

# DPP - Daily Practice Problems

## Chapter-wise Sheets

Date :

Start Time :

End Time :

# BIOLOGY

CB13

SYLLABUS : Photosynthesis in Higher Plants

Max. Marks : 180

Marking Scheme : + 4 for correct & (–1) for incorrect

Time : 60 min.

INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQs. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. Quantasomes are present in
  - (a) chloroplast
  - (b) mitochondria
  - (c) golgi body
  - (d) lysosome
2. The  $C_4$  plants are photosynthetically more efficient than  $C_3$  plants because:
  - (a) the  $CO_2$  compensation point is more
  - (b)  $CO_2$  generated during photorespiration is trapped and recycled through PEP carboxylase
  - (c) the  $CO_2$  efflux is not prevented
  - (d) they have more chloroplasts
3. Photorespiration is favoured by
  - (a) high  $O_2$  and low  $CO_2$
  - (b) low light and high  $O_2$
  - (c) low temperature and high  $O_2$
  - (d) low  $O_2$  and high  $CO_2$
4. Which one is the correct summary equation of photosynthesis?
  - (a)  $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{energy}$
  - (b)  $C_6H_{12}O_6 + 6O_2 + 6H_2O \longrightarrow 6CO_2 + 12H_2O + \text{energy}$
  - (c)  $6CO_2 + 6H_2O \longrightarrow 6H_2O + C_6H_{12}O_6$
  - (d)  $6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light}} 6O_2 + C_6H_{12}O_6 + 6H_2O$
5.  $C_4$  acid, formed in the mesophyll of  $C_4$  plants leaf during photosynthesis is
  - (a) OAA or malic acid or aspartic acid
  - (b) pyruvic acid
  - (c) succinic acid
  - (d) fumaric acid
6. The organelles which take part in photo-respiration are
  - (a) chloroplast, mitochondria, nucleus
  - (b) chloroplast, mitochondria, lysosome
  - (c) mitochondria, chloroplast, peroxisome
  - (d) mitochondria, lysosomes, peroxisome

RESPONSE GRID

1. (a) (b) (c) (d)  
6. (a) (b) (c) (d)

2. (a) (b) (c) (d)

3. (a) (b) (c) (d)

4. (a) (b) (c) (d)

5. (a) (b) (c) (d)

