



Chapter 8 Exercises

Review Questions

- Which of the following components is *not* used by both plants and cyanobacteria to carry out photosynthesis?
 - chloroplasts
 - chlorophyll
 - carbon dioxide
 - water
- What two main products result from photosynthesis?
 - oxygen and carbon dioxide
 - chlorophyll and oxygen
 - sugars/carbohydrates and oxygen
 - sugars/carbohydrates and carbon dioxide
- In which compartment of the plant cell do the light-independent reactions of photosynthesis take place?
 - thylakoid
 - stroma
 - outer membrane
 - mesophyll
- Which statement about thylakoids in eukaryotes is *not* correct?
 - Thylakoids are assembled into stacks.
 - Thylakoids exist as a maze of folded membranes.
 - The space surrounding thylakoids is called stroma.
 - Thylakoids contain chlorophyll.
- Predict the end result if a chloroplast's light-independent enzymes developed a mutation that prevented them from activating in response to light.
 - G3P accumulation
 - ATP and NADPH accumulation
 - water accumulation
 - carbon dioxide depletion
- How are the NADPH and G3P molecules made during photosynthesis similar?
 - They are both end products of photosynthesis.
 - They are both substrates for photosynthesis.
 - They are both produced from carbon dioxide.
 - They both store energy in chemical bonds.
- Which of the following structures is *not* a component of a photosystem?
 - ATP synthase
 - antenna molecule
 - reaction center
 - primary electron acceptor
- How many photons does it take to fully reduce one molecule of NADP^+ to NADPH?
 - 1
 - 2
 - 4
 - 8
- Which complex is *not* involved in the establishment of conditions for ATP synthesis?
 - photosystem I
 - ATP synthase
 - photosystem II
 - cytochrome complex

10. From which component of the light-dependent reactions does NADPH form most directly?
 - a. photosystem II
 - b. photosystem I
 - c. cytochrome complex
 - d. ATP synthase
11. A plant exposed to only green light for a period of one week:
 - a. fails to grow because chlorophyll *a* and *b* reflect green light.
 - b. fails to grow because chlorophyll *a* and *b* absorb green light.
 - c. grows normally because chlorophyll *a* and *b* reflect green light.
 - d. grows normally because chlorophyll *a* and *b* absorb green light.
12. Plants containing only chlorophyll *b* are exposed to radiation with the following wavelengths: 10 nm (X-rays), 450 nm (blue light), 670 nm (red light), and 800 nm (infrared light). Which plants harness the most energy for photosynthesis?
 - a. X-ray irradiated plants
 - b. blue-light irradiated plants
 - c. red-light irradiated plants
 - d. infrared irradiated plants
13. Which molecule must enter the Calvin cycle continually for light-independent reactions to take place?
 - a. RuBisCO
 - b. RuBP
 - c. 3-PGA
 - d. CO₂
14. Which order of molecular conversions is correct for the Calvin cycle?
 - a. RuBP + G3P → 3-PGA → sugar
 - b. RuBisCO → CO₂ → RuBP → G3P
 - c. RuBP + CO₂ → [RuBisCO] 3-PGA → G3P
 - d. CO₂ → 3-PGA → RuBP → G3P
15. Where in eukaryotic cells does the Calvin cycle take place?
 - a. thylakoid membrane
 - b. thylakoid lumen
 - c. chloroplast stroma
 - d. granum
16. Which statement correctly describes carbon fixation?
 - a. the conversion of CO₂ into an organic compound
 - b. the use of RuBisCO to form 3-PGA
 - c. the production of carbohydrate molecules from G3P
 - d. the formation of RuBP from G3P molecules
 - e. the use of ATP and NADPH to reduce CO₂
17. If four molecules of carbon dioxide enter the Calvin cycle (four “turns” of the cycle), how many G3P molecules are produced and how many are exported?
 - a. 4 G3P made, 1 G3P exported
 - b. 4 G3P made, 2 G3P exported
 - c. 8 G3P made, 1 G3P exported
 - d. 8 G3P made, 4 G3P exported

Critical Thinking Questions

18. What is the overall outcome of light reactions in photosynthesis?
19. Why are carnivores, such as lions, dependent on photosynthesis to survive?
20. Why are energy carriers thought of as either “full” or “empty”?
21. Describe how the grey wolf population would be impacted by a volcanic eruption that spewed a dense ash cloud that blocked sunlight in a section of Yellowstone National Park.
22. How does the closing of the stomata limit photosynthesis?
23. Describe the pathway of electron transfer from photosystem II to photosystem I in light-dependent reactions.
24. What are the roles of ATP and NADPH in photosynthesis?
25. How and why would the end products of photosynthesis be changed if a plant had a mutation that eliminated its photosystem II complex?
26. Why is the third stage of the Calvin cycle called the regeneration stage?

27. Which part of light-independent reactions would be affected if a cell could not produce the enzyme RuBisCO?
28. Why does it take three turns of the Calvin cycle to produce G3P, the initial product of photosynthesis?
29. Imagine a sealed terrarium containing a plant and a beetle. How does each organism provide resources for the other? Could each organism survive if it was the only living thing in the terrarium? Why or why not?
30. Compare the flow of energy with the flow of nutrients in a closed, sunny ecosystem consisting of a giraffe and a tree.