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If both Assertion and Reason are false.

Answer: C



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18. Assertion : Long distance flows of photoassimilates in plants occurs through sieve tubes

Reason : Mature sieve tubes have parietal cytoplasm and perforated sieve plates

- A. If both Assertion and Reason are true and Reason is correct explanation of Assertion.
- B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If both Assertion and Reason are false.

Answer: C



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19. 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 Reason is correct explanation of Assertion.

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

C. If Assertion is true but Reason is false.

D. If both Assertion and Reason are false.

Answer: B



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20. 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 Reason is correct explanation of Assertion.
- B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion.
- C. If Assertion is true but Reason is false.
- D. If both Assertion and Reason are false.

Answer: D



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Competition File Objective Type Questions E Analogy Type Questions

1. RuBP : Ribulose 1,5 biphosphate :: PGA :



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2. PGA : 3-carbon compound :: RuBP :



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3. Cyclic photophosphorylation : PS I :: Non-cyclic photophosphorylation :

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Competition File Objective Type Questions F Reasoning Type Questions

1. The process of photorespiration has been considered as disadvantageous to C_3 plants.

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2. Hill reaction is not the true form of light reaction.

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3. Photosynthetic pigments absorb visible part of radiation (380 $m\mu$ to 760 $m\mu$).

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4. In photorespiration glycine is transported out of peroxisomes into mitochondria.

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5. C_4 plants show Kranz anatomy.

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6. Cyclic electron transport in photosynthesis is only concerned with production of ATP.

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7. Reduce form of $NADP^+$ is abbreviated at NADPH.

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8. Quantum requirement in photosynthesis is 8.

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1. What is common between chloroplasts, chromoplasts and leucoplasts

- A. Presence of pigments
- B. Possession of thylakoids and grana
- C. Storage of starch, proteins and lipids
- D. Ability to multiply by a fission like process

Answer: D



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2. Structurally chlorophyll a and b are different as:

A. Chl a has a methyl group and Chl b has an aldehyde group

B. Chl a has a carboxyl group and Chl b has an aldehyde group

C. Chl a has an aldehyde group and Chl b has a methyl group

D. Chl a has an ethyl group and Chl b has an aldehyde group

Answer: A



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3. Which one does not occur in cyclic photophosphorylation?

- A. Oxygen is not given off
- B. Water is not consumed
- C. Only photosystem-I is involved
- D. NADPH formation

Answer: D



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4. In higher plants, the shape of the chloroplast is

- A. Discoid

B. Cup shaped

C. Girdle shaped

D. Reticulate

Answer: A



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5. In C_4 plants , the bundle sheath cells

A. Have thin walls to facilitate gaseous exchange

B. Have large intercellular spaces

C. Are rich in PEP carboxylase

D. Have a high density of chloroplasts

Answer: D



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6. Kranz anatomy is observed in:

A. C_2 plants

B. C_3 plants

C. C_4 plants

D. CAM plants

Answer: C



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7. Primary CO_2 acceptor of CAM plant :

A. OAA

B. PGA

C. PEP and RuBP

D. Citric acid

Answer: C



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8. First stable compound in C_3 plant is :

A. PGA

B. OAA

C. RuBP

D. PEP

Answer: A



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9. Stomata of CAM plants :

A. Are always open

B. Open during the day and close at night

C. Open during the night and close during the day

D. Never open

Answer: C



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10. Stroma in the chloroplasts of higher plant contains

- A. Light independent reaction enzymes
- B. Light dependent reaction enzymes
- C. Ribosomes
- D. Chlorophyll

Answer: A



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11. Oxygenic photosynthesis occurs in

- A. Chromatium
- B. Oscillatoria
- C. Rhodospirillum
- D. None of above

Answer: B

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12. The active component of photosystem-I is composed of

- A. Chlorophyll a with absorption peak at 680 nm
- B. Chlorophyll a with absorption peak at 700 nm
- C. Chlorophyll h with absorption peak at 680 nm
- D. Chlorophyll a and h with absorption peak at 700 nm

Answer: C



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13. In photorespiration, the cell organelles involved are:

- A. Chloroplast and mitochondrion
- B. Chloroplast only
- C. Chloroplast, mitochondrion and ribosome
- D. Chloroplast, mitochondrion and peroxisome

Answer: D



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14. The conversion of phosphoglyceric acid to phosphoglyceraldehyde during photosynthesis can be described as :

- A. Oxidation
- B. Hydrolysis
- C. Electrolysis
- D. Reduction

Answer: D



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15. ATP can be formed in the photosynthesizing plant cells by:

- A. Photophosphorylation
- B. Oxidative phosphorylation
- C. Substrate level phosphorylation
- D. All of the above

Answer: A

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Chapter Practice Test

1. Red drop is

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2. Define action spectrum.

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3. What does hill experiment prove ?

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4. Define phosphorescence

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5. 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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6. how many molecules of ATP and NADPH are require in formation of two molecules of glucose ? How many calvin cycles are required

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7. Differentiate between absorption spectrum and action spectrum.

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8. Write the schematic representation of Calvin cycle.



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9. Factors affecting photosynthesis



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