

# Chapter 10

## Photosynthesis

Active Lecture Questions for use with Classroom Response Systems  
*Biology, Seventh Edition*

*Neil Campbell and Jane Reece*

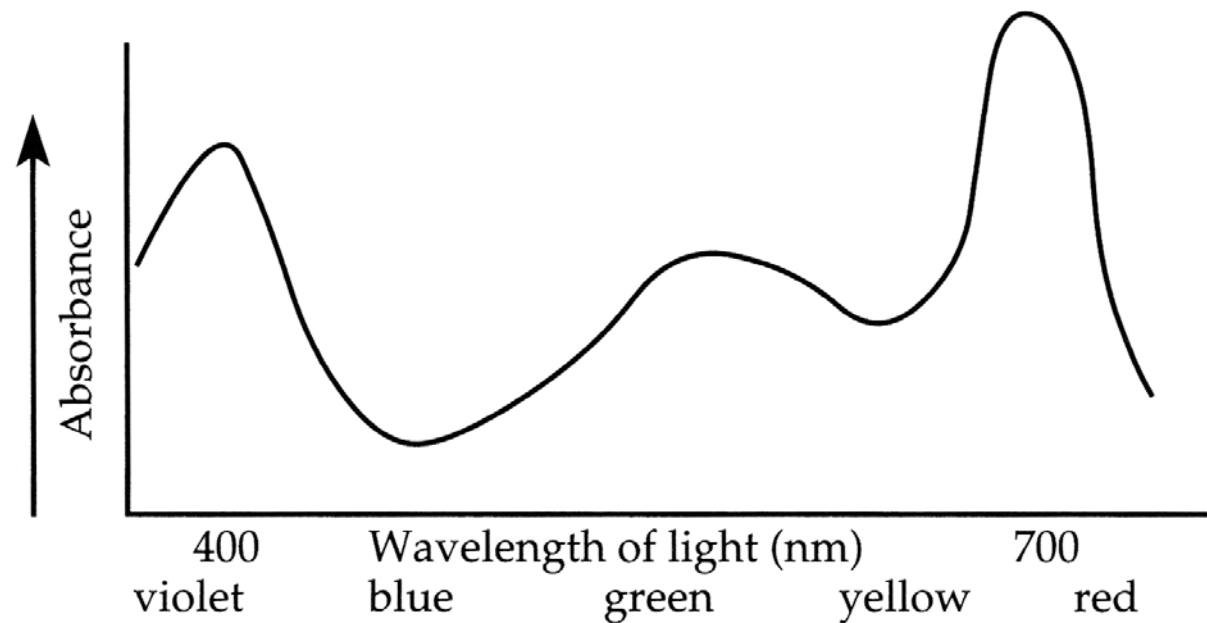
**Edited by William Wischusen, Louisiana State University**

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1. Below is an absorption spectrum for an unknown pigment molecule. What color would this pigment appear to you?

- a. violet
- b. blue
- c. green
- d. yellow
- e. red



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2. What portion of an illuminated plant cell would you expect to have the lowest pH?

- a. nucleus
- b. vacuole
- c. chloroplast
- d. stroma of chloroplast
- e. thylakoid space

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3. A new flower species has a unique photosynthetic pigment. The leaves of this plant appear to be reddish yellow. What wavelengths of visible light are *not* being absorbed by this pigment?

- a. red and yellow
- b. blue and violet
- c. green and yellow
- d. blue, green, and red
- e. green, blue, and violet

- 
4. Assume a thylakoid is somehow punctured so that the interior of the thylakoid is no longer separated from the stroma. This damage will have the most direct effect on which of the following processes?
- a. the splitting of water
  - b. the absorption of light energy by chlorophyll
  - c. the flow of electrons from photosystem II to photosystem I
  - d. the synthesis of ATP
  - e. the reduction of  $\text{NADP}^+$

