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Chapter 9

Cellular Respiration

Section 9–1 Chemical Pathways (pages 221–225)

This section explains what cellular respiration is. It also describes what happens during a process called glycolysis and describes two types of a process called fermentation.

Chemical Energy and Food (page 221)

1. What is a calorie? _____

_____

2. How many calories make up 1 Calorie? _____

3. Cellular respiration begins with a pathway called _____.

4. Is the following sentence true or false? Glycolysis releases a great amount of energy. _____

Overview of Cellular Respiration (page 222)

5. What is cellular respiration? _____

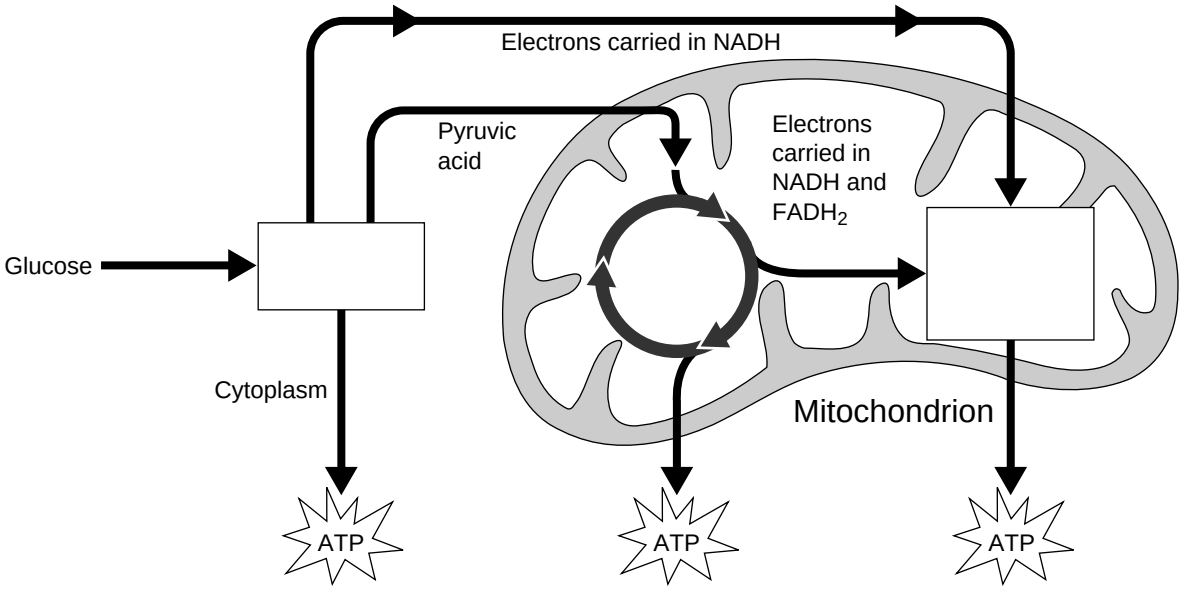
_____

6. What is the equation for cellular respiration, using chemical formulas? _____

7. What would be the problem if cellular respiration took place in just one step? _____

_____

8. Label the three main stages of cellular respiration on the illustration of the complete process.



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9. Where does glycolysis take place? _____

_____

10. Where do the Krebs cycle and electron transport take place? _____

_____

Glycolysis (page 223)

11. What is glycolysis? _____

_____

_____

12. How does the cell get glycolysis going? _____

_____

13. If the cell uses 2 ATP molecules at the beginning of glycolysis, how does it end up with a net gain of 2 ATP molecules? _____

_____

_____

14. What is NAD^+? _____

_____

15. What is the function of NAD^+ in glycolysis? _____

_____

_____

_____

_____

16. Why can glycolysis supply energy to cells when oxygen is not available? _____

_____

17. What problem does a cell have when it generates large amounts of ATP from glycolysis? _____

_____

Fermentation (pages 224–225)

18. What is fermentation? _____

_____

_____

19. How does fermentation allow glycolysis to continue? _____

_____

20. Because fermentation does not require oxygen, it is said to be _____.

21. What are the two main types of fermentation?

a. _____ **b.** _____

22. What organisms use alcoholic fermentation? _____

_____

23. What is the equation for alcoholic fermentation after glycolysis?

_____

24. What happens to the small amount of alcohol produced in alcoholic fermentation during the baking of bread? _____

25. What does lactic acid fermentation convert into lactic acid?

_____

26. What is the equation for lactic acid fermentation after glycolysis?

_____

27. During rapid exercise, how do your muscle cells produce ATP? _____

_____

Reading Skill Practice

When your read about complex topics, writing an outline can help you organize and understand the material. Outline Section 9–1 by using the headings and subheadings as topics and subtopics and then writing the most important details under each topic. Do your work on a separate sheet of paper.

