

Cell Processes and Energy ▪ Guided Reading and Study

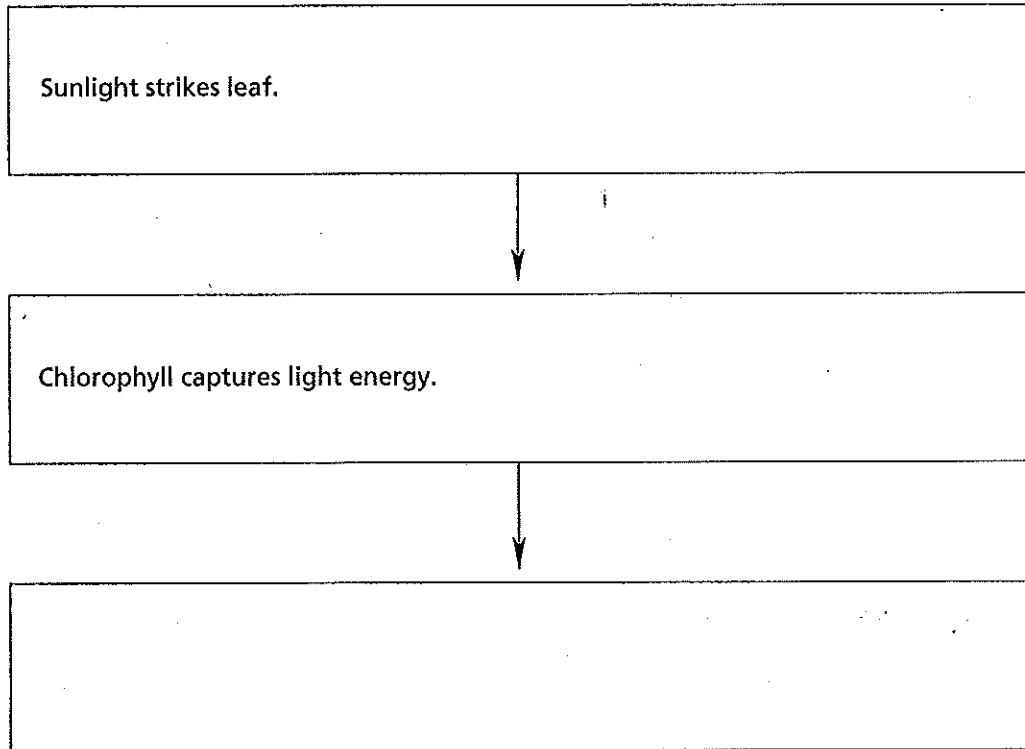
Photosynthesis (pp. 44–48)

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

Use Target Reading Skills

As you read, create a flowchart that shows the steps in photosynthesis. Put each step in a separate box in the flowchart in the order in which it occurs.

Steps in Photosynthesis



Sources of Energy (p. 45)

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

Cell Processes and Energy ▪ *Guided Reading and Study***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		
Zebra		
Lion		

The Two Stages of Photosynthesis (pp. 46–48)

3. List the two stages in the process of photosynthesis.
- a. _____
- b. _____
4. The green pigment in chloroplasts, called _____, 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. _____
6. What are stomata?
- _____
- _____

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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. _____

9. Write the chemical equation for the process of photosynthesis.

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

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.

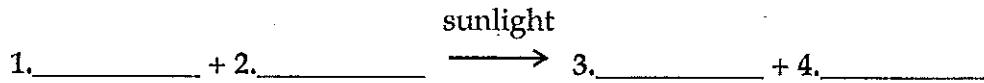
and Energy

Cell Processes and Energy ▪ *Review and Reinforce*

Photosynthesis

Understanding Main Ideas

Fill in the blanks in the photosynthesis equation below with the names of the missing compounds. Then answer the questions that follow in the spaces provided.



5. What are the raw materials of photosynthesis?

6. What are the products of photosynthesis?

7. Why is *sunlight* written above the arrow in the equation, rather than on either side of it?

8. Where does photosynthesis occur?

Building Vocabulary

Fill in the blank to complete each statement.