Space for Rough Work

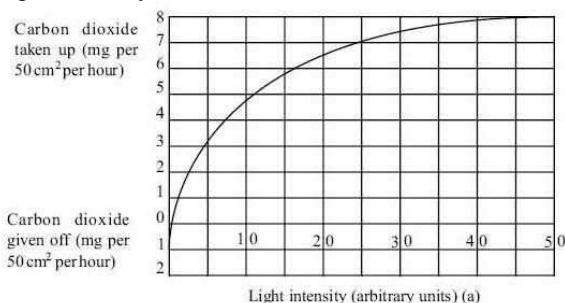
7. Grana are present inside the :  
(a) mitochondria (b) chloroplast  
(c) endoplasmic reticulum (d) ribosome
8. Photosynthetically active radiation is represented by the range of wavelength of  
(a) 340 - 450 nm (b) 400 - 700 nm  
(c) 500 - 600 nm (d) 400 - 950 nm
9. Which of the following statement is incorrect ?  
(a)  $C_3$  plants respond to higher temperature, show higher photosynthetic rate while  $C_4$  plants have lower optimum temperature.  
(b) Tropical plants have higher temperature optimum than the plants adapted to temperate climate.  
(c) Light reaction is less temperature sensitive than dark reaction.  
(d) The effect of water as a factor is more through its effect on plant, rather than directly on photosynthesis.
10. Chemiosmotic hypothesis given by Peter Mitchell proposes the mechanism of  
(a) synthesis of ATP (b) synthesis of  $FADH_2$   
(c) synthesis of NADH (d) synthesis of NADPH
11. RuBisCO stands for  
(a) Ribulose Biphosphate Carboxylase Oxygenase  
(b) Ribulose Phosphate Carboxylase Oxygenase  
(c) Ribulose Phosphate Carboxylic Oxygenase  
(d) None of the above
12. Which enzyme is most abundantly found on earth?  
(a) Catalase (b) RuBisCo  
(c) Nitrogenase (d) Invertase
13. The first carbon dioxide acceptor in  $C_4$ -plants is  
(a) Phosphoenol-pyruvate  
(b) Ribulose 1, 5-diphosphate  
(c) Oxalo-acetic acid  
(d) Phosphoglyceric acid
14. Which one of the following is essential for photolysis of water ?  
(a) Manganese (b) Zinc  
(c) Copper (d) Boron
15. Which element is required in the germination of pollen grain?  
(a) Chlorine (b) Potassium  
(c) Boron (d) Calcium
16. In a CAM plant, the concentration of organic acid  
(a) increases during the day.  
(b) decreases during the day.  
(c) increases during night.  
(d) decreases or increases during day.
17. Which of the following statements regarding photorespiration are **true**?  
(a) Photorespiration is a metabolically expensive pathway.  
(b) Photorespiration is avoided when  $CO_2$  is abundant.  
(c) Photorespiration results in a loss of usable carbon dioxide.  
(d) All of the above
18. The Z-scheme refers to  
(a) the type of photosynthesis occurs in plants found in areas with minimal precipitation.  
(b) the pattern of grana within the chloroplasts of photosynthetic plants.  
(c) the carbon-fixation process which is also known as the Calvin cycle.  
(d) an energy diagram for the transfer of electrons in the light reactions of photosynthesis in plants.
19. Which one is a  $C_4$ -plant?  
(a) Papaya (b) Pea  
(c) Potato (d) Maize/Corn
20. In an experiment, mature leaves on the plant were enclosed for a fixed amount of time in a transparent bag that had radioactive  $CO_2$ . In which part of the plant will maximum radioactivity be found after some time?  
(a) Actively growing leaves.  
(b) Guard cells of all the leaves.  
(c) In mature leaves.  
(d) Senescing leaves and roots.
21. When a photosynthetic plant is transferred to an atmosphere of enriched  $O_2$ , its rate of  
(a) photosynthesis would increase.  
(b) photosynthesis would decrease.  
(c) respiration would decrease.  
(d) osmosis would increase.

**RESPONSE  
GRID**

- |                  |                  |                  |                  |                  |
|------------------|------------------|------------------|------------------|------------------|
| 7. (a)(b)(c)(d)  | 8. (a)(b)(c)(d)  | 9. (a)(b)(c)(d)  | 10. (a)(b)(c)(d) | 11. (a)(b)(c)(d) |
| 12. (a)(b)(c)(d) | 13. (a)(b)(c)(d) | 14. (a)(b)(c)(d) | 15. (a)(b)(c)(d) | 16. (a)(b)(c)(d) |
| 17. (a)(b)(c)(d) | 18. (a)(b)(c)(d) | 19. (a)(b)(c)(d) | 20. (a)(b)(c)(d) | 21. (a)(b)(c)(d) |

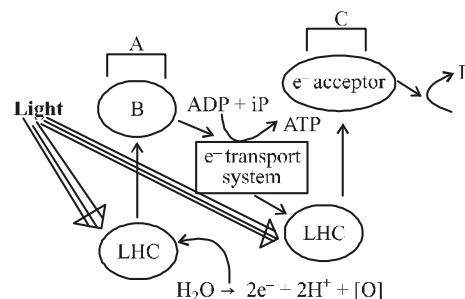
Space for Rough Work

22. In  $C_4$  plants, agranal chloroplasts are found in  
 (a) mesophyll cells  
 (b) epidermal cell chloroplasts of green stem  
 (c) bundle sheath cells  
 (d) chloroplasts of guard cells
23. Oxyosomes or  $F_0 - F_1$  particles occur on  
 (a) thylakoids  
 (b) mitochondrial surface  
 (c) inner mitochondrial membrane  
 (d) chloroplast surface
24. Photorespiration is favoured by  
 (a) high  $O_2$  and low  $CO_2$   
 (b) low light and high  $O_2$   
 (c) low temperature and high  $O_2$   
 (d) low  $O_2$  and high  $CO_2$
25. 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
26. The graph shows the relation between light intensity and the giving off and taking up of carbon dioxide by the leaves of a plant. Why is most carbon dioxide given off when the light intensity is zero units ?



