Name _____ Date _____ Class _____

55-57

Photosynthesis (pp. 118–122)

This section explains how plants make food by using the energy from sunlight.

Use Target Reading Skills

As you read, make an outline to show the relationships between main ideas and supporting ideas. Use the headings, subheadings, Key Terms, and Key Concepts to help you complete the outline.

I. Sources of Energy
- A.
- B.
- C.
- D.
- E.

II.
- A.
  1.
  2.
  3.
- B.
  1.
  2.
  3.
  4.
  5.
  6.
- C.
  1.
  2.

Sources of Energy (p. 119)

1. In the process of photosynthesis, plants use the energy in _____sunlight_____ to make food.

Photosynthesis *(continued)*

2. Complete the following table about how living things use the sun's energy.

How Living Things Obtain Energy From the Sun		
Living Thing	**Autotroph or Heterotroph?**	**Obtains Energy From the Sun Directly or Indirectly?**
Grass	Auto	Directly
Zebra	Hetero	Indirectly
Lion	Hetero	Indirectly

The Two Stages of Photosynthesis (pp. 120–122)

3. List the two stages in the process of photosynthesis.
   a. Capturing the Sun's energy
   b. producing sugar
4. The green pigment in chloroplasts, called Chlorophyll, absorbs light energy from the sun.
5. Is the following sentence true or false? Besides the energy in sunlight, the cell needs water and carbon dioxide to make sugar. true
6. What are stomata?
   Small openings on the undersides of leaves through which CO_2 enters

7. Circle the letter of each product of photosynthesis.
   a. water
   b. carbon dioxide
   c. oxygen
   d. sugars

8. Is the following sentence true or false? Photosynthesis produces the carbon dioxide that most living things need to survive. false

9. Write the chemical equation for the process of photosynthesis.
   $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

10. What word does the arrow in the chemical equation stand for?
    yields

11. Circle the letter of each raw material of photosynthesis.
    a. carbon dioxide
    b. glucose
    c. water
    d. oxygen

12. Circle the letter of each sentence that is true about the products of photosynthesis.
    a. Plant cells use the sugar for food.
    b. Some of the sugar is made into other compounds, such as cellulose.
    c. Some of the sugar is stored in the plant's cells for later use.
    d. Extra sugar molecules pass out of the plant through the stomata.

Name _____ Date _____ Class _____

Respiration

Key Concepts

- What events occur during respiration?
- What is fermentation?

Cells store and use energy in a way that is similar to the way you deposit and withdraw money from a savings account. When you eat a meal, you add to your body's energy savings account. When your cells need energy, they make a withdrawal by breaking down the carbohydrates in food to release energy.

The process by which cells obtain energy from glucose (a type of sugar) is called **respiration. During respiration, cells break down simple food molecules such as sugar and release the energy they contain.** Because living things need a continuous supply of energy, the cells of all living things carry out respiration continuously. The term *respiration* also is used to mean breathing, that is, moving air in and out of your lungs. To avoid confusion, the respiration process that takes place inside cells sometimes is called cellular respiration. The two kinds of respiration are related. Breathing brings oxygen into your lungs, and oxygen is necessary for cellular respiration to occur in most cells.

Like photosynthesis, respiration is a two-stage process. The first stage takes place in the cytoplasm of the organism's cells. There, glucose molecules are broken down into smaller molecules. Oxygen is not involved in this stage of respiration, and only a small amount of energy is released. The second stage of respiration takes place in the mitochondria. There, the small molecules are broken down into even smaller molecules. These chemical reactions require oxygen, and a great deal of energy is released. Two other products of respiration are carbon dioxide and water.

Photosynthesis and respiration can be thought of as opposite processes. Together, these two processes form a cycle that keeps the levels of oxygen and carbon dioxide fairly constant in the atmosphere.

Some cells obtain their energy through **fermentation**, an energy-releasing process that does not require oxygen. **Fermentation provides energy for cells without using oxygen.** One type of fermentation occurs in yeast and some other single-celled organisms. This process is sometimes called alcoholic fermentation because alcohol is one of the products made when these organisms break down sugars. Another type of fermentation takes place at times in your body when your muscles run out of oxygen—for example, when you've run as fast as you could for as long as you could. One product of this type of fermentation is an acid known as lactic acid. When lactic acid builds up, your muscles feel weak and sore.

Name _____ Date _____ Class _____

Respiration (pp. 123–127)

59-60

In this section, you will learn how cells get energy from food.

Use Target Reading Skills

As you read, make an outline to show the relationships between main ideas and supporting ideas. Use the headings, subheadings, Key Terms, and Key Concepts to help you complete the outline.