9. The process by which a cell captures the energy in sunlight and uses it to make food is called _____.

10. _____ are colored chemical compounds that absorb light.

11. The main pigment found in the chloroplasts of plants is _____.

12. _____ are small openings on the undersides of leaves through which carbon dioxide enters a plant.

13. An organism that makes its own food is a(n) _____.

14. A(n) _____ is an organism that cannot make its own food.

Cell Processes and Energy ▪ Laboratory Investigation

Stomata Functions

Pre-Lab Discussion

During photosynthesis, plants capture light energy and convert it into chemical energy that is stored in sugar molecules. The two raw materials needed for this process are water and carbon dioxide. Plants obtain water through their roots. They obtain carbon dioxide, a gas, through tiny openings, or pores, called stomata (singular *stoma*). Most of the stomata are located in the plant's leaves. The stomata must be open to allow carbon dioxide to pass into the leaf. The open stomata also allow water and oxygen to pass out of the leaf.

The opening and closing of the stomata is carried out by guard cells. When guard cells absorb water, they swell, and the stomata open, as shown in Figure 1. When guard cells lose water, the swelling is reduced, and the stomata close, as shown in Figure 2. Stomata are adaptations that help plants survive. When they are open, they allow carbon dioxide to enter. When they are closed, they help prevent the loss of water from the plant.

In this investigation, you will determine the number of stomata on different types of leaves.

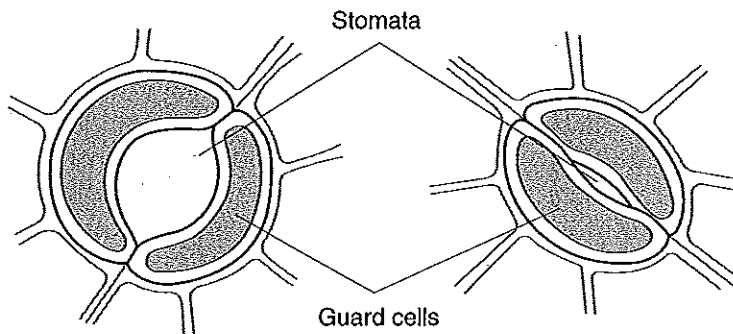


Figure 1.

Figure 2

1. Are the stomata usually open or closed during photosynthesis? Explain.

2. Are stomata usually open or closed during dry periods? Explain.

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Cell Processes and Energy • *Laboratory Investigation*

Stomata Functions *(continued)*

Problem

Approximately how many stomata are present on a typical leaf?

Materials *(per group)*

microscope slide

coverslip

water

plastic dropper

lettuce leaf, fresh

forceps

iodine solution

compound microscope

paper towel

leaves from two different plants

metric ruler

Safety  Review the safety guidelines in Appendix A of your textbook.

Wipe up spills immediately. Coverslips and slides break easily, so handle them carefully. Tell the teacher if a slide breaks. If your microscope has a mirror, do not use it to reflect direct sunlight. Eye damage can occur if direct sunlight is used as a light source. Iodine solution can stain skin and clothing. If you spill any solution on your skin, rinse it off immediately with cold running water, and tell the teacher.

Procedure

Part A: Identifying Guard Cells

1. Prepare to make a wet mount by placing a drop of water in the center of a microscope slide.
2. Obtain a fresh lettuce leaf, and turn it over so that it curves downward. You are now looking at the lower epidermis, or bottom, of the lettuce leaf. Locate the large central rib in the leaf.
3. Bend the leaf backward against the curve until it breaks, as shown in Step 2 of Figure 3 on the next page. Use forceps to carefully remove a small piece of the thin epidermal layer.

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- Spread out the epidermis specimen in the water drop on the slide. Be sure that no part of the epidermis is folded over.

