

## Photosynthesis Review

### Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

- \_\_\_\_\_ 1. Plants need which of the following to carry on photosynthesis?
- H<sub>2</sub>O
  - CO<sub>2</sub>
  - O<sub>2</sub>
  - both O<sub>2</sub> and CO<sub>2</sub>
  - both H<sub>2</sub>O and CO<sub>2</sub>
- \_\_\_\_\_ 2. Organisms that derive their chemical energy either from the process of chemosynthesis or photosynthesis are classified as
- autotrophs.
  - parasites.
  - heterotrophs.
  - saprophytes.
  - mutualists.
- \_\_\_\_\_ 3. The carbon source for organisms that derive their energy from photosynthesis is
- carbon monoxide.
  - carbon dioxide.
  - hydrocarbons.
  - methane.
  - glucose.
- \_\_\_\_\_ 4. Most carbon enters the web of life through
- chemosynthesis.
  - aerobic respiration.
  - anaerobic respiration.
  - photosynthesis.
  - both chemosynthesis and aerobic respiration.
- \_\_\_\_\_ 5. Chlorophyll reflects (does not absorb) which color of light?
- red
  - yellow
  - orange
  - green
  - blue
- \_\_\_\_\_ 6. Which of the following are the pigments that absorb blue-violet and blue-green light and reflect red, orange, and yellow light?
- chlorophyll a
  - photons
  - phycobilins
  - carotenoids
  - anthocyanin
- \_\_\_\_\_ 7. Where in a plant cell is chlorophyll found?
- on the outer chloroplast membrane
  - inside the mitochondria
  - in the stroma
  - in the thylakoids
  - none of these

- \_\_\_\_\_ 8. Thylakoid disks are
- stacked.
  - separate compartments.
  - also called the stroma.
  - participants in the light-independent reactions.
  - none of these
- \_\_\_\_\_ 9. When chlorophyll *a* molecules absorb energy, the molecules
- release electrons.
  - release X-rays.
  - release energy.
  - release electrons and X-rays.
  - release electrons and energy.
- \_\_\_\_\_ 10. The flow of what particle across the thylakoid membrane powers the production of ATP?
- electrons
  - hydrogen ions
  - oxygen
  - carbon dioxide
  - phosphate ions
- \_\_\_\_\_ 11. The oxygen released in photosynthesis comes from
- carbon dioxide.
  - glucose.
  - ribulose biphosphate.
  - water.
  - atmospheric oxygen.
- \_\_\_\_\_ 12. The cyclic pathway of ATP formation functions mainly to
- fix CO<sub>2</sub>.
  - produce O<sub>2</sub>.
  - make ATP.
  - reduce NADP.
  - split H<sub>2</sub>O.
- \_\_\_\_\_ 13. Photolysis involves
- the cyclic pathway of ATP formation.
  - photosystem I.
  - carotenoid pigments.
  - the noncyclic pathway of ATP formation.
  - both the cyclic pathway of ATP formation and photosystem I.
- \_\_\_\_\_ 14. The electrons that are passed to NADP' during noncyclic pathways were obtained from
- chlorophyll.
  - CO<sub>2</sub>.
  - glucose.
  - sunlight.
  - ATP.
- \_\_\_\_\_ 15. An important electron and hydrogen acceptor in noncyclic pathways of ATP formation is
- NADP'.
  - ADP.
  - O<sub>2</sub>.
  - H<sub>2</sub>O.
  - ATP
- \_\_\_\_\_ 16. Hydrogen ion flow in the thylakoid compartments