I. What Is Respiration?
- A.
- B.
- C.
- D.
- E.
- F.
- G.
- H.

II.
- A.
- B.
- C.

What Is Respiration? (pp. 124–126)

1. What happens during respiration?

cells break down simple molecules such as sugar and release the energy and CO_2

2. Cells store energy in the form of carbohydrates / sugars

Respiration *(continued)*

3. How do cells "withdraw" energy?

break down carbs

break down sugars to release stored chemical energy

4. Is the following sentence true or false? Respiration that takes place inside of cells is the same as breathing air in and out of the lungs.

false

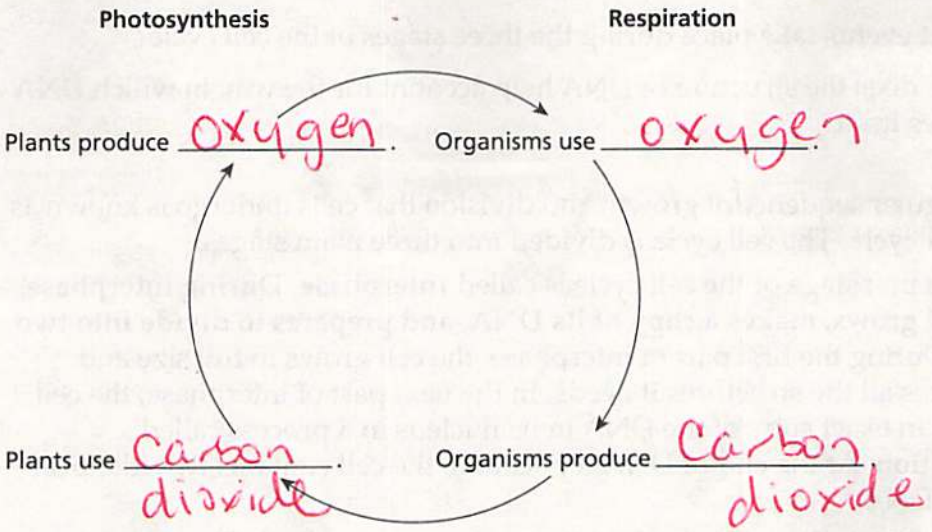
5. Use the table below to list the raw materials and products of respiration.

Respiration	
Raw Materials	**Products**
Sugar	Carbon Dioxide
Oxygen	Water
	Energy Chemical (ATP)

Match the events in respiration with the stages in which they occur. The items in the second column may be used more than once.

Event in Respiration	Stage of Process
b 6. Takes place in the mitochondria	a. first stage only
a 7. Takes place in the cytoplasm	b. second stage only
b 8. Oxygen is involved.	c. both first and second stages
c 9. Energy is released.	
a 10. Glucose molecules are broken down.	

11. Complete the cycle diagram below, which describes the relationship between photosynthesis and respiration.



Fermentation (pp. 126–127)

12. What is fermentation?
A form of anerobic (without oxygen) respiration that provides energy

13. Is the following sentence true or false? Fermentation releases more energy than respiration. False

14. List the two types of fermentation and explain where each takes place.
    a. Alcoholic fermentation - yeast and other single celled organisms; produces alcohol, CO_2 + small amt. of energy
    b. Lactic Acid fermentation - in our muscles; lack of oxygen when excercising vigorously produces lactic acid in our muscles.

Cell Division

Key Concepts

- What events take place during the three stages of the cell cycle?
- How does the structure of DNA help account for the way in which DNA copies itself?

The regular sequence of growth and division that cells undergo is known as the **cell cycle**. The cell cycle is divided into three main stages.

The first stage of the cell cycle is called **interphase. During interphase, the cell grows, makes a copy of its DNA, and prepares to divide into two cells.** During the first part of interphase, the cell grows to full size and produces all the structures it needs. In the next part of interphase, the cell makes an exact copy of the DNA in its nucleus in a process called **replication**. At the end of DNA replication, the cell contains two identical sets of DNA.

Once interphase is complete, the second stage of the cell cycle begins. **Mitosis** is the stage during which the cell's nucleus divides into two new nuclei. **During mitosis, one copy of the DNA is distributed into each of the two daughter cells.** Scientists divide mitosis into four parts, or phases: prophase, metaphase, anaphase, and telophase. During prophase, the threadlike chromatin in the cell's nucleus condenses to form double-rod structures called **chromosomes**. Each identical rod in a chromosome is called a chromatid. The two chromatids are held together by a structure called a centromere. As the cell progresses through metaphase, anaphase, and telophase, the chromatids separate from each other and move to opposite ends of the cell. Then two nuclear envelopes form around the chromatids at the two ends of the cell.