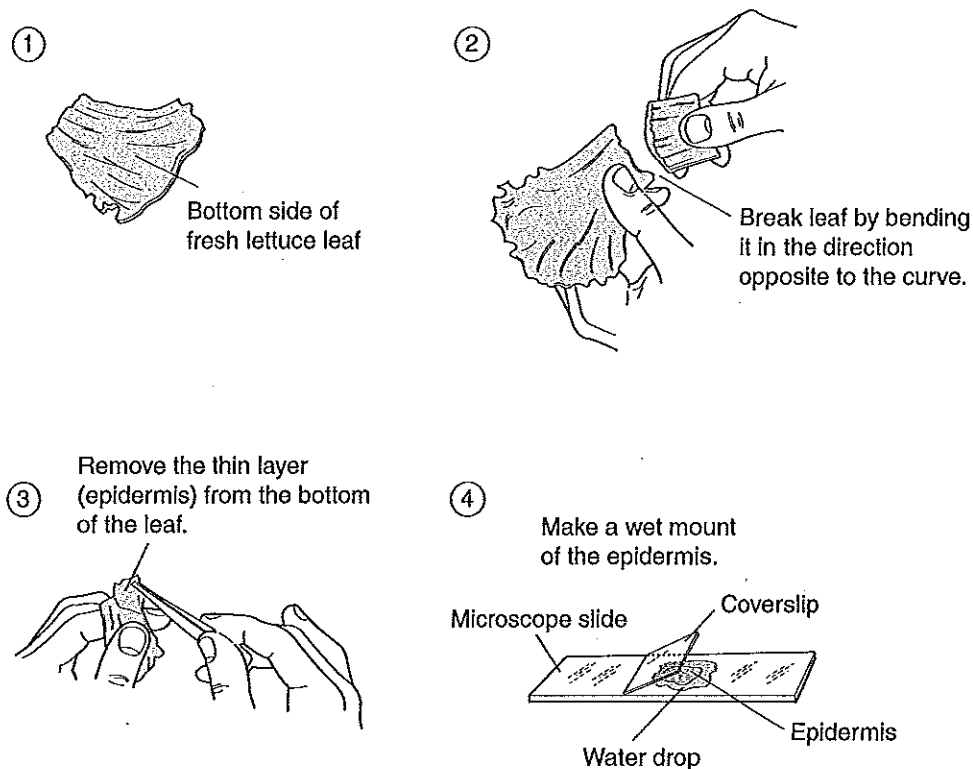


Figure 3

- Add a drop of iodine to the water. **CAUTION: Iodine is poisonous, and it can cause stains. Handle it carefully.** Then hold a coverslip at the angle shown in Step 4 of Figure 3, and gently lower it over the specimen. Touch the edge of a paper towel to one side of the coverslip to remove excess water.
- Observe the slide with a microscope under low power. **CAUTION: When using the microscope, follow safety procedures described in Appendix A of your textbook.** Look for different types of cells. Most of the cells you see will have an irregular shape. The rest of the cells, which are shaped like sausages, appear in pairs. The paired cells are the guard cells. Notice whether they are open or closed.
- On the next page, make a labeled drawing of the epidermis under low power.
- Examine a pair of guard cells under high power, and make a labeled drawing beside the one you drew in Step 7.

Part B: Comparing the Number of Stomata in Different Leaves

- Obtain freshly cut leaves from two different kinds of plants. Record the types of plants you are using in the Data Table.
- Use a metric ruler to determine the approximate length and width of the first leaf in millimeters. If the leaf has an irregular shape, estimate the length and width as closely as you can. Multiply the length times the width to find the area in square millimeters (mm^2). Record the area in the Data Table.

Cell Processes and Energy ▪ *Guided Reading and Study*

Respiration (pp. 49–53)

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

Use Target Reading Skills

Before you read, write a definition of respiration in the graphic organizer. As you read, revise your definition based on what you learn.

What You Know
1. Definition of respiration:

What You Learned

What Is Respiration? (pp. 50–52)

1. What happens during respiration?

2. Cells store energy in the form of _____.

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3. How do cells "withdraw" 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.

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

Respiration	
Raw Materials	Products

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

Cell Processes and Energy ▪ Review and Reinforce

Respiration

Understanding Main Ideas

Fill in the blanks in the table below. Then answer the questions that follow in the spaces provided.

Respiration

Raw Materials	Products
1.	3.
2.	4.
	5.

