A-LEVEL

Multiple-choice questions on photosynthesis

1. Which of the following is the primary pigment responsible for capturing light energy during photosynthesis?
A. Chlorophyll a
B. Chlorophyll b
C. Carotenoids
D. Phycobilins
Answer: A. Chlorophyll a Explanation: Chlorophyll a is the primary photosynthetic pigment that absorbs light in the red and blue regions of the electromagnetic spectrum.

2. During the light-dependent reactions of photosynthesis, where does the oxygen released come from?
A. Carbon dioxide
B. Water
C. Glucose
D. Oxygen gas
Answer: B. Water Explanation: Oxygen released during the light-dependent reactions is a byproduct of the splitting of water molecules.

3. In which part of the chloroplast do the light-dependent reactions occur?
A. Thylakoid membrane
B. Stroma
C. Grana
D. Outer membrane
Answer: A. Thylakoid membrane
Explanation: The thylakoid membrane is where the photosystems and electron transport chains are located, facilitating the light-dependent reactions.

4. What is the primary purpose of the Calvin cycle in photosynthesis?
A. Carbon fixation
B. Oxygen production
C. ATP synthesis
D. Electron transport
Answer: A. Carbon fixation Explanation: The Calvin cycle is responsible for converting carbon dioxide into organic molecules, a process known as carbon fixation.

5. During the Calvin cycle, which molecule is used as a carbon source for the synthesis of glucose?
A. CO2
B. O2
C. NADPH
D. ATP
Answer: A. CO2 Explanation: Carbon dioxide is used as the carbon source during the Calvin cycle to synthesize glucose.

6. In the context of photosynthesis, what is the role of NADPH?

A. To absorb light energy
B. To transport electrons
C. To fix carbon dioxide
D. To generate ATP
Answer: B. To transport electrons
Explanation: NADPH serves as a carrier of high-energy electrons during photosynthesis.

7. Which enzyme is responsible for the synthesis of ATP during the light-dependent reactions of photosynthesis?
A. ATP synthase
B. Rubisco
C. DNA polymerase
D. RNA polymerase
Answer: A. ATP synthase Explanation: ATP synthase is an enzyme that synthesizes ATP using the proton gradient generated during the light-dependent reactions.

8. What is the primary function of the enzyme Rubisco in photosynthesis?
A. Carbon fixation
B. Oxygen production

C. Electron transport
D. ATP synthesis
Answer: A. Carbon fixation Explanation: Rubisco is responsible for catalyzing the incorporation of carbon dioxide into organic molecules during the Calvin cycle.

9. Which of the following is a product of the light-dependent reactions that is used in the Calvin cycle?
A. ATP
B. Oxygen
C. NADPH
D. All of the above
Answer: D. All of the above Explanation: ATP and NADPH generated during the light-dependent reactions are both utilized in the Calvin cycle.

10. In C4 plants, where does the initial carbon fixation occur?
A. Mesophyll cells
B. Bundle sheath cells
C. Stomata

D. Thylakoid membrane
Answer: A. Mesophyll cells Explanation: C4 plants initially fix carbon dioxide into a four-carbon compound in mesophyll cells before transferring it to bundle sheath cells.

11. Which of the following factors directly influences the rate of photosynthesis?
A. Temperature
B. Light intensity
C. Carbon dioxide concentration
D. All of the above
Answer: D. All of the above Explanation: Temperature, light intensity, and carbon dioxide concentration are all factors that influence the rate of photosynthesis.

12. In CAM plants, when does carbon fixation occur?
A. Daytime
B. Nighttime
C. Both daytime and nighttime
D. Never

Answer: B. Nighttime Explanation: CAM plants fix carbon dioxide at night when stomata are open, and they store it for use during the day.

13. What is the primary function of the light-harvesting complexes in photosynthesis?
A. ATP synthesis
B. Carbon fixation
C. Absorption of light energy
D. Oxygen production
Answer: C. Absorption of light energy Explanation: Light-harvesting complexes capture and transfer light energy to the reaction center of photosystems.

14. Which molecule is the final electron acceptor in the electron transport chain during the light-dependent reactions?
A. NADPH
B. Oxygen
C. ATP
D. Carbon dioxide

Answer: B. Oxygen Explanation: Oxygen is the final electron acceptor, and it combines with protons to form water.

15. How do C3, C4, and CAM plants differ in their carbon fixation strategies?
A. C3 plants fix carbon directly in the Calvin cycle.
B. C4 plants initially fix carbon in mesophyll cells.
C. CAM plants fix carbon at night.
D. All of the above
Answer: D. All of the above Explanation: C3, C4, and CAM plants employ different strategies for carbon fixation as described in the options.

16. What is the primary function of the pigment phycobilin in certain photosynthetic organisms?
A. Absorbing blue light
B. Absorbing red light
C. Protecting against excessive light
D. Fixing carbon dioxide

Answer: B. Absorbing red light Explanation: Phycobilins, found in certain algae and cyanobacteria, absorb red light during photosynthesis.

17. During the light-dependent reactions, where is the proton gradient established?
A. Stroma
B. Thylakoid space
C. Cytosol
D. Outer membrane
Answer: B. Thylakoid space Explanation: The proton gradient is established in the thylakoid space during the flow of electrons through the electron transport chain.

18. What role do carotenoids play in photosynthesis?
A. Absorbing light energy
B. Protecting against photo-damage
C. Carbon fixation
D. Electron transport
Answer: B. Protecting against photo-damage Explanation: Carotenoids act as antioxidants,

protecting the plant from damage caused by excess light.

