

# Photosynthesis in Higher Plants — NEET Biology PYQ (2005-2021)

Class 11 Biology · 34 real NEET & AIPMT questions, year-tagged · answers checked by RankUp

NEET 2021

**1. The first stable product of CO<sub>2</sub> fixation in sorghum is :**

- (A) Pyruvic acid
- (B) Oxaloacetic acid
- (C) Succinic acid
- (D) Phosphoglyceric acid

NEET 2021

**2. Which of the following statements is incorrect ?**

- (A) Both ATP and NADPH + H<sup>+</sup> are synthesized during non-cyclic photophosphorylation.
- (B) Stroma lamellae have PS I only and lack NADP reductase.
- (C) Grana lamellae have both PS I and PS II.
- (D) Cyclic photophosphorylation involves both PS I and PS II.

NEET 2020 · Q65

**3. In light reaction, plastoquinone facilitates the transfer of electrons from:**

- (A) PS-II to Cytb<sub>6</sub>f complex
- (B) Cytb<sub>6</sub>f complex to PS-I
- (C) PS-I to NADP<sup>+</sup>
- (D) PS-I to ATP synthase

NEET 2018 · Q91

**4. Oxygen is not produced during photosynthesis by**

- (A) Cycas
- (B) Nostoc
- (C) Green sulphur bacteria
- (D) Chara

NEET 2018 · Q120

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

- (A) NADPH
- (B) NADH
- (C) ATP
- (D) Oxygen

NEET 2017 · Q48

**6. Phosphoenol pyruvate (PEP) is the primary CO<sub>2</sub> acceptor in:**

- (A) C<sub>3</sub> plants
- (B) C<sub>4</sub> plants
- (C) C<sub>2</sub> plants
- (D) C<sub>3</sub> and C<sub>4</sub> plants

NEET 2017 (Gujarati paper) · Q92

**7. Which statement is wrong about photorespiration?**

- (A) Photorespiration occurs in C<sub>3</sub> plants and not C<sub>4</sub> plants
- (B) There is no synthesis of ATP or NADPH
- (C) RuBisCO has higher affinity for CO<sub>2</sub> than O<sub>2</sub>
- (D) RuBP binds with O<sub>2</sub> to form two molecules of phosphoglycolate

NEET 2016 Phase 2 · Q113

**8. The process which makes major difference between C<sub>3</sub> and C<sub>4</sub> plants is**

- (A) glycolysis
- (B) Calvin cycle
- (C) photorespiration
- (D) respiration

NEET 2016 Phase 1 · Q97

**9. Emerson's enhancement effect and Red drop have been instrumental in the discovery of:**

- (A) Photophosphorylation and non-cyclic electron transport
- (B) Two photosystems operating simultaneously
- (C) Photophosphorylation and cyclic electron transport
- (D) Oxidative phosphorylation

NEET 2016 Phase 1 · Q103

**10. In a chloroplast the highest number of protons are found in:**

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

NEET 2016 Phase 1 · Q143

**11. 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

AIPMT 2014

**12. A few normal seedlings of tomato were kept in a dark room. After a few days they were found to have become white-coloured like albinos. Which of the following terms will you use to describe them?**

- (A) Embolised
- (B) Etiolated
- (C) Defoliated
- (D) Mutated

AIPMT 2014

**13. Anoxygenic photosynthesis is characteristic of:**

- (A) Spirogyra
- (B) Chlamydomonas
- (C) Ulva
- (D) Rhodospirillum

AIPMT 2012 Prelims

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

- (A) Photorespiration
- (B) Transpiration
- (C) Glycolysis
- (D) Photosynthesis

AIPMT 2011 Mains

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

- (A) Copper
- (B) Boron
- (C) Manganese
- (D) Zinc

AIPMT 2011 Mains

**16. In Kranz anatomy, the bundle sheath cells have**

- (A) Thin walls, no intercellular spaces and several chloroplasts
- (B) Thick walls, many intercellular spaces and few chloroplasts
- (C) Thin walls, many intercellular spaces and no chloroplasts
- (D) Thick walls, no intercellular spaces and large number of chloroplasts