- a. occurs between photosystems I and II.
  - b. is called the hydrogen transfer system.
  - c. provides energy to produce ATP molecules.
  - d. causes excitation of chlorophyll molecules.
  - e. requires the intermediary action of acceptor molecules.
- \_\_\_ 17. In the noncyclic pathway,
- a. there is a one-way flow of electrons from photosystem II to photosystem I.
  - b. ATP alone is produced.
  - c. electrons accumulate in the thylakoid compartments.
  - d. only electrons are transferred to hydrogen acceptors.
  - e. water is not involved in any of the reactions.
- \_\_\_ 18. In the cyclic pathway, the final electron acceptor is
- a.  $\text{NADP}^+$ .
  - b. ATP.
  - c. p700.
  - d. p680.
  - e.  $\text{H}_2\text{O}$ .
- \_\_\_ 19. The light-independent reactions were discovered by
- a. M. D. Hatch.
  - b. Andrew Benson.
  - c. Melvin Calvin.
  - d. Robert Hill.
  - e. both Andrew Benson and Melvin Calvin.
- \_\_\_ 20. Which of the following chemicals has five carbon atoms?
- a. phosphoglycerate (PGA)
  - b. ribulose biphosphate (RuBP)
  - c. phosphoglyceraldehyde (PGAL)
  - d. glucose
  - e. oxaloacetate
- \_\_\_ 21. For each six atoms of carbon dioxide fixed in the light-independent reactions, how many molecules of PGAL (phosphoglyceraldehyde) are produced?
- a. 2
  - b. 3
  - c. 6
  - d. 12
  - e. 15
- \_\_\_ 22. How many molecules of PGAL (phosphoglyceraldehyde) are used to regenerate the six molecules of RuBP (ribulose biphosphate)?
- a. 3
  - b. 6
  - c. 10
  - d. 12
  - e. 18
- \_\_\_ 23. The joining of carbon dioxide to RuBP occurs in the
- a. thylakoids.
  - b. stroma.
  - c. mitochondria.
  - d. cytoplasm.
  - e. p700.

- \_\_\_\_\_ 24. Which chemical has six carbon atoms?
- phosphoglycerate (PGA)
  - ribulose biphosphate (RuBP)
  - phosphoglyceraldehyde (PGAL)
  - glucose
  - oxaloacetate
- \_\_\_\_\_ 25. Which of the following can pass through stomata?
- carbon dioxide
  - oxygen
  - water
  - carbon dioxide and water
  - carbon dioxide, oxygen, and water
- \_\_\_\_\_ 26. Which chemical has four carbon atoms?
- phosphoglycerate (PGA)
  - ribulose biphosphate (RuBP)
  - phosphoglyceraldehyde (PGAL)
  - glucose
  - oxaloacetate
- \_\_\_\_\_ 27. Which is a C<sub>4</sub> plant?
- corn
  - pine
  - sugarcane
  - crabgrass
  - all of these except pine
- \_\_\_\_\_ 28. In the C<sub>4</sub> pathway, the first stable intermediate is
- RuBP.
  - FAD.
  - oxaloacetate.
  - ATP.
  - water.
- \_\_\_\_\_ 29. Which type of plant(s) is(are) adapted to hot, dry conditions?
- C<sub>3</sub>
  - C<sub>4</sub>
  - CAM
  - C<sub>3</sub> and CAM
  - C<sub>4</sub> and CAM
- \_\_\_\_\_ 30. Four of the five answers listed below are heterotrophs. Select the exception.
- fungus
  - carrot
  - earthworm
  - lobster
  - parasite
- \_\_\_\_\_ 31. Four of the five answers listed below are part of the light-independent reactions. Select the exception.
- water
  - carbon dioxide
  - ribulose biphosphate
  - phosphoglyceraldehyde
  - phosphoglycerate
- \_\_\_\_\_ 32. Four of the five answers listed below are participants in photosynthesis. Select the exception.

- a. photosystem
- b. chlorophyll
- c. mitochondrion
- d. chloroplast
- e. thylakoid

- \_\_\_ 33. Four of the five answers listed below are processes associated with light-dependent reactions. Select the exception.
- a. photolysis
  - b. chemiosmosis
  - c. fixing carbon dioxide
  - d. photosystem I and II
  - e. noncyclic pathways of ATP formation
- \_\_\_ 34. Four of the five answers listed below are associated with light-independent reactions. Select the exception.
- a. uses ATP and NADPH
  - b. involves RuBP
  - c. produces PGA
  - d. is called the Calvin-Benson pathway
  - e. requires light

### Matching

Choose the one most appropriate answer for each.