- (a) Because it is just the start of the experiment.  
 (b) Only respiration is taking place at this intensity of light.  
 (c) Only photosynthesis is taking place at this intensity of light.  
 (d) The rate of photosynthesis is equivalent to the rate of respiration.
27. In photosystem-I the first electron acceptor is  
 (a) cytochrome (b) plastocyanin  
 (c) an iron-sulphur protein (d) ferredoxin

28. Which of the following statement is false?  
 (a)  $H_2S$ , not  $H_2O$ , is involved in photosynthesis of purple sulphur bacteria.  
 (b) Light and dark reactions are stopped in the absence of light.  
 (c) Calvin cycle occurs in the grana of chloroplast.  
 (d) ATP is produced during light reaction *via* chemiosmosis.
29. Given below is the pathway of light reaction. Identify the given blanks indicated by A, B, C, D and E.



	A	B	C	D
(a)	P 700	$H^+$ acceptor	P680	$NADP^+$
(b)	Photosystem I	$e^-$ acceptor	Photosystem II	$NADPH_2^+$ ATP
(c)	Photosystem II	$H^+$ acceptor	P700	NADPH
(d)	Photosystem II	$e^-$ acceptor	Photosystem I	$NADPH + H^+$

30. Warburg effect refers to  
 (a) decreased photosynthetic rate at very high  $O_2$  concentration  
 (b) increased photosynthetic rate at very high  $O_2$  concentration  
 (c) decreased photosynthetic rate at very low  $O_2$  concentration  
 (d) increased photosynthetic rate at very low  $O_2$  concentration

## RESPONSE GRID

22. (a)(b)(c)(d) 23. (a)(b)(c)(d) 24. (a)(b)(c)(d) 25. (a)(b)(c)(d) 26. (a)(b)(c)(d)  
 27. (a)(b)(c)(d) 28. (a)(b)(c)(d) 29. (a)(b)(c)(d) 30. (a)(b)(c)(d)