After mitosis, the final stage of the cell cycle, called **cytokinesis**, completes the process of cell division. **During cytokinesis, the cytoplasm divides. The organelles are distributed into each of the two new cells.** Each daughter cell has the same number of chromosomes as the original parent cell. At the end of cytokinesis, each cell enters interphase, and the cycle begins again. The length of each stage and cell cycle varies, depending on the type of cell.

DNA replication ensures that each daughter cell will have all of the genetic information it needs to carry out its activities. The two sides of the DNA ladder are made up of alternating sugar and phosphate molecules. Each rung of the DNA ladder is made up of a pair of molecules called nitrogen bases. There are four kinds of nitrogen bases: adenine, thymine, guanine, and cytosine. Adenine pairs only with thymine, and guanine pairs only with cytosine. DNA replication begins when the two sides of the DNA molecule unwind and separate. Next, nitrogen bases that are floating in the nucleus pair up with the bases on each half of the DNA molecule. **Because of the way in which the nitrogen bases pair with one another, the order of the bases in each new DNA molecule exactly matches the order in the original DNA molecule.** Once the new bases are attached, two new DNA molecules are formed.

Name _____ Date _____ Class _____

Cell Division (pp. 129–136)

61-65

This section explains how cells grow, divide, and specialize.

Use Target Reading Skills

As you read, make an outline to show the relationships between main ideas and supporting ideas. Use the headings, subheadings, Key Terms, and Key Concepts to help you complete the outline.

I. Stage 1: Interphase
- A.
- B.
- C.
- D.
- E.

II.
- A.
- B.
- C.
- D.
- E.
- F.
- G.
- H.

III.
- A.
- B.
- C.
- D.
- E.

IV.
- A.
- B.
- C.
- D.
- E.
- F.
- G.
- H.

Cell Division *(continued)*

Stage 1: Interphase (p. 130)

1. The regular sequence of growth and division that cells undergo is called the cell cycle.
2. List three things that the cell is doing during interphase.
   a. grows
   b. makes a copy of its DNA
   c. prepares to divide into 2 cells - produces organelles for division
3. Circle the letter of the specific process during which the cell copies its DNA.
   a. interphase
   b. cytokinesis
   c. replication
   d. division

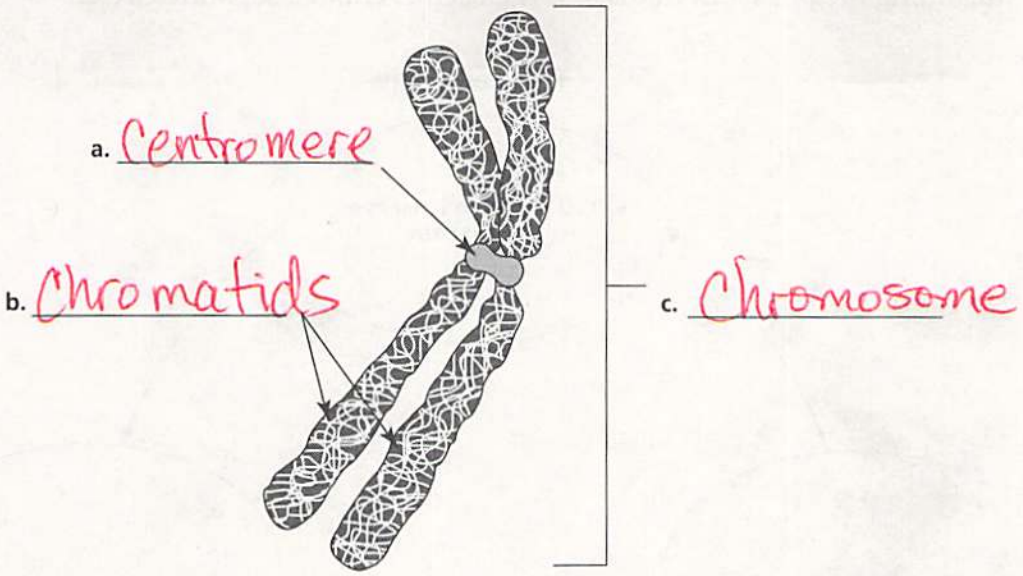
Stage 2: Mitosis (pp. 131–133)

4. Circle the letter of each sentence that is true about mitosis.
   a. The cell makes a copy of its DNA.
   b. The cell membrane pinches in around the middle of the cell.
   c. The cell's nucleus divides into two new nuclei.
   d. One copy of DNA is distributed into each daughter cell.