- a. uses ribulose biphosphate; produces PGA
  - b. uses ATP and NADPH
  - c. detaches two phosphate groups
  - d. produces ATP and NADPH
  - e. uses an electron transport system to produce ATP but not NADPH
- \_\_\_ 35. cyclic pathway
- \_\_\_ 36. noncyclic pathway
- \_\_\_ 37. carbon dioxide fixation
- \_\_\_ 38. the PGA to PGAL conversion
- \_\_\_ 39. the formation of glucose

The processes listed below represent major chemical pathways in the photosynthetic process. Answer the questions with reference to these five processes.

- a. light-dependent reactions
  - b. chemosynthetic reactions
  - c. carbon dioxide fixation
  - d. Calvin-Benson cycle
  - e. C<sub>4</sub> pathway
- \_\_\_ 40. Glucose-6-phosphate (sugar phosphate) is formed from two molecules of phosphoglyceraldehyde.
- \_\_\_ 41. Carbon dioxide is incorporated first into an unstable intermediate compound and then into phosphoglycerate.
- \_\_\_ 42. This process yields NADPH as well as ATP.
- \_\_\_ 43. This is a carbon-fixing system that precedes the Calvin-Benson cycle in some plants.
- \_\_\_ 44. PGAL molecules are formed from the reaction of PGA molecules with ATP and NADPH.

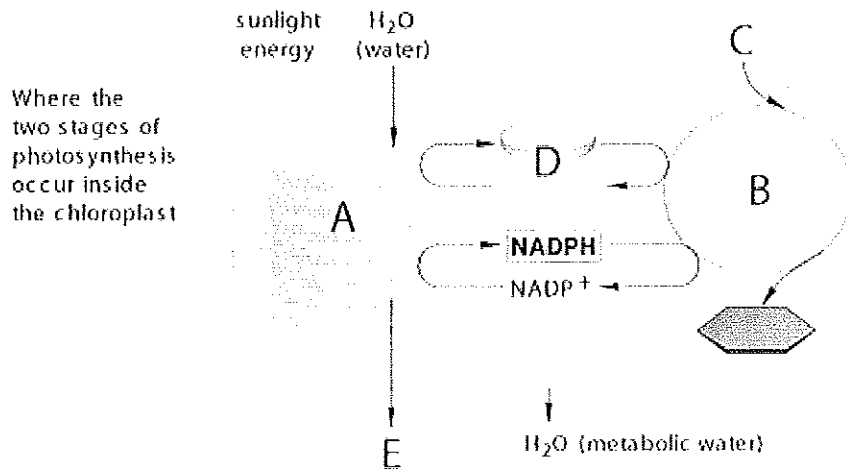
The five reactions listed below occur during noncyclic pathways of ATP formation. Use them to answer the questions.

- a. reduction of NADP
- b. phosphorylation of ADP
- c. photolysis of water
- d. oxidation of chlorophyll
- e. reduction of chlorophyll

- \_\_\_ 45. This process releases electrons to fill "holes" in chlorophyll in noncyclic pathways.
- \_\_\_ 46. When light energy is absorbed by a leaf, this will be the first result.
- \_\_\_ 47. This is the final step that occurs during noncyclic pathways of ATP formation.
- \_\_\_ 48. High energy phosphate bonds are formed during this process.
- \_\_\_ 49. Oxygen is produced by this process.