AIPMT 2011 Prelims

**17. CAM helps the plants in**

- (A) Reproduction
- (B) Conserving water
- (C) Secondary growth
- (D) Disease resistance

AIPMT 2010 Mains · Q20

**18. 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 PSI only.**

**(B) Only PS I is functional in cyclic photophosphorylation.**

**(C) Cyclic photophosphorylation results into synthesis of ATP and NADPH<sub>2</sub>**

**(D) Stroma lamellae lack PS II as well as NADP.**

- (A) B and D
- (B) A and B
- (C) B and C
- (D) C and D

AIPMT 2010 Mains · Q32

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

- (A) Potato
- (B) Wheat
- (C) Sugarcane
- (D) Mustard

AIPMT 2010 Prelims · Q133

**20. C<sub>4</sub> plants are more efficient in photosynthesis than C<sub>3</sub> plants due to**

- (A) Lower rate of photorespiration
- (B) Higher leaf area
- (C) Presence of larger number of chloroplasts in the leaf cells
- (D) Presence of thin cuticle

AIPMT 2010 Prelims · Q141

**21. PGA as the first CO<sub>2</sub> fixation product was discovered in photosynthesis of**

- (A) Alga
- (B) Bryophyte
- (C) Gymnosperm
- (D) Angiosperm

AIPMT 2009 Prelims · Q91

**22. Cyclic photophosphorylation results in the formation of**

- (A) ATP and NADPH
- (B) ATP, NADPH and O<sub>2</sub>
- (C) ATP
- (D) NADPH

AIPMT 2008 Prelims · Q130

**23. The  $C_4$  plants are photosynthetically more efficient than  $C_3$  plants because**

- (A) They have more chloroplasts
- (B) The  $CO_2$  compensation point is more
- (C)  $CO_2$  generated during photorespiration is trapped and recycled through PEP carboxylase
- (D) The  $CO_2$  efflux is not prevented

AIPMT 2008 Prelims · Q136

**24. In leaves of  $C_4$  plants malic acid synthesis during  $CO_2$  fixation occurs in**

- (A) Guard cells
- (B) Epidermal cells
- (C) Mesophyll cells
- (D) Bundle sheath

AIPMT 2008 Prelims · Q143

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

- (A) Ferredoxin
- (B) Cytochrome - b
- (C) Cytochrome - f
- (D) Quinone

AIPMT 2007 Prelims · Q147

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

- (A) iron-sulphur protein
- (B) ferredoxin
- (C) quinone
- (D) cytochrome

AIPMT 2007 Prelims · Q153

**27. 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

AIPMT 2006 Prelims · Q118

**28. In photosystem-I, the first electron acceptor is :**

- (A) ferredoxin
- (B) cytochrome
- (C) plastocyanin
- (D) an iron-sulphur protein

AIPMT 2006 Prelims · Q161

**29. During photorespiration, the oxygen consuming reaction(s) occur in :**

- (A) stroma of chloroplasts and mitochondria
- (B) stroma of chloroplasts and peroxisomes
- (C) grana of chloroplasts and peroxisomes
- (D) stroma of chloroplasts

AIPMT 2005 Prelims · Q119

**30. Chlorophyll in chloroplasts is located in :**

- (A) grana
- (B) pyrenoid
- (C) stroma
- (D) both grana and stroma

**31. As compared to a  $C_3$  plant, how many additional molecules of ATP are needed for net production of one molecule of hexose sugar by  $C_4$  plants :**

- (A) 2
- (B) 6
- (C) 0
- (D) 12

**32. Carbohydrates, the most abundant biomolecules on earth, are produced by :**

- (A) all bacteria, fungi and algae
- (B) fungi, algae and green plant cells
- (C) some bacteria, algae and green plant cells
- (D) viruses, fungi and bacteria