Space for Rough Work

31. Read the following statements and select the correct ones.  
 (i) PS I is involved in non-cyclic photophosphorylation only.  
 (ii) PS II is involved in both cyclic and non-cyclic photophosphorylation  
 (iii) Stroma lamellae membranes possess PS I only, whereas grana lamellae membranes possess both PS I and PS II.  
 (a) (i) only (b) (ii) only  
 (c) (iii) only (d) (i), (ii) and (iii)
32. Which is not correct for cyclic photophosphorylation ?  
 (a) No  $O_2$  given off  
 (b) No water consumed  
 (c) No  $NADPH_2$  synthesized  
 (d) PS-I and PS-II are involved
33. Calvin cycle expends the following for fixation of 3-molecules of  $CO_2$   
 (a) 9 ATP and 6  $NADPH_2$  (b) 8 ATP and 6  $NADPH_2$   
 (c) 9 ATP and 3  $NADPH_2$  (d) 6 ATP and 9  $NADPH_2$
34. In a classic experiment on photosynthesis, R. L. Hill demonstrated that an illuminated *in vitro* suspension of isolated chloroplasts could produce oxygen in the presence of a hydrogen acceptor such as methylene blue. In this case methylene blue is reduced. Which one of the following compounds replaces methylene blue in the intact photosynthesising plant ?  
 (a) adenosine triphosphate (ATP)  
 (b) carbon dioxide  
 (c) nicotinamide adenine dinucleotide phosphate (NADP)  
 (d) phosphoglyceric acid (PGA)
35. The key compound of Calvin cycle is  
 (a) PGA (b) PGAL  
 (c) DHAP (d) DPGA
36. Which one of the following is a correct outline of the main events in photosynthesis?  
 (a) Oxygen reacts with a carbohydrate to produce water and carbon dioxide in the presence of light.  
 (b) Light joins carbon dioxide to an acceptor compound which is then reduced by hydrogen obtained from water.  
 (c) Light splits water and the resulting hydroxyl group combines with a compound which has incorporated carbon dioxide  
 (d) Carbon dioxide combines with an acceptor compound and this is reduced by hydrogen split from water by light.
37. Who used prism, white light, green alga, *Cladophora* and aerobic bacteria and plotted the action spectra for photosynthesis?  
 (a) Sachs (b) Arnon  
 (c) Arnold (d) Englemann
38. Which one of the following pigment does not occur in the chloroplast?  
 (a) Carotene (b) Xanthophyll  
 (c) Chlorophyll 'b' (d) Anthocyanin
39. Which pigment is water soluble?  
 (a) Chlorophyll (b) Carotene  
 (c) Anthocyanin (d) Xanthophyll
40. Generally  $CO_2$  is not limiting for hydrophytes –  
 (a) Mesophytes plants fix  $H_2S$  in their photosynthesis.  
 (b) These plants also  $CO_2$  have from water in the form of  $HCO_3^-$ .  
 (c) Glucose is not required for their respiration  
 (d) All of the above
41. Suspension of isolated thylakoids in culture medium containing  $CO_2$  and  $H_2O$  does not produce hexose due to absence of  
 (a) ATP (b) Enzyme  
 (c) Proteins (d) Hill reagent
42. Stroma in the chloroplasts of higher plant contains  
 (a) Light-independent reaction enzymes  
 (b) Light-dependent reaction enzymes  
 (c) Ribosomes  
 (d) Chlorophyll
43. The light harvesting complex (LHC) is made up of  
 (a) one molecule of chl *a*.  
 (b) very few molecules of chl *a*.  
 (c) hundreds of pigment molecules bound to proteins.  
 (d) Chl *a* + Chl *c* + protein + DNA.
44. Hatch and Slack pathway (HSK pathway) is otherwise known as  $C_4$ -cycle because  
 (a) the first stable product is oxaloacetic acid / OAA which is a  $C_4$ -compound.  
 (b) the primary  $CO_2$  acceptor is OAA, a  $C_4$ -compounds.  
 (c) all intermediate metabolites are  $C_4$ -compound.  
 (d) at one time  $4CO_2$  molecules take part in carboxylation pathway.
45. The first acceptor of electrons from an excited chlorophyll molecule of photosystem II is –  
 (a) Quinone (b) Cytochrome  
 (c) Iron-sulphur protein (d) Ferredoxin

**RESPONSE  
GRID**

31. (a)(b)(c)(d)	32. (a)(b)(c)(d)	33. (a)(b)(c)(d)	34. (a)(b)(c)(d)	35. (a)(b)(c)(d)
36. (a)(b)(c)(d)	37. (a)(b)(c)(d)	38. (a)(b)(c)(d)	39. (a)(b)(c)(d)	40. (a)(b)(c)(d)
41. (a)(b)(c)(d)	42. (a)(b)(c)(d)	43. (a)(b)(c)(d)	44. (a)(b)(c)(d)	45. (a)(b)(c)(d)

Space for Rough Work

**DAILY PRACTICE PROBLEM DPP CHAPTERWISE 13 - BIOLOGY**

Total Questions	45	Total Marks	180
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	45	Qualifying Score	60
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