Match the phases of mitosis with the events that occur in each.

	Event	Phase
C	5. The centromeres split and the chromatids separate.	a. prophase
A	6. The chromatin condenses to form chromosomes.	b. metaphase
D	7. A new nuclear envelope forms around each region of chromosomes.	c. anaphase
B	8. The chromosomes line up across the center of the cell.	d. telophase

9. Label the parts of the structure in the diagram below.



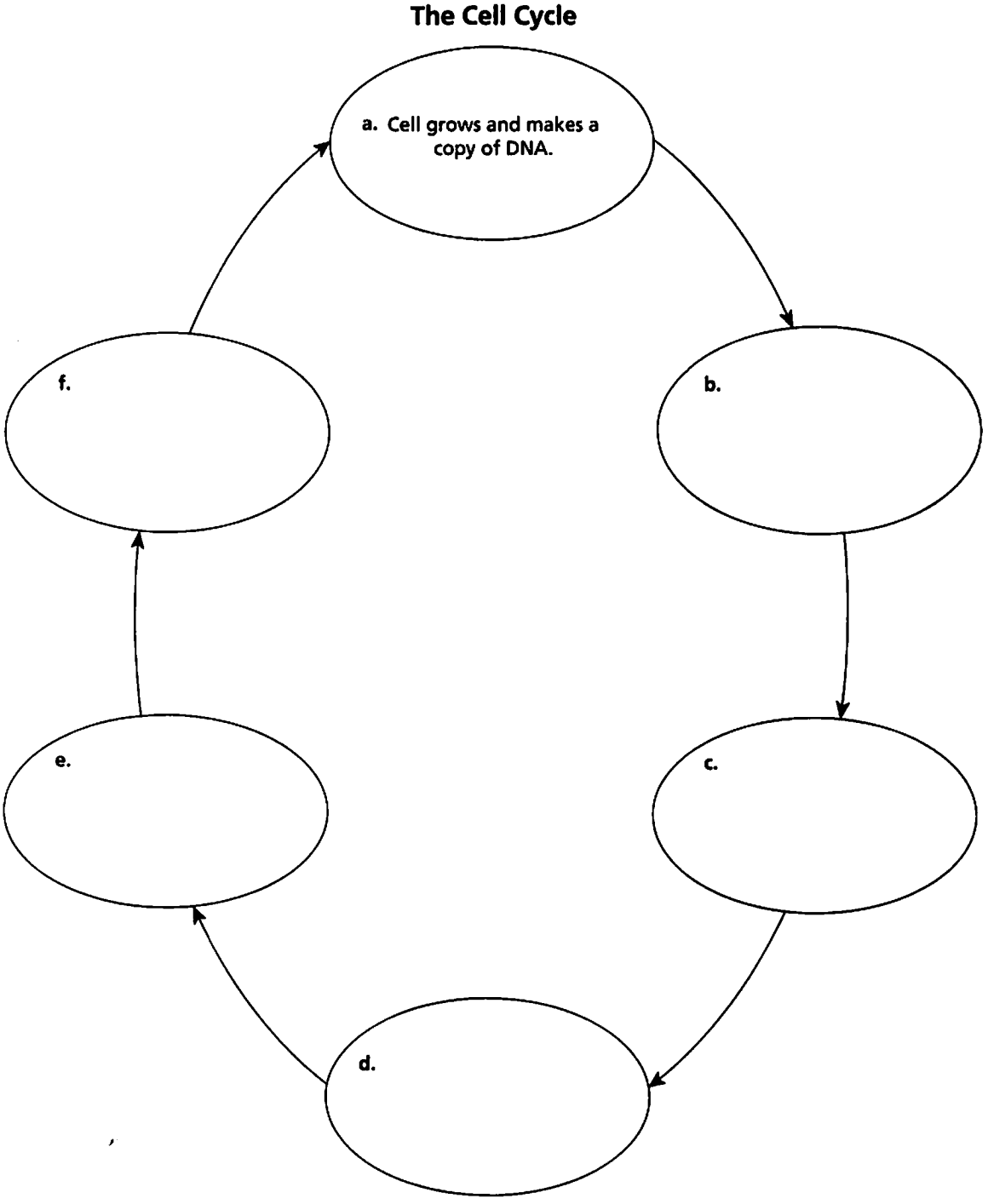
Stage 3: Cytokinesis (p. 134)

10. During cytokinesis the Cytoplasm divides, distributing the organelles into each of the two new cells.

11. Is the following sentence true or false? During cytokinesis in plant cells, the new cell membrane forms before the new cell wall does.
FALSE = NO

Cell Division *(continued)*

12. Complete this cycle diagram, which shows the events in the cell cycle, including the phases of mitosis. Write each event in a separate circle.