**33. Chemiosmotic theory of ATP synthesis in the chloroplasts and mitochondria is based on :**

- (A) proton gradient
- (B) accumulation of K ions
- (C) accumulation of Na ions
- (D) membrane potential

**34. Photosynthetic Active Radiation (PAR) has the following range of wavelengths :**

- (A) 400 - 700 nm
- (B) 450 - 950 nm
- (C) 340 - 450 nm
- (D) 500 - 600 nm

## Answer key and explanations

### 1. Answer: (B) Oxaloacetic acid

Sorghum is a  $C_4$  plant, and in  $C_4$  plants PEP carboxylase fixes  $CO_2$  into the four-carbon oxaloacetic acid as the first stable product. Phosphoglyceric acid is the first stable product only in  $C_3$  plants.

### 2. Answer: (D) Cyclic photophosphorylation involves both PS I and PS II.

Cyclic photophosphorylation uses only PS I, with electrons cycling back to it so that only ATP is made, so the statement that it involves both photosystems is incorrect. Non-cyclic photophosphorylation makes both ATP and  $NADPH + H^+$ , and stroma lamellae carry only PS I and lack NADP reductase.

### 3. Answer: (A) PS-II to Cytb<sub>6</sub>f complex

In the Z scheme the electron from PS II goes to plastoquinone, a mobile carrier that passes it to the cytochrome b<sub>6</sub>f complex; plastocyanin then carries it on to PS I. Reduction of  $NADP^+$  happens after PS I, through ferredoxin, not plastoquinone.

### 4. Answer: (C) Green sulphur bacteria

Green sulphur bacteria carry out anoxygenic photosynthesis: they use  $H_2S$  rather than water as the electron donor, so sulphur, not oxygen, is released. Nostoc is a cyanobacterium and, like Cycas and Chara, splits water and evolves oxygen.

### 5. Answer: (B) NADH

The light reaction produces ATP, NADPH and  $O_2$  (from photolysis of water). NADH is a product of respiration (glycolysis and the Krebs cycle), not of photosynthesis.

### 6. Answer: (B) $C_4$ plants

In  $C_4$  plants PEP in mesophyll cells accepts  $CO_2$  (catalysed by PEP carboxylase) to form the 4-carbon oxaloacetic acid.  $C_3$  plants use RuBP as the primary  $CO_2$  acceptor, so PEP is not the acceptor in both groups.

### 7. Answer: (D) RuBP binds with $O_2$ to form two molecules of phosphoglycolate

When RuBisCO binds  $O_2$ , one RuBP gives one molecule of phosphoglycerate and one molecule of phosphoglycolate, not two phosphoglycolates. RuBisCO does have a much greater affinity for  $CO_2$  than  $O_2$ , photorespiration produces no ATP or NADPH, and it does not occur in  $C_4$  plants.

**8. Answer: (C) photorespiration**

C<sub>4</sub> plants concentrate CO<sub>2</sub> around RuBisCO in bundle sheath cells, so photorespiration is almost absent, while C<sub>3</sub> plants lose much fixed carbon to it. Glycolysis, respiration and the Calvin cycle run in both types of plant.

**9. Answer: (B) Two photosystems operating simultaneously**

Emerson found that the rate of photosynthesis falls in light beyond 680 nm (red drop) but rises above the sum of separate rates when shorter-wavelength light is given together with it (enhancement effect). This showed that two photosystems (PS I and PS II) work together.

**10. Answer: (B) Lumen of thylakoids**

During the light reaction, water splitting on the inner side of the thylakoid membrane and proton pumping by the cytochrome b<sub>6</sub>f complex accumulate H<sup>+</sup> in the thylakoid lumen. This gradient drives ATP synthase; the stroma becomes relatively proton-poor (alkaline).