6. Where in the cell does the first stage of respiration take place?
7. Where in the cell does the second stage of respiration take place?
8. How does fermentation differ from respiration?
9. Which type of fermentation occurs in yeast?
10. Which type of fermentation sometimes occurs in human muscle cells?

Building Vocabulary

If the statement is true, write true. If it is false, change the underlined word to make it true.

- _____ 11. The process by which cells "withdraw" energy from glucose is called photosynthesis.
- _____ 12. Respiration provides energy for cells without using oxygen.

Problem: When is carbon dioxide released by Elodea plants, when in sunlight or in darkness?

Research: Class notes. (When plants are in sunlight photosynthesis will occur and plants release oxygen. When plants are in darkness respiration will occur and plants release carbon dioxide.)

Hypothesis: I believe Elodea will release carbon dioxide when they are in darkness because of respiration.

Experiment:

Materials: Elodea plants, phenol blue, 7 small test tubes, 2 test tube racks, 1 straw, 1 dropper

Procedure:

- 1) Fill 7 small test tubes with about 2 full droppers of phenol blue in each.
- 2) Show that phenol blue turns clear when in contact with CO₂. Hold a straw about 3 cm above the phenol blue in one of the test tubes and blow into the straw. The phenol blue should turn clear as it comes in contact with CO₂ in your breath.
- 3) Put Elodea plants in 4 of the test tubes and make sure the plant is completely covered by the phenol blue in each test tube.
- 4) Put 2 test tubes with Elodea plants and 1 test tube with just phenol blue in each of the 2 test tube racks. The test tube with only phenol blue will be the control.
- 5) Place one rack by a sunny window and the other in a dark place.
- 6) After at least one hour check to see if the color of the phenol blue in any of the test tubes has changed. If CO₂ is present the phenol blue should become clear or light yellow.
- 7) Record your results.

Data:

Observations: When I checked the test tubes in the sunlight the phenol blue in all 3 test tubes was still blue. When I checked the test tubes in the dark the phenol blue in the 2 tests tubes with Elodea was clear, but the phenol blue in the test tube without the Elodea was still blue.

Test Tubes	In Sunlight	In Darkness
2 test tubes with Elodea and phenol blue	Phenol blue was still blue	Phenol blue became clear
Test tube with only phenol blue	Phenol blue was still blue	Phenol blue was still blue

Conclusion:

My hypothesis was correct. The Elodea kept in the darkness released CO₂ because the phenol blue became clear. The plants in the sunlight did not produce CO₂ because the phenol blue remained blue. The test tubes with only phenol blue remained blue, so phenol blue does not become clear just because of light or darkness.

The plants in darkness released CO₂ because without sunlight they experienced respiration. The plants in sunlight were able to perform photosynthesis so they did not produce CO₂.

This experiment could be improved by using more samples.