19. In the context of the light-dependent reactions, what is photophosphorylation?
A. Synthesis of ATP using light
B. Synthesis of NADPH using light
C. Carbon fixation using light
D. Oxygen production using light
Answer: A. Synthesis of ATP using light
Explanation: Photophosphorylation is the process of synthesizing ATP using light energy during the light-dependent reactions.

20. Which of the following is a direct product of the Calvin cycle?
A. Glucose
B. Oxygen
C. ATP
D. NADPH
Answer: A. Glucose Explanation: The Calvin cycle produces glucose through the reduction of carbon dioxide.

21. What is the purpose of the water-splitting reactions in photosynthesis?
A. To release oxygen
B. To generate ATP
C. To provide electrons for the photosystems
D. To fix carbon dioxide
Answer: C. To provide electrons for the photosystems Explanation: The splitting of water provides electrons to replace those lost during the light-dependent reactions.

22. How does the rate of photosynthesis change with increasing temperature?
A. Increases
B. Decreases
C. Remains constant
D. Depends on light intensity
Answer: A. Increases Explanation: Generally, the rate of photosynthesis increases with temperature, up to a certain point where enzyme denaturation may occur.

23. What is the role of the enzyme PEP carboxylase in C4 plants?

A. Carbon fixation in mesophyll cells
B. Oxygen production in bundle sheath cells
C. ATP synthesis in thylakoid membrane
D. Electron transport in stroma
Answer: A. Carbon fixation in mesophyll cells Explanation: PEP carboxylase is responsible for fixing carbon dioxide into a four-carbon compound in the mesophyll cells of C4 plants.

24. In the context of photosynthesis, what is the significance of the Z-scheme?
A. It represents the Calvin cycle reactions.
B. It illustrates the flow of electrons in the light-dependent reactions.
C. It describes the process of carbon fixation.
D. It outlines the steps of glycolysis.
Answer: B. It illustrates the flow of electrons in the light-dependent reactions. Explanation: The Z-scheme visually represents the flow of electrons through the photosystems during the light-dependent reactions.

25. How do light-dependent and light-independent reactions of photosynthesis differ?

A. Light-dependent reactions occur in the thylakoid membrane, while light-independent reactions occur in the stroma.

B. Light-dependent reactions involve the absorption of light, while light-independent reactions involve the synthesis of glucose.

C. Light-dependent reactions produce oxygen, while light-independent reactions consume carbon dioxide.

D. Light-dependent reactions occur only during the day, while light-independent reactions occur only at night.

Answer: A. Light-dependent reactions occur in the thylakoid membrane, while light-independent reactions occur in the stroma.

Explanation: Light-dependent reactions take place in the thylakoid membrane, while light-independent reactions occur in the stroma.

26. What is the fate of the ATP produced during the light-dependent reactions?
A. Used directly in the Calvin cycle
B. Used in the light-harvesting complexes
C. Stored for later use
D. Released as a byproduct
Answer: A. Used directly in the Calvin cycle
Explanation: ATP produced during the light-dependent reactions is utilized in the Calvin cycle for the synthesis of glucose.

27. What is the primary role of the enzyme RuBisCO in photosynthesis?
A. Absorption of light energy
B. Carbon fixation
C. Electron transport
D. Oxygen production
Answer: B. Carbon fixation Explanation: RuBisCO catalyzes the incorporation of carbon dioxide into organic molecules during the Calvin cycle.

28. During the Calvin cycle, which molecule provides the energy required for carbon fixation?
A. ATP
B. NADPH
C. Glucose
D. Oxygen
Answer: A. ATP Explanation: ATP provides the energy necessary for the fixation of carbon dioxide during the Calvin cycle.

29. In the context of photosynthesis, what is the function of the enzyme phosphoenolpyruvate carboxylase (PEP carboxylase)?
A. Absorption of light energy
B. Carbon fixation in C3 plants
C. Carbon fixation in C4 plants
D. Electron transport
Answer: C. Carbon fixation in C4 plants Explanation: PEP carboxylase is responsible for fixing carbon dioxide in the initial step of carbon fixation in C4 plants.

30. Which of the following is NOT a product of the light-dependent reactions of photosynthesis?
A. Oxygen
B. ATP
C. NADPH
D. Glucose
Answer: D. Glucose Explanation: Glucose is produced during the light-independent reactions (Calvin cycle), not the light-dependent reactions.

31. How do the light reactions and the Calvin cycle depend on each other in photosynthesis?
A. The Calvin cycle produces ATP for the light reactions.
B. The light reactions provide the Calvin cycle with ATP and NADPH.
C. The Calvin cycle produces light for the light reactions.
D. The light reactions and the Calvin cycle are independent processes.

Answer: B. The light reactions provide the Calvin cycle with ATP and NADPH.
Explanation: The products of the light reactions (ATP and NADPH) are used in the Calvin cycle for carbon fixation and glucose synthesis.

32. What role does the enzyme ATP synthase play in photosynthesis?
A. Catalyzing carbon fixation
B. Producing ATP during the light-dependent reactions
C. Fixing carbon dioxide in the Calvin cycle
D. Absorbing light energy
Answer: B. Producing ATP during the light-dependent reactions Explanation: ATP synthase is responsible for synthesizing ATP during the light-dependent reactions using the proton gradient.

33. What is the purpose of the Calvin cycle in photosynthesis?
A. To produce oxygen
B. To fix carbon dioxide and produce glucose

C. To transfer electrons in the electron transport chain
D. To absorb light energy
Answer: B. To fix carbon dioxide and produce glucose Explanation: The Calvin cycle is responsible for converting carbon dioxide into organic molecules, ultimately producing glucose.