Structure and Replication of DNA (pp. 135–136)

13. Why does a cell make a copy of its DNA before mitosis occurs?

ensures each daughter cell will have all of the genetic info needed to carry out activities

14. Circle the letter of each molecule that makes up the sides of the DNA ladder.

a. deoxyribose
b. glucose
c. phosphate
d. oxygen

15. Name the nitrogen bases that pair up to make up the rungs of the DNA ladder.

a. Adenine pairs with Thymine.

b. Guanine pairs with Cytosine.

16. Complete the flowchart to show what happens during DNA replication.

DNA Replication

The two sides of the DNA molecule unwind and seperate.

↓

Nitrogen bases floating in the nucleus pair up with the bases on each half of the DNA molecule.

↓

When the new bases are attached, two new DNA molecules are formed.

Name _____ Date _____ Class _____

Cell Differentiation

Key Concepts

- What is differentiation?
- What factors influence how and when cells differentiate within different organisms?

Cell division alone cannot explain the development of new structures. If cells only divided, the result would be a big ball of identical cells. Instead, cells differentiate. **Differentiation** is the process by which cells change in structure and become capable of carrying out specialized functions. **As cells differentiate, they become different from one another. They also form groups made of other, similarly specialized cells. These groups then form tissues and organs.**

Plants, animals, and other multicellular organisms begin their lives as one cell. Through mitosis and differentiation, the single cell becomes an organism with specialized structures. When cells differentiate, they also become organized. At first, they group into tissues. Tissues are groups of specialized cells that work together to carry out specific functions. Groups of tissues also combine to form organs. Systems are groups of organs that function together. As development continues, more fine-grained differentiation may take place.

During development, each cell becomes fixed—or set—in how it will differentiate. The plan that determines which type of cell it will become is coded in the DNA in the cell's nucleus. Differentiation occurs when certain sections of DNA are turned off. The active DNA then guides how the cell develops. **Once a cell's future has been determined, when and how much it changes depends on its DNA, its function, and the type of organism.**

Some animals, like reptiles and crustaceans, can grow a limb or tail to replace a lost one. Cells at the point of injury can differentiate, forming new muscle, bone, blood, and nerves. The replacement of lost body parts does not occur in humans. Once human cells differentiate, they usually lose the ability to become other types of cells. However, humans do produce cells—called **stem cells**—that can differentiate throughout life. Stem cells exist throughout the body, and they respond to certain needs in the body by becoming specialized cells. For example, your body needs a constant supply of red blood cells to replace older ones. Every day, stem cells produce new red blood cells.

Cells differentiate in developing plants in much the same way that they do in animals. Differentiated cells group together to form tissues that make up the roots, stems, and leaves. Adult plants have the ability to grow bigger throughout their lives. This growth happens because certain cells in the roots and stems of plants are not fixed in their development. These cells can undergo rapid cell division and differentiate, increasing the size of the roots and stems.

Name _____ Date _____ Class _____

Cell Differentiation (pp. 138–141)

66-68

This section explains cell differentiation and the factors that influence how and when cells differentiate within different organisms.

Use Target Reading Skills

As you read, make an outline to show the relationships between main ideas and supporting ideas. Use the headings, subheadings, Key Terms, and Key Concepts to help you complete the outline.

I. Differentiation
- A.
- B.
- C.
- D.
- E.

II.
- A.
- B.
- C.
- D.
- E.
- F.
- G.

Differentiation (pp. 138–139)

1. What is differentiation?
process by which cells change in structure to be able to carry out

2. Through mitosis and differentiation specialized function an organism develops from a single cell into a multicellular organism with specialized structures.

3. Is the following sentence true or false? Cells become capable of carrying out specialized functions when they differentiate in structure.
true

4. List the three levels into which cells become organized when they differentiate.
   a. tissues
   b. organs
   c. systems

How Cells Differentiate (pp. 140–141)

5. Circle the letter of each sentence that is true about how cells differentiate.
   a. The plan for what a cell will become is coded in its DNA.
   b. Differentiation occurs when certain sections of DNA are turned off.
   c. How much and when a cell changes depends on its function and its organelles.
   d. All cells differentiate completely during development.

6. Why can some lizards grow new tails?
   cells differentiate to make tail

7. What are stem cells in humans?
   cells that can change through life

8. Is the following sentence true or false? Plants can continue to grow all of their lives because certain cells in their roots and stems are not fixed in their development. true