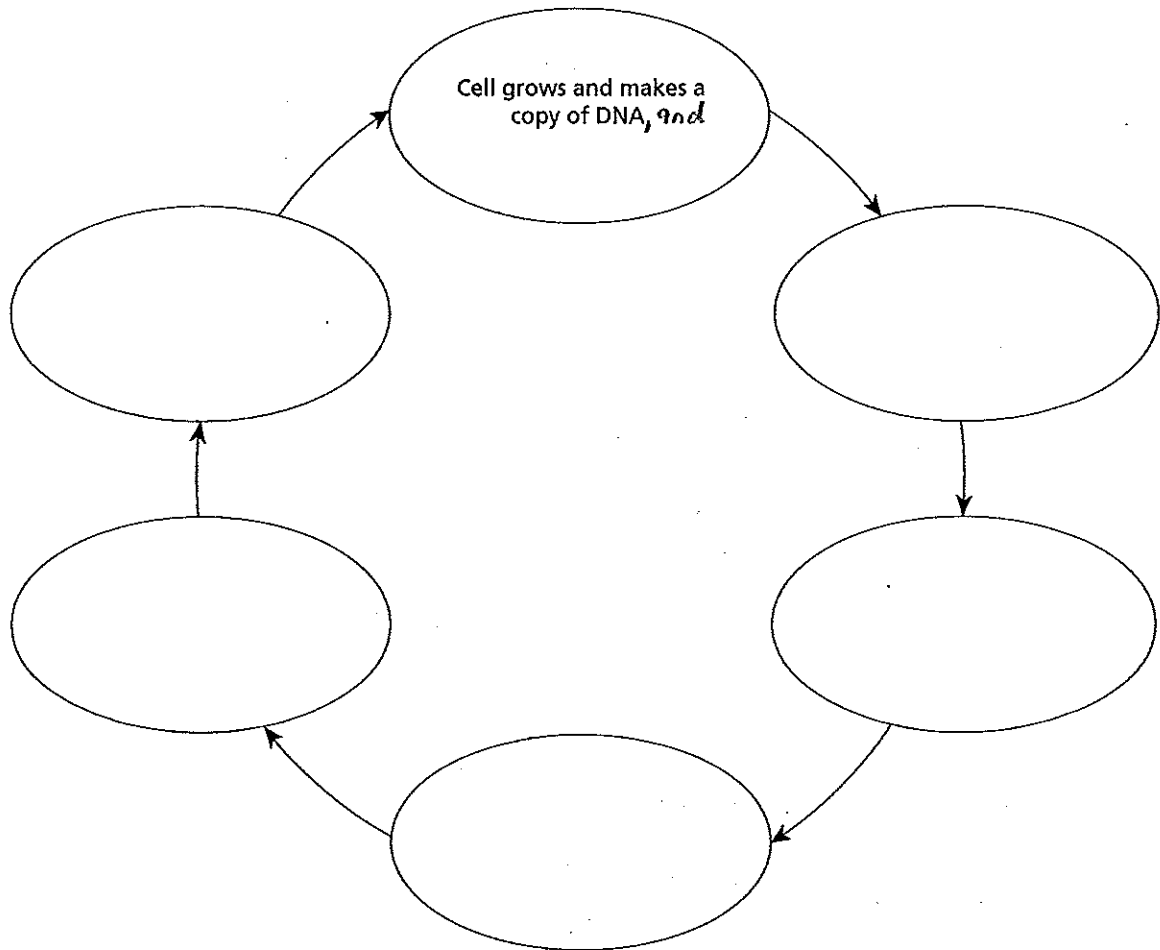
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Cell Division (pp. 55–62)

This section explains how cells grow and divide.

Use Target Reading Skills

As you read, make a cycle diagram that shows the events in the cell cycle, including the phases of mitosis. Write each event in a separate circle.



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Cell Division *(continued)*

Stage 1: Interphase (p. 56)

1. The regular sequence of growth and division that cells undergo is called the _____.
2. List three things that the cell is doing during interphase.
 - a. _____
 - b. _____
 - c. _____
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 (p. 57)

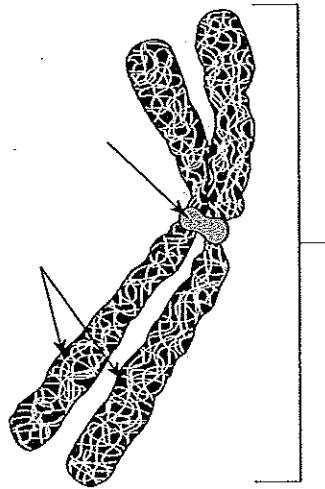
4. Circle the letter of each sentence that is true about mitosis.
 - a. The cell makes a copy of its DNA.
 - b. The cell membrane pinches in around the middle of the cell.
 - c. The cell's nucleus divides into two new nuclei.
 - d. One copy of DNA is distributed into each daughter cell.

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

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

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



Stage 3: Cytokinesis (p. 60)

10. During cytokinesis the _____ 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.
- _____

Structure and Replication of DNA (pp. 61–62)

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

13. Circle the letter of each molecule that makes up the sides of the DNA ladder.
- a. deoxyribose
 - b. glucose
 - c. phosphate
 - d. oxygen

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Cell Division *(continued)*

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

a. _____ pairs with _____.

b. _____ pairs with _____.

