CHAPTER 7—CELLULAR RESPIRATION

MULTIPLE CHOICE

1. When cells break down food molecules, energy
   a. is released all at once.
   b. is released entirely as body heat into the environment.
   c. is temporarily stored in ATP molecules.
   d. causes excitation of electrons in chlorophyll molecules.

   ANS: C DIF: 1 OBJ: 7-1.1

2. ATP
   a. contains five phosphate groups.
   b. is essential for a cell to perform all the tasks necessary for life.
   c. is found only in bacteria.
   d. All of the above

   ANS: B DIF: 1 OBJ: 7-1.1

3. A substance produced during photosynthesis that is used for completion of cellular respiration is
   a. water.
   b. ATP.
   c. NADPH.
   d. oxygen.

   ANS: D DIF: 1 OBJ: 7-1.1

4. The process of cellular respiration
   a. is performed only by organisms that are incapable of photosynthesis.
   b. breaks down food molecules to release stored energy.
   c. occurs before plants are able to carry out photosynthesis.
   d. occurs only in animals.

   ANS: B DIF: 1 OBJ: 7-1.1

5. cellular respiration : organic compounds ::
   a. light bulb : glass
   b. trunk : clothing
   c. automobile : gasoline
   d. country : nation

   ANS: C DIF: 2 OBJ: 7-1.1

6. When glycolysis occurs,
   a. a molecule of glucose is split.
   b. two molecules of pyruvic acid are made.
   c. some ATP is produced.
   d. All of the above

   ANS: D DIF: 1 OBJ: 7-1.2

7. The name of the process that takes place when organic compounds are broken down in the absence of oxygen is
   a. respiration.
   b. oxidation.
   c. fermentation.
   d. All of the above

   ANS: C DIF: 1 OBJ: 7-1.3

8. When muscles are exercised extensively in the absence of sufficient oxygen,
   a. a large amount of ATP is formed.
   b. NADH molecules split.
   c. lactic acid is produced.
   d. cellular respiration ceases.

   ANS: C DIF: 1 OBJ: 7-1.3

9. You have been growing some animal cells in culture. The cells grow well for several weeks, and then their growth slows down. You conduct some tests and determine that there is a lot of lactic acid in the culture fluid. Which of the following is the most likely explanation for the poor growth of the cells?
   a. There is too much glucose in the culture fluid.
   b. There is not enough glucose in the culture fluid.
   c. There is too much oxygen in the culture fluid.
   d. There is not enough oxygen in the culture fluid.

   ANS: D DIF: 3 OBJ: 7-1.3

10. If the formation of a standard amount of ATP under certain conditions requires 12 kcal of energy and the complete oxidation of glucose yields 686 kcal of energy, how efficient is glycolysis at extracting energy from glucose?
   a. 1.7%
   b. 3.5%
   c. 7.0%
   d. 35%

   ANS: B DIF: 1 OBJ: 7-1.4

11. Cellular respiration takes place in two stages:
   a. glycolysis and fermentation.
   b. Stage 1 and Stage 2 of photosynthesis.
   c. glycolysis, then aerobic respiration.
   d. aerobic respiration, then glycolysis.

   ANS: C DIF: 1 OBJ: 7-2.5

12. In cellular respiration, a two-carbon molecule combines with a four-carbon molecule to form citric acid as part of
   a. glycolysis.
   b. carbon fixation.
   c. the Krebs cycle.
   d. the electron transport chain.

   ANS: C DIF: 1 OBJ: 7-2.2

13. Acetyl coenzyme A
   a. is formed from the breakdown of pyruvic acid.
   b. enters the Krebs cycle.
   c. can be used in synthesis of needed molecules.
   d. All of the above

   ANS: D DIF: 1 OBJ: 7-2.2

14. Glycolysis and aerobic respiration are different in that
    a. glycolysis occurs on the cell membrane, while aerobic respiration occurs in mitochondria.
    b. glycolysis occurs only in photosynthesis, while aerobic respiration is part of cellular respiration.
    c. glycolysis occurs in the absence of oxygen, while aerobic respiration requires oxygen.
    d. There is no difference; these terms are different names for the same process.

    ANS: C DIF: 1 OBJ: 7-2.5

15. Which of the following is *not* formed during the Krebs cycle?
    a. CO_2
    b. $FADH_2$
    c. NADH
    d. NADPH

    ANS: D DIF: 1 OBJ: 7-2.2

16. Which of the following is *not* part of cellular respiration?
    a. electron transport
    b. glycolysis
    c. the Krebs cycle
    d. the Calvin cycle

    ANS: D DIF: 1 OBJ: 7-1.1

17. With oxygen present, the Krebs cycle and the electron transport chain
    a. provide organisms an alternative to glycolysis.
    b. produce most of the ATP needed for life.
    c. break down glucose to produce carbon dioxide, water, and ATP.
    d. All of the above

    ANS: D DIF: 1 OBJ: 7-1.1

18. Water is an end product in
    a. lactic acid formation.
    b. fermentation.
    c. the Krebs cycle.
    d. the electron transport chain.