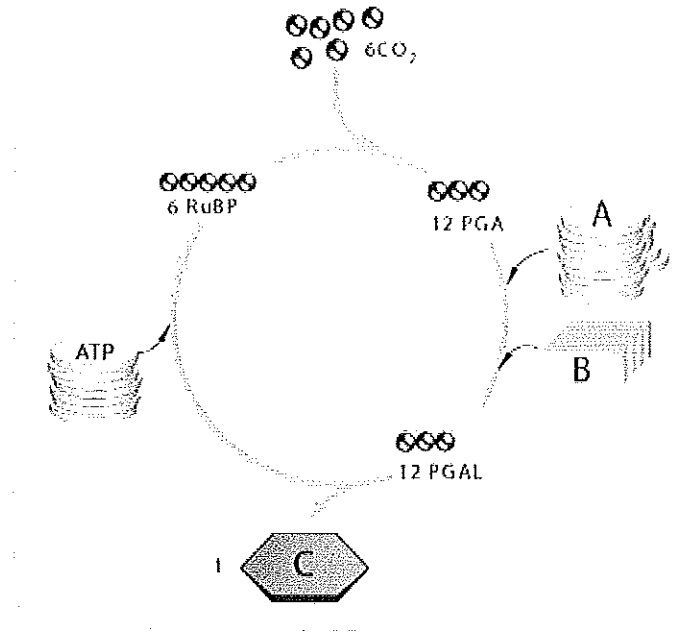
**Other**

**Figure 6-1**



- 50. Refer to Figure 6-1. What is the product labeled "E"?
  - a. carbon dioxide
  - b. chlorophyll
  - c. glucose
  - d. water
  - e. oxygen
- 51. Refer to Figure 6-1. Carbon dioxide enters the reactions at letter \_\_\_\_\_.
- 52. Refer to Figure 6-1. What is generated at letter "D"?
  - a. oxygen
  - b. ATP
  - c. glucose
  - d. inorganic phosphate
  - e. ADP

**Figure 6-2**



53. Refer to Figure 6-2. The product at letter "C" is
  - a. glucose.
  - b. protein.
  - c. ADP.
  - d. water.
  - e. oxygen.
54. Refer to Figure 6-2. Hydrogens and electrons are contributed by NADPH at letter \_\_\_\_\_.
55. Refer to Figure 6-2. Energy from ATP is represented by the letter \_\_\_\_\_.