# HINTS & SOLUTIONS

## DPP/CB13

1. (a)
2. (c) The  $C_4$  pathway allows photosynthesis to occur at very low concentrations of carbon dioxide as PEP carboxylase has an extremely high affinity for carbon dioxide. This pathway also works well at high temperatures and light intensity, enabling efficient photosynthesis in tropical plants.
3. (a) Photorespiratory loss of  $CO_2$  occurs when RuBisCo starts functioning as an oxygenase instead of carboxylase under conditions of high  $O_2$  and low  $CO_2$ . It involves three organelles chloroplast, mitochondria and peroxisomes. Half of the photosynthetically fixed carbon (in the form of RuBP) may be lost into the atmosphere through this process and no ATP formation occurs.
4. (d)
5. (a)
6. (c) The process of photorespiration requires 3 cell organelles-mitochondria, chloroplasts and peroxisomes. In chloroplasts glycolate is formed from ribulose biphosphate which passes into peroxisomes to be changed into glyoxylate. In this reaction  $H_2O_2$  is evolved. Glyoxylate is changed to glycine which now enters mitochondria. Two molecules of glycine combine to form one molecule of serine with the evolution of  $CO_2$ .
7. (b) Grana are present inside the chloroplasts. Each granum may contain 10 – 100 thylakoids. Thylakoids or baggy trousers are membrane lined flattened sacs. Thylakoids (or granna) contain chloroplast proteins, photosynthetic pigments and other factors required for photosynthesis.
8. (b) Photosynthesis takes place only in the visible part (400 - 700 nm wavelength) of electromagnetic radiations. Hence, this component comprises the photo-synthetically active radiation.
9. (a)
10. (a)
11. (a)
12. (b) RuBisCo is the enzyme involved in Calvin cycle. Nitrogenase catalyses nitrogenation. Invertase catalyses breaking of sucrose to glucose and fructose.
13. (a) The primary acceptor of  $CO_2$  in  $C_4$  plants is phosphoenol pyruvate or PEP. PEP in mesophyll cells combine with  $CO_2$  and is converted into 4 carbon compound oxaloacetic acid by PEP carboxylase. In  $C_3$  plant, Ribulose 1, 5-diphosphate is primary acceptor of  $CO_2$ .
14. (a) Photolysis is catalysed by the protein-bound inorganic complex containing manganese ions (oxygen evolving complex) of photosystem II.
15. (c)
16. (c)
17. (d)
18. (d)
19. (d)
20. (a)
21. (b)
22. (c)
23. (c)
24. (a)
25. (d)
26. (b)
27. (c)
28. (c)
29. (d)
30. (a) Oxygen is a product of photosynthesis. A small quantity of  $O_2$  is essential for photosynthesis to take place. But as  $O_2$  concentration rises, rate of photosynthesis decreases. It may be because (i) Oxygen takes part in oxidation of photosynthetic pigments, intermediates and enzymes in the presence of strong light (photo-oxidation), (ii) Oxygen is a strong quencher of excited state of chlorophyll. Oxygen competes with  $CO_2$  for reducing power. It converts RuBP-carboxylase to RuBP-oxygenase. At very high oxygen concentration, the rate of photosynthesis begins to decline in all plants. This phenomenon is referred to as Warburg effect.
31. (c) PS I is involved in both cyclic and non-cyclic photophosphorylation. PS II is involved only in non-cyclic photophosphorylation. PS II is present in the appressed (inner) part of grana thylakoids. PS I is located in the non-appressed (outer) part of grana thylakoids as well as stroma thylakoids.
32. (d) In cyclic photophosphorylation, only PS-I is involved.
33. (a) In Calvin cycle, three molecules of  $CO_2$  will require  $3 \times 3 = 9$  ATP and  $2 \times 3 = 6$   $NADPH_2$ .
34. (c) In photosynthesis, light energy trapped by chlorophyll is used to excite electrons in the chlorophyll. (An electron extracted from water by photolysis fills the electron hole.) The excited electrons are then transferred through the electron transport chain in the thylakoid membrane to  $NADP^+$ , forming NADPH in the stroma.
35. (b) The key compound of C-3 cycle or Calvin cycle is 3-PGAL as it is starting point for many other metabolic pathways in the plant.
36. (d) Photosynthesis is the process by which plants manufacture food. This occurs when  $CO_2$  combines with ribulose 1,5-bisphosphate (RuBP) to form the products of photosynthesis.
37. (d)
38. (d)
39. (c)
40. (b)
41. (b)
42. (a)
43. (c)
44. (a)
45. (a)