    ANS: D DIF: 1 OBJ: 7-2.3

19. Krebs cycle : CO_2 ::
    a. glycolysis : glucose
    b. acetyl CoA formation : O_2
    c. cellular respiration : O_2
    d. electron transport chain : ATP

    ANS: D DIF: 2 OBJ: 7-2.3

20. ATP molecules produced during aerobic respiration
    a. remain in the mitochondria in which they are formed.
    b. are stored in chloroplasts of the same cell in which they are formed.
    c. enter the cell's cytoplasm through the membranes of the mitochondria in which they are formed.
    d. are distributed by the bloodstream to all cells in the body.

    ANS: C DIF: 2 OBJ: 7-2.1

21. At the end of the electron transport chain,
    a. the electrons combine with oxygen and protons to form water.
    b. the electrons are used in the formation of ethyl alcohol.
    c. the electrons build up inside the mitochondria and diffuse back to a thylakoid.
    d. None of the above

    ANS: A DIF: 1 OBJ: 7-2.3

$C_6 H_{12}O_6 + 6O_2 + ADP + P \rightarrow 6CO_2 + 6 H_2O$ + MOLECULE A

22. The process shown in the equation above begins in the cytoplasm of a cell and ends in the
    a. cytoplasm.
    b. mitochondria.
    c. endoplasmic reticulum.
    d. lysosome.

    ANS: B DIF: 2 OBJ: 7-2.1

23. The equation above summarizes the process known as
    a. photosynthesis.
    b. fermentation.
    c. cellular respiration.
    d. protein breakdown.

    ANS: C DIF: 2 OBJ: 7-1.1

24. The molecule referred to as "molecule A" in the equation above is
    a. NADPH.
    b. ATP.
    c. NADH.
    d. ADP.

    ANS: B DIF: 2 OBJ: 7-1.1

25. When living cells break down molecules, energy is
    a. stored as ADP.
    b. stored as ATP.
    c. released as heat.
    d. Both b and c

    ANS: D DIF: 2 OBJ: 7-1.1

26. Which of the following is the best explanation for the presence of both chloroplasts and mitochondria in plant cells?
    a. In the light, plants are photosynthetic autotrophs. In the dark, they are heterotrophs.
    b. If plants cannot produce enough ATP in the process of photosynthesis to meet their energy needs, they can produce it in aerobic respiration.
    c. Sugars are produced in chloroplasts. These sugars can be stored in the plant for later use, converted to other chemicals, or broken down in aerobic respiration to yield ATP for the plant to use to meet its energy needs.
    d. The leaves and sometimes the stems of plants contain chloroplasts, which produce ATP to meet the energy needs of these plant parts. The roots of plants contain mitochondria, which produce ATP to meet the energy needs of these plant parts.

    ANS: C DIF: 3 OBJ: 7-2.1

27. In cellular respiration, the most energy is transferred during
    a. glycolysis.
    b. lactic acid fermentation.
    c. the Krebs cycle.
    d. the electron transport chain

    ANS: D DIF: 2 OBJ: 7-2.5

28. Electrons are donated to the electron transport chain by
    a. ATP and NADH.
    b. $FADH_2$ and NADH.
    c. ATP and NAD^+.
    d. NAD^+ and ATP.

    ANS: B DIF: 2 OBJ: 7-2.3

29. If the formation of 38 molecules of ATP requires 266 kcal of energy and the complete oxidation of glucose yields 686 kcal of energy, how efficient is cellular respiration at extracting energy from glucose?
    a. 20%
    b. 39%
    c. 25%
    d. 100%

    ANS: B DIF: 1 OBJ: 7-2.4

COMPLETION

1. _____ is a biochemical pathway of cellular respiration that is anaerobic.

   ANS: Glycolysis

   DIF: 1 OBJ: 7-1.2

2. Glucose is split into smaller molecules during a biochemical pathway called _____.

   ANS: glycolysis

   DIF: 1 OBJ: 7-1.2

3. In the absence of oxygen, glycolysis is followed by _____ instead of aerobic respiration.

   ANS: fermentation

   DIF: 1 OBJ: 7-1.3

4. During fermentation, either ethyl alcohol and carbon dioxide or _____ is formed.

   ANS: lactic acid

   DIF: 1 OBJ: 7-1.3

5. Of the maximum possible yield of 38 ATP molecules produced by the complete oxidation of one glucose molecule, _____ molecules of ATP are produced during glycolysis.

   ANS:
   two
   2

   DIF: 2 OBJ: 7-1.4

6. The Krebs cycle takes place in the _____.

   ANS: mitochondrial matrix

   DIF: 1 OBJ: 7-2.1

ESSAY

1. The relationship between photosynthesis and cellular respiration is usually described as a cycle. Briefly explain. Write your answer in the space below.

   ANS:
   The relationship between photosynthesis and cellular respiration is often described as cyclic because the products of one process are used as the reactants for the other. Photosynthesis produces carbohydrates from carbon dioxide and water, incorporating light energy into the bonds of glucose. Cellular respiration, on the other hand, releases energy from the bonds of glucose for use by the cell, and in the process produces carbon dioxide and water.

   DIF: 2 OBJ: 7-1.1