**11. Answer: (B) C<sub>4</sub>**

C<sub>4</sub> plants concentrate CO<sub>2</sub> around RuBisCO in bundle-sheath cells, which suppresses photorespiration, gives high photosynthetic rates at high temperature and needs less water and nitrogen (less RuBisCO) per unit carbon fixed. C<sub>3</sub> plants suffer photorespiration; CAM plants save water but have low photosynthetic rates.

**12. Answer: (B) Etiolated**

Seedlings grown in darkness cannot form chlorophyll and become pale, yellow-white and elongated; this condition is called etiolation. They are not mutated (the change reverses in light), and defoliation and embolism refer to leaf loss and air blockage of xylem.

**13. Answer: (D) Rhodospirillum**

Rhodospirillum is a purple non-sulphur photosynthetic bacterium that does not use water as the electron donor, so no oxygen is evolved: anoxygenic photosynthesis. Spirogyra, Chlamydomonas and Ulva are green algae that split water and release O<sub>2</sub>.

**14. Answer: (A) Photorespiration**

Photorespiration occurs in C<sub>3</sub> plants, where RuBisCO also acts as an oxygenase, but is almost absent in C<sub>4</sub> plants because CO<sub>2</sub> is concentrated around RuBisCO in the bundle sheath. Both types carry out photosynthesis, transpiration and glycolysis.

**15. Answer: (C) Manganese**

Splitting of water in photosystem II is carried out by the oxygen-evolving complex, which needs manganese along with calcium and chloride ions. Copper (in plastocyanin), boron and zinc are not involved in photolysis of water.

**16. Answer: (D) Thick walls, no intercellular spaces and large number of chloroplasts**

In Kranz anatomy of C<sub>4</sub> leaves, the bundle sheath cells are large, have thick walls, lack intercellular spaces and contain a large number of chloroplasts, where the Calvin cycle runs. Thin walls, intercellular spaces or few chloroplasts describe mesophyll-type cells, not the bundle sheath.

**17. Answer: (B) Conserving water**

CAM plants open their stomata at night to take up CO<sub>2</sub>, which is stored as organic acids and used for photosynthesis in the day while the stomata stay closed. This cuts transpiration loss sharply, so CAM is an adaptation for conserving water in dry habitats.

**18. Answer: (A) B and D**

Cyclic photophosphorylation uses only PS I, and the stroma lamellae lack PS II and NADP reductase, so cyclic flow there makes only ATP. The Z scheme (non-cyclic flow) needs both PS II and PS I, and cyclic photophosphorylation does not produce NADPH.

**19. Answer: (C) Sugarcane**

Kranz anatomy, with large chloroplast-rich bundle sheath cells ringing the vascular bundles, is typical of C<sub>4</sub> plants such as sugarcane and maize. Wheat, potato and mustard are C<sub>3</sub> plants and lack this arrangement.

**20. Answer: (A) Lower rate of photorespiration**

In C<sub>4</sub> plants, CO<sub>2</sub> is concentrated around RuBisCO in the bundle sheath cells, so its oxygenase activity, and with it photorespiration, is almost absent. This is why their productivity is higher. Having more chloroplasts is not the reason, and the mesophyll cells of C<sub>4</sub> plants do not carry out the Calvin cycle.

**21. Answer: (A) Alga**

Melvin Calvin traced radioactive <sup>14</sup>C in the green alga Chlorella and found that 3-phosphoglyceric acid (PGA) was the first stable product of CO<sub>2</sub> fixation. The C<sub>4</sub> pathway (OAA first) was found later in angiosperms such as sugarcane and maize.

**22. Answer: (C) ATP**

In cyclic photophosphorylation only PS I works and electrons return to the same reaction centre, so only ATP is made. NADPH and  $O_2$  come from the non-cyclic pathway, which involves PS II and water splitting.