Section 9–2 The Krebs Cycle and Electron Transport (pages 226–232)

This section describes what happens during the second stage of cellular respiration, called the Krebs cycle. It also explains how high-energy electrons are used during the third stage, called electron transport.

Introduction (page 226)

1. At the end of glycolysis, how much of the chemical energy in glucose is still unused? _____

2. Because the final stages of cellular respiration require oxygen, they are said to be _____.

The Krebs Cycle (pages 226–227)

3. In the presence of oxygen, how is the pyruvic acid produced in glycolysis used? _____

_____

4. What happens to pyruvic acid during the Krebs cycle? _____

_____

_____

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5. Why is the Krebs cycle also known as the citric acid cycle? _____

6. When does the Krebs cycle begin? _____

7. What happens to each of the 3 carbon atoms in pyruvic acid when it is broken down? _____

8. What happens to the carbon dioxide produced in breaking down pyruvic acid? _____

9. How is citric acid produced? _____

10. During the energy extraction part of the Krebs cycle, how many molecules of CO_2 are released? _____

11. What is the energy tally from 1 molecule of pyruvic acid during the Krebs cycle? _____

12. When electrons join NAD^+ and FAD during the Krebs cycle, what do they form? _____

13. Why is the 4-carbon compound generated in the breakdown of citric acid the only permanent compound in the Krebs cycle? _____

Electron Transport (pages 228–229)

14. What is the electron transport chain? _____

15. What does the electron transport chain use the high-energy electrons from the Krebs cycle for? _____

16. How does the location of the electron transport chain differ in eukaryotes and prokaryotes? _____

17. Where does the electron transport chain get the high-energy electrons that are passed down the chain? _____

_____

18. Is the following sentence true or false? Hydrogen serves as the final electron acceptor of the electron transport chain.

_____

19. What is the energy of the high-energy electrons used for every time 2 high-energy electrons move down the electron transport chain? _____

_____

20. What causes the H^+ ions in the intermembrane space to move through the channels in the membrane and out into the matrix? _____

_____

_____

_____

_____

21. On average, how many ATP molecules are produced as each pair of high-energy electrons moves down the electron transport chain? _____

22. Complete the flowchart about electron transport.

High-energy electrons from NADH and $FADH_2$ are passed into and along the _____.

↓

The energy from the electrons moving down the chain is used to move H^+ ions across the _____.

↓

H^+ ions build up in the _____ space, making it _____ charged and making the matrix negatively charged.

↓

H^+ ions move through channels of _____ in the inner membrane.

↓

The ATP synthase uses the energy from the moving ions to combine ADP and phosphate, forming high-energy _____.

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The Totals (page 229)

23. What is the total number of ATP molecules formed during cellular respiration? _____

24. Why can 18 times as much ATP be generated from glucose in the presence of oxygen than when oxygen is not available? _____

25. What happens to the 62 percent of the total energy of glucose that is not used to make ATP molecules? _____

26. What are the final waste products of cellular respiration? _____

Energy and Exercise (pages 230–231)

27. What are the three sources of ATP a human body uses at the beginning of a race? _____

28. When a runner needs quick energy for a short race, what source can supply enough ATP for about 90 seconds? _____

29. Why does a sprinter have an oxygen debt to repay after the race is over? _____

30. A runner needs more energy for a longer race. How does the body generate the necessary ATP? _____

31. Why are aerobic forms of exercise so beneficial for weight control? _____

Comparing Photosynthesis and Cellular Respiration (page 232)

32. If photosynthesis is the process that "deposits" energy in a "savings account," then what is cellular respiration? _____

33. How are photosynthesis and cellular respiration opposite in terms of carbon dioxide? _____

34. How are photosynthesis and cellular respiration opposite in terms of oxygen? _____

_____

WordWise

Match each definition in the left column with the correct term in the right column. Then, write the number of each term in the box below on the line under the appropriate letter. When you have filled in all the boxes, add up the numbers in each column, row, and diagonal. All the sums should be the same.

Definition

A. The process in which cells convert NADH to NAD^+ by passing high-energy electrons back to pyruvic acid

B. The second stage of cellular respiration

C. An electron carrier

D. The stage of cellular respiration in which a molecule of glucose is broken into two molecules of pyruvic acid

E. The process that releases energy by breaking down food molecules in the presence of oxygen

F. The amount of energy needed to raise the temperature of 1 gram of water 1 Celsius degree

G. A process that does not require oxygen

H. A process that requires oxygen

I. A series of carrier proteins in the inner membrane of mitochondria

Term

1. Krebs cycle

2. anaerobic

3. calorie

4. electron transport chain

5. cellular respiration

6. fermentation

7. glycolysis

8. NAD^+

9. aerobic