## Photosynthesis Review Answer Section

### MULTIPLE CHOICE

1. ANS: E                    DIF: Easy                    TOP: PASTURES OF THE SEAS
2. ANS: A                    DIF: Easy                    TOP: PASTURES OF THE SEAS
3. ANS: B                    DIF: Easy                    TOP: PASTURES OF THE SEAS
4. ANS: D                    DIF: Moderate                TOP: PASTURES OF THE SEAS
5. ANS: D                    DIF: Moderate                TOP: SUNLIGHT AS AN ENERGY SOURCE
6. ANS: D                    DIF: Easy                    TOP: SUNLIGHT AS AN ENERGY SOURCE
7. ANS: D                    DIF: Moderate  
TOP: WHAT IS PHOTOSYNTHESIS AND WHERE DOES IT HAPPEN?
8. ANS: A                    DIF: Easy  
TOP: WHAT IS PHOTOSYNTHESIS AND WHERE DOES IT HAPPEN?
9. ANS: E                    DIF: Moderate                TOP: LIGHT-DEPENDENT REACTIONS
10. ANS: B                    DIF: Moderate                TOP: LIGHT-DEPENDENT REACTIONS
11. ANS: D                    DIF: Moderate                TOP: LIGHT-DEPENDENT REACTIONS
12. ANS: C                    DIF: Easy                    TOP: LIGHT-DEPENDENT REACTIONS
13. ANS: D                    DIF: Moderate                TOP: LIGHT-DEPENDENT REACTIONS
14. ANS: A                    DIF: Moderate                TOP: LIGHT-DEPENDENT REACTIONS
15. ANS: A                    DIF: Easy                    TOP: LIGHT-DEPENDENT REACTIONS
16. ANS: C                    DIF: Difficult                TOP: A CASE OF CONTROLLED ENERGY RELEASE
17. ANS: A                    DIF: Difficult                TOP: A CASE OF CONTROLLED ENERGY RELEASE
18. ANS: C                    DIF: Easy                    TOP: A CASE OF CONTROLLED ENERGY RELEASE
19. ANS: E                    DIF: Easy  
TOP: LIGHT-INDEPENDENT REACTIONS: THE SUGAR FACTORY
20. ANS: B                    DIF: Moderate  
TOP: LIGHT-INDEPENDENT REACTIONS: THE SUGAR FACTORY
21. ANS: D                    DIF: Difficult  
TOP: LIGHT-INDEPENDENT REACTIONS: THE SUGAR FACTORY
22. ANS: C                    DIF: Difficult  
TOP: LIGHT-INDEPENDENT REACTIONS: THE SUGAR FACTORY
23. ANS: B                    DIF: Moderate  
TOP: LIGHT-INDEPENDENT REACTIONS: THE SUGAR FACTORY
24. ANS: D                    DIF: Moderate  
TOP: LIGHT-INDEPENDENT REACTIONS: THE SUGAR FACTORY
25. ANS: E                    DIF: Moderate  
TOP: DIFFERENT PLANTS, DIFFERENT CARBON-FIXING PATHWAYS
26. ANS: E                    DIF: Moderate  
TOP: DIFFERENT PLANTS, DIFFERENT CARBON-FIXING PATHWAYS
27. ANS: E                    DIF: Moderate  
TOP: DIFFERENT PLANTS, DIFFERENT CARBON-FIXING PATHWAYS
28. ANS: C                    DIF: Moderate  
TOP: DIFFERENT PLANTS, DIFFERENT CARBON-FIXING PATHWAYS
29. ANS: E                    DIF: Moderate  
TOP: DIFFERENT PLANTS, DIFFERENT CARBON-FIXING PATHWAYS



30. ANS: B	DIF: Easy	OBJ: TYPE: Selecting the Exception
31. ANS: A	DIF: Difficult	OBJ: TYPE: Selecting the Exception
32. ANS: C	DIF: Moderate	OBJ: TYPE: Selecting the Exception
33. ANS: C	DIF: Difficult	OBJ: TYPE: Selecting the Exception
34. ANS: E	DIF: Difficult	OBJ: TYPE: Selecting the Exception

## MATCHING

35. ANS: E	DIF: Moderate	
36. ANS: D	DIF: Moderate	
37. ANS: A	DIF: Moderate	
38. ANS: B	DIF: Moderate	
39. ANS: C	DIF: Moderate	
40. ANS: D	DIF: Difficult	OBJ: TYPE: Classification Questions
41. ANS: C	DIF: Moderate	OBJ: TYPE: Classification Questions
42. ANS: A	DIF: Easy	OBJ: TYPE: Classification Questions
43. ANS: E	DIF: Moderate	OBJ: TYPE: Classification Questions
44. ANS: D	DIF: Moderate	OBJ: TYPE: Classification Questions
45. ANS: C	DIF: Difficult	OBJ: TYPE: Classification Questions
46. ANS: D	DIF: Difficult	OBJ: TYPE: Classification Questions
47. ANS: A	DIF: Difficult	OBJ: TYPE: Classification Questions
48. ANS: B	DIF: Moderate	OBJ: TYPE: Classification Questions
49. ANS: C	DIF: Difficult	OBJ: TYPE: Classification Questions

## OTHER

50. ANS: e	DIF: Easy	OBJ: TYPE: Labeling
51. ANS: c	DIF: Easy	OBJ: TYPE: Labeling
52. ANS: b	DIF: Easy	OBJ: TYPE: Labeling
53. ANS: a	DIF: Easy	OBJ: TYPE: Labeling
54. ANS: b	DIF: Easy	OBJ: TYPE: Labeling

55. ANS:  
a

DIF: Moderate OBJ: TYPE: Labeling

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