CLASS 11 BIOLOGY EXTRA QUESTIONS

Class 11 Biology Chapter 11 Photosynthesis in Higher Plants – Extra Questions with Answers

Extra practice questions for Class 11 Biology Chapter 11 (Photosynthesis in Higher Plants), beyond the textbook. These Class 11 Biology Chapter 11 important questions are handy for last-minute exam practice.

Contents

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Very Short Answer Questions (1 mark)

Q1. Name the primary photosynthetic pigment.
Ans: Chlorophyll a.

Q2. In which part of the chloroplast do light reactions occur?
Ans: Thylakoid membrane.

Q3. What enzyme fixes CO_2 in C3 plants?
Ans: RuBisCO.

Q4. What gas is released during photolysis of water?
Ans: Oxygen (O_2).

Q5. Name two examples of C4 plants.
Ans: Maize and sugarcane.

Short Answer Questions (2–3 marks)

Q6. What are the products of the light reaction that are used in the dark reaction?
Ans: ATP and NADPH (collectively called assimilatory power).

Q7. List the three phases of the Calvin cycle.
Ans: Carboxylation (CO_2 fixation), reduction (3-PGA to G3P), regeneration (RuBP regenerated).

Q8. Why do C4 plants have an advantage over C3 plants in hot, dry climates?
Ans: C4 plants minimize photorespiration by concentrating CO_2 in bundle sheath cells via PEP carboxylase (which has a higher affinity for CO_2 than RuBisCO), making them more efficient under high light/temperature and low CO_2/water conditions.

Higher-Order Thinking / Application Questions

Q9. Explain, using Blackman's Law of Limiting Factors, why increasing light intensity beyond a certain point does not continue to increase the rate of photosynthesis if CO_2 concentration remains constant and low, and describe what would happen to the rate if CO_2 concentration were then increased.
Ans: According to Blackman's Law of Limiting Factors, when a physiological process like photosynthesis depends on several factors (light, CO_2, temperature), the overall rate at any given time is determined by whichever factor is closest to its minimum, limiting supply, not by the factor that is abundant. Initially, at low light intensities, light itself is the limiting factor, so increasing light intensity increases the rate of photosynthesis proportionally. However, once light intensity increases beyond a certain point, if the CO_2 concentration remains low and constant, CO_2 then becomes the new limiting factor — the photosynthetic machinery (specifically the Calvin cycle, which uses CO_2) cannot process light energy captured any faster than the rate at which CO_2 is available for fixation by RuBisCO, so the rate of photosynthesis plateaus even as light intensity continues to increase. If CO_2 concentration were then increased (while keeping light intensity high and non-limiting), the rate of photosynthesis would increase again, since the previously limiting factor (CO_2) is now more available, until some other factor (perhaps temperature or a new light limitation) becomes the new bottleneck — this illustrates how the overall rate is always capped by

whichever single factor is currently in shortest supply, exactly as Blackman's law describes.

Q10. Explain the biochemical and structural basis (specifically Kranz anatomy) that allows C4 plants to suppress photorespiration much more effectively than C3 plants, connecting this to why C4 plants are often more productive in hot, high-light environments.
Ans: In C3 plants, the enzyme RuBisCO, which fixes CO_2 onto RuBP during the Calvin cycle, has a dual affinity: it can also bind O_2 instead of CO_2 under conditions of high temperature and low CO_2/high O_2 concentration (such as when stomata partially close to conserve water on a hot day), leading to a wasteful process called photorespiration, which consumes energy and releases previously fixed carbon without producing useful sugar, reducing net photosynthetic efficiency. C4 plants have evolved a specialized leaf anatomy called Kranz anatomy, in which mesophyll cells and bundle sheath cells are arranged concentrically around the vascular bundles, with chloroplasts present in both cell types. In C4 plants, CO_2 is first fixed in mesophyll cells by the enzyme PEP carboxylase (which has a much higher affinity for CO_2 than RuBisCO and, critically, does not bind O_2 at all, so it is immune to the photorespiration-causing side reaction), forming a 4-carbon compound (oxaloacetate/malate) that is then transported into the bundle sheath cells, where it is broken down to release a high, concentrated dose of CO_2 directly around RuBisCO in an internal environment shielded from atmospheric O_2. This CO_2-concentrating mechanism ensures that RuBisCO in bundle sheath cells is exposed to consistently high CO_2 and low O_2 levels, effectively suppressing its wasteful oxygenase (photorespiratory) activity even in hot, bright conditions where C3 plants would suffer significant photorespiratory losses, which is why C4 plants like maize and sugarcane tend to be more productive and water-efficient than C3 plants in hot, high-light, and often water-limited environments.

Class 11 Biology Chapter 11 – Solutions and Notes

For complete step-by-step answers and a quick summary, check the Class 11 Biology Chapter 11 Solutions and Class 11 Biology Chapter 11 Revision Notes.

See also: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5 | Chapter 6 | Chapter 7 | Chapter 8 | Chapter 9 | Chapter 10 | Chapter 11

Practice more: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5 | Chapter 6 | Chapter 7 | Chapter 8 | Chapter 9 | Chapter 10

Quick revision: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5 | Chapter 6 | Chapter 7 | Chapter 8 | Chapter 9 | Chapter 10