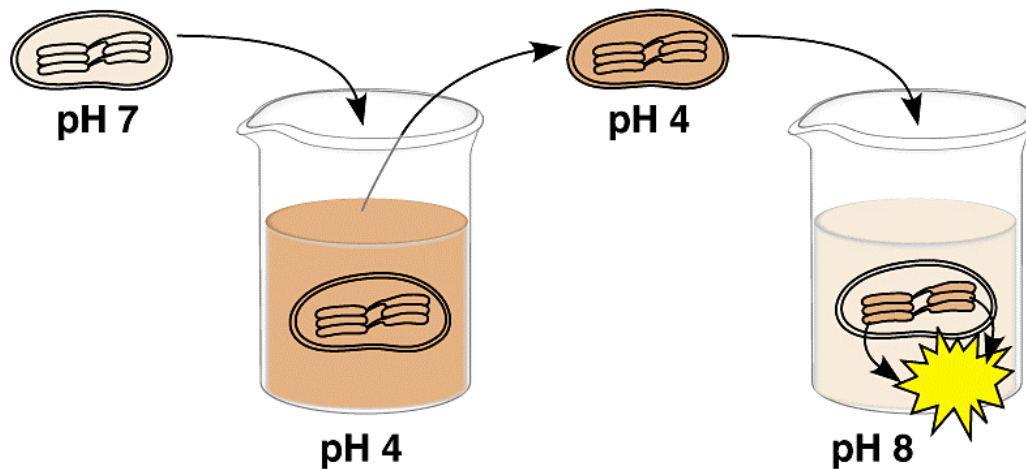
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5. In an experiment studying photosynthesis performed during the day, you provide a plant with radioactive carbon ( $^{14}\text{C}$ ) dioxide as a metabolic tracer. The  $^{14}\text{C}$  is incorporated first into oxaloacetic acid. The plant is best characterized as a

- a.  $\text{C}_4$  plant.
- b.  $\text{C}_3$  plant.
- c. CAM plant.
- d. heterotroph.
- e. chemoautotroph.

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6. Which of the following conclusions does *not* follow from studying the absorption spectrum for chlorophyll *a* and the action spectrum for photosynthesis?
- a. Not all wavelengths are equally effective for photosynthesis.
  - b. There must be accessory pigments that broaden the spectrum of light that contributes energy for photosynthesis.
  - c. The red and blue areas of the spectrum are most effective in driving photosynthesis.
  - d. Chlorophyll owes its color to the absorption of green light.
  - e. Chlorophyll *a* has two absorption peaks.

7. The diagram below represents an experiment with isolated chloroplasts. The chloroplasts were first made acidic by soaking them in a solution at pH 4. After the thylakoid space reached pH 4, the chloroplasts were transferred to a basic solution at pH 8. The chloroplasts are then placed in the dark. Which of these compounds would you expect to be produced?



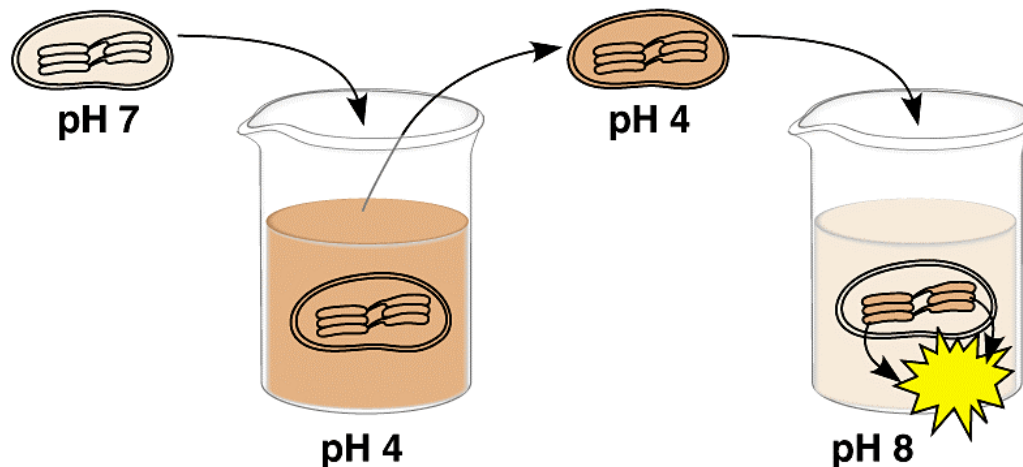
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- a. ATP
- b. NADPH + H<sup>+</sup>
- c. G3P
- d. ATP and NADPH + H<sup>+</sup>
- e. ATP, NADPH + H<sup>+</sup>, and G3P

8. The diagram below represents an experiment with isolated chloroplasts. The chloroplasts were first made acidic by soaking them in a solution at pH 4. After the thylakoid space reached pH 4, the chloroplasts were transferred to a basic solution at pH 8. The chloroplasts are then placed in the dark.