**23. Answer: (C)  $CO_2$  generated during photorespiration is trapped and recycled through PEP carboxylase**

$C_4$  plants use PEP carboxylase in mesophyll cells to capture  $CO_2$  and concentrate it in bundle sheath cells, so RuBisCO works near saturation and photorespiration is minimal; any  $CO_2$  that leaks out can be refixed by PEP carboxylase. Their efficiency comes from this  $CO_2$ -concentrating mechanism, not from simply having more chloroplasts, and their  $CO_2$  compensation point is lower, not higher.

**24. Answer: (C) Mesophyll cells**

In  $C_4$  plants PEP carboxylase in the mesophyll cells fixes  $CO_2$  into oxaloacetate, which is converted to malic acid there. The malate then moves to the bundle sheath, where it is decarboxylated, so the bundle sheath is where malate breaks down, not where it is made.

**25. Answer: (D) Quinone**

Electrons leaving the PS II reaction centre are passed to a quinone acceptor (via pheophytin to plastoquinone) before reaching the cytochrome  $b_6f$  complex. Ferredoxin accepts electrons on the PS I side, much later in the chain.

**26. Answer: (C) quinone**

Electrons from P680 pass to the primary acceptor of PSII and then to plastoquinone, so among the options a quinone is the first acceptor. Ferredoxin and iron-sulphur proteins accept electrons on the PSI side, and cytochromes come later in the chain.

**27. Answer: (D) mesophyll**

In  $C_4$  plants PEP carboxylase in mesophyll cells fixes  $CO_2$  into oxaloacetate, which is turned into malic acid there before moving to the bundle sheath. In the bundle sheath, malate is broken down to release  $CO_2$  for the Calvin cycle, so malate is not formed there.

**28. Answer: (D) an iron-sulphur protein**

Electrons from excited P700 pass through bound iron-sulphur proteins of PS I before reaching ferredoxin, so the early acceptor is an iron-sulphur protein. Plastocyanin is the donor to PS I, not its acceptor, and ferredoxin comes later.

**29. Answer: (B) stroma of chloroplasts and peroxisomes**

Oxygen is taken up when RuBisCO acts as an oxygenase on RuBP in the chloroplast stroma, and again when glycolate is oxidised by glycolate oxidase in the peroxisome. Mitochondria release  $CO_2$  in this pathway; they do not consume  $O_2$  in it.

**30. Answer: (A) grana**

Chlorophyll sits in the thylakoid membranes, which are stacked into grana. The stroma is the fluid matrix where the dark reactions happen and holds no pigment, and the pyrenoid is a starch-forming body in algae.

**31. Answer: (D) 12**

A  $C_3$  plant needs 18 ATP per hexose. A  $C_4$  plant also spends 2 ATP per  $CO_2$  to regenerate PEP (pyruvate to PEP), which is 12 more for six  $CO_2$ , giving 30 ATP in total. So it needs 12 extra ATP.

**32. Answer: (C) some bacteria, algae and green plant cells**

Carbohydrates are made by photosynthetic (and chemosynthetic) autotrophs: some bacteria, algae and green plants. Fungi and viruses cannot make carbohydrate from  $CO_2$ , and not all bacteria are autotrophic.

**33. Answer: (A) proton gradient**

Mitchell's chemiosmotic theory says that electron transport pumps protons across a membrane, and the protons flowing back through ATP synthase ( $CF_0$ - $CF_1$  or  $F_0$ - $F_1$ ) drive ATP formation. The driving force is the proton gradient, not  $K^+$  or  $Na^+$  build-up.

**34. Answer: (A) 400 - 700 nm**

NCERT gives PAR as light from 400 to 700 nm, the visible band that chlorophylls and carotenoids absorb. Wavelengths beyond 700 nm (far-red, infrared) and in the ultraviolet are not used for photosynthesis.

Questions as set in the AIPMT/NEET papers conducted by CBSE and NTA. Answers checked and explanations written by the RankUp team. RankUp is not affiliated with CBSE or NTA.