

4. PHOTOSYNTHESIS IN HIGHER PLANTS

(1 x 2) + (1 x 4) = 6 Marks

ROOT POINTS

1. **Green plants** carry out 'Photosynthesis'.
2. During this process **carbondioxide** from the atmosphere is **taken in** by leaves through stomata.
3. During photosynthesis **plants use light energy** and synthesise carbohydrates.
4. Ultimately all living organisms on the earth depend on plants either directly or indirectly.
5. Photosynthesis provides food to all, as well it **releases oxygen** into the atmosphere.
6. **Chloroplasts** present in mesophyll cells of leaves are responsible for **CO₂ fixation**.
7. **Pigments** present in chloroplasts are Chl 'a', Chl 'b', xanthophylls and carotenoids.
8. There are two photosystems in Chl 'a'. (i) PSI (ii) PSII.
9. **Assimilatory power** is generated in ATP and NADPH during photochemical reaction.
10. This power is utilised in **dark reaction** for the synthesis of carbohydrates.
11. **Dark reaction** occurs on **stroma of chloroplast**.
12. Based on the **first stable product** in dark reactions, two pathways are identified.
13. They are (i) Calvin cycle (C₃ cycle) (ii) Hatch and Slack cycle (C₄ cycle). [IPE]
14. Calvin cycle includes carboxylation, reduction and regeneration.
15. First stable compound in Calvin cycle is PGA (a C₃ compound).
16. C₄ cycle operates in two photosynthetic cells-Mesophyll and bundle sheath cells.
17. First stable product in Hatch and Slack pathway is OAA (a C₄ compound).

FRUITY Qs OF IPE

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1. Where does the photolysis of H₂O occur? What is its significance?
2. Distinguish between action spectrum and absorption spectrum.
3. Define the law of limiting factors proposed by Blackman.
4. What is the primary acceptor of CO₂ in C₃ plants? What is first stable compound formed in a Calvin cycle?
5. Explain how Calvin worked out the complete biosynthetic pathway for the synthesis of sugar.
6. Explain the structure of chloroplast? Draw a neat labelled diagram.
7. Tabulate eight differences between C₃ cycles and C₄ cycles.

SCENT BOXES- MEMORY HINTS

FOR SELECTIVE QUESTIONS

18. Tabulate any eight differences between C₃ and C₄ plants/ cycles.

A:

C ₃ Cycle	C ₄ Cycle
1) First stable product of carbon pathway is C ₃ compound (PGA-Phospho glyceric acid)	1) First stable product of carbon pathway is C ₄ compound (OAA-Oxalo acetic acid)
2) This occurs mostly in Temperate plants.	2) This occurs only in Tropical plants.
3) Leaves donot show Kranz anatomy.	3) Leaves show Kranz anatomy.
4) Chloroplast dimorphism is not seen.	4) Chloroplast dimorphism is seen.
5) Photo respiration is very high.	5) Photo respiration is not detectable.
6) In C ₃ plants, transpiration is more.	6) In C ₄ plants, transpiration is less.
7) Less efficient in utilising atmospheric CO ₂ .	7) More efficient in utilising atmospheric CO ₂ .
8) Biomass is produced in less quantity.	8) Biomass is produced in high quantity.
9) Ex: Almost all dicot plants	9) Ex: Maize, Sugarcane, Sorghum

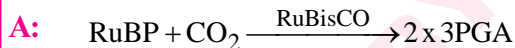
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C₃ eats more but works less where as

C₄ eats less but works more

19. Describe in brief photorespiration.

[TS 19,20]



- 1) RuBisCO is the most abundant enzyme in the world.
- 2) Its active site can bind to both CO₂ and O₂ hence the name.
- 3) RuBisCO has a much greater affinity for CO₂ than for O₂.
- 4) If O₂ concentration is more, RuBisCO functions as oxygenase, and binds with O₂.
- 5) Instead of forming two molecules of PGA, it forms one molecule of phosphoglycerate and one molecule of phosphoglycolate.
- 6) This pathway is called photorespiration.
- 7) In photorespiration pathway there is synthesis of neither sugar nor ATP nor NADPH.
- 8) Moreover, there is a release of CO₂ with the utilisation of ATP.
- 9) Therefore photorespiration is a wasteful process.

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Plant says
Mr. Photo Ruben is waste
because he consumes
all of my ATP

63. Name the processes which take place in the grana and stroma regions of chloroplasts.

- A:** 1) Light reaction occurs in grana of chloroplast.
2) Dark reaction (carbon fixation) occurs in stroma of chloroplast.

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My Grandma
living in Chloroplast
likes light.
But her neighbour
stroma doesn't like it.

64. Where does the photolysis of H_2O occur?

What is its significance? [AP 17,20][TS 19,22]

- A:** 1) Photolysis of H_2O occurs in grana of chloroplast.
2) **Significance:** During photolysis oxygen is evolved.
It is the main source of atmospheric oxygen.

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My Grandma living in
Chloroplast is a
Photographer of atmoxy.

69. Which tissue transports photosynthates?

What experiment proves this?

- A:** 1) Phloem is the tissue that transports photosynthates.
2) Ringing / girdling experiments of phloem proves this.

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When we ring a bell
Phloem transports food