*Why can't the chloroplasts make a sugar with the energy that was just produced?*

Short answer:



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## Answers Ch 10 practice questions

1. b

2. e

3. a

4. d

5. a

6. d

7. a

8. Since this process did not involve light or the splitting of water or Photosystems II or I, there is not an electron for the reduction of NADP<sup>+</sup>. The Calvin cycle requires NADPH.

Also, the multiple enzymes required for the Calvin cycle may have been denatured through the extreme pH changes of this experiment.

# Chapter 9

## Cellular Respiration: Harvesting Chemical Energy

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1. When electrons flow along the electron transport chains of mitochondria, which of the following changes occur?
    - a. The pH of the matrix increases.
    - b. ATP synthase pumps protons by active transport.
    - c. The electrons gain free energy.
    - d. The cytochromes of the chain phosphorylate ADP to form ATP.
    - e. NAD<sup>+</sup> is oxidized.

- 
2. In the presence of a metabolic poison that specifically and completely inhibits the function of mitochondrial ATP synthase, which of the following would you expect?
- a. a decrease in the pH difference across the inner mitochondrial membrane
  - b. an increase in the pH difference across the inner mitochondrial membrane
  - c. increased synthesis of ATP
  - d. oxygen consumption to cease
  - e. proton pumping by the electron transport chain to cease

- 
3. In the 1940s, some physicians prescribed low doses of a drug called dinitrophenol (DNP) to help patients lose weight. This unsafe method was abandoned after a few patients died. DNP uncouples the chemiosmotic machinery by making the lipid bilayer of the inner mitochondrial membrane leaky to  $H^+$ . What impact does this have on ATP production?
- a. reduces substrate level phosphorylations
  - b. increases substrate level phosphorylations
  - c. reduces oxidative level phosphorylations
  - d. increase oxidative level phosphorylations
  - e. This would have no impact on ATP production.

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4. Glucose, made from six radioactively labeled carbon atoms, is fed to yeast cells in the absence of oxygen. How many molecules of radioactive alcohol ( $C_2H_5OH$ ) are formed from each molecule of glucose? (remember, yeast cells undergo alcoholic fermentation)

a. 0

b. 1

c. 2

d. 3

e. 6

- 
5. Cyanide is a poison that blocks the passage of electrons along the electron transport chain. Which of the following is a metabolic effect of this poison?
- a. The lower pH of the intermembrane space is much lower than normal.
  - b. Electrons are passed directly to oxygen, causing cells to explode.
  - c. Alcohol would build up in the cells.
  - d. NADH supplies would be exhausted, and ATP synthesis would cease.
  - e. No proton gradient would be produced, and ATP synthesis would cease.

- 
6. Which kind of metabolic poison would most directly interfere with glycolysis?
- a. an agent that reacts with oxygen and depletes its concentration in the cell
  - b. an agent that binds to pyruvate and inactivates it
  - c. an agent that closely mimics the structure of glucose but is not metabolized
  - d. an agent that reacts with NADH and oxidizes it to NAD<sup>+</sup>
  - e. an agent that inhibits the formation of acetyl coenzyme A

## **CHALLENGING QUESTION! Not like test questions!**

7. A young relative of yours has never had much energy. He goes to a doctor for help and is sent to the hospital for some tests. There they discover his mitochondria can use only fatty acids and amino acids for respiration, and his cells produce more lactate than normal. Of the following, which is the best explanation of his condition?
- a. His mitochondria lack the transport protein that moves pyruvate across the outer mitochondrial membrane.
  - b. His cells can not move NADH from glycolysis into the mitochondria.
  - c. His cells contain something that inhibits oxygen use in his mitochondria.
  - d. His cells lack the enzyme in glycolysis that forms pyruvate.
  - e. His cells have a defective electron transport chain, so glucose goes to lactate instead of to acetyl CoA.

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8. You have a friend who lost 15 pounds of fat on a diet. Where did the fat go (how was it lost)?
- a. It was released as  $\text{CO}_2$  and  $\text{H}_2\text{O}$ .
  - b. Chemical energy was converted to heat and then released.
  - c. It was converted to ATP, which weighs much less than fat.
  - d. It was broken down to amino acids and eliminated from the body.
  - e. It was converted to urine and eliminated from the body.

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## Answers to Ch 9 Practice Questions

1. A

2. B

3. C

4. C

5. E

6. C

7. A

8. A