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

DNA Replication

The two sides of the DNA molecule
_____ and _____.



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



When the new bases are attached, two new
_____ are formed.

Cell Processes and Energy ▪ *Review and Reinforce*

Cell Division

Understanding Main Ideas

Fill in the blanks in the table below. Then answer the questions that follow in the spaces provided.

Phases of Mitosis

Phase	Event
Prophase	1. _____
2. _____	Chromosomes attach to spindle fibers.
Anaphase	3. _____
4. _____	New nuclear envelope forms.

5. Which stage of the cell cycle usually lasts longest?

6. During which stage of the cell cycle does DNA replication occur?

7. During which stage of the cell cycle does the cell membrane pinch the cell in two?

Building Vocabulary

Match each term with its definition by writing the correct letter in the blank.

- | | |
|--|--|
| <p>_____ 8. Regular sequence of growth and division that cells undergo</p> <p>_____ 9. First stage of the cell cycle</p> <p>_____ 10. Process in which DNA is copied</p> <p>_____ 11. Stage of the cell cycle during which the cell's nucleus divides</p> <p>_____ 12. Doubled rod of condensed chromatin</p> <p>_____ 13. Final stage of the cell cycle</p> | <p>a. interphase</p> <p>b. mitosis</p> <p>c. cell cycle</p> <p>d. cytokinesis</p> <p>e. replication</p> <p>f. chromosome</p> |
|--|--|

Cell Processes and Energy ▪ *Guided Reading and Study*

Cancer (pp. 64–67)

This section explains what happens when cells grow out of control.

Use Target Reading Skills

Preview Figure 17. Then write two questions that you have in the graphic organizer below. As you read, answer your questions.

How cancer spreads

Q. What is a tumor?
A.
Q.
A.

What Is Cancer? (pp. 65–66)

1. What is cancer?

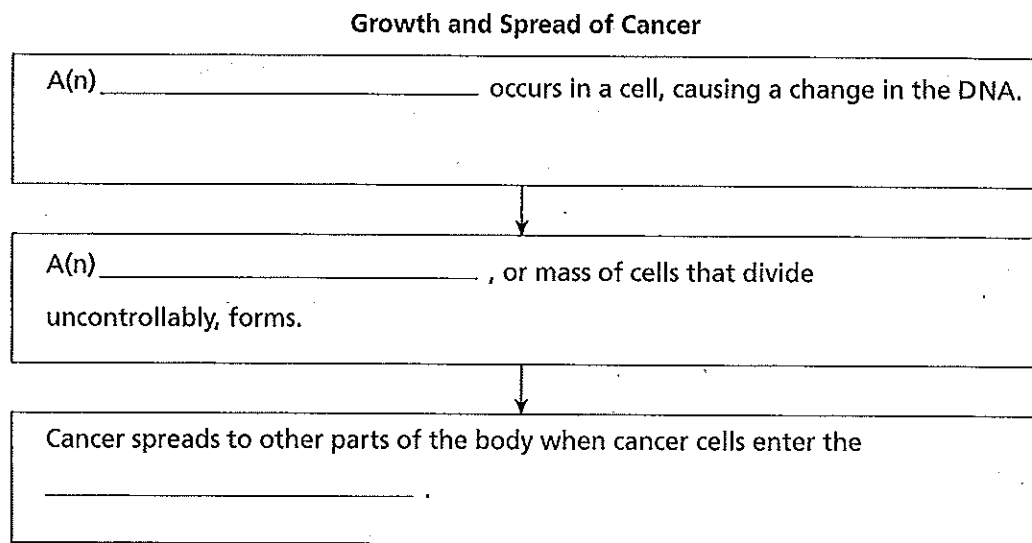
2. Circle the letter of each event that can cause cancer to begin.

- a. A cell divides normally.
- b. A change in DNA affects the cell cycle.
- c. A cell divides too often.
- d. A cell stops dividing.

Cell Processes and Energy ▪ *Guided Reading and Study*

Cancer *(continued)*

3. Complete the flowchart below, which describes how cancer begins and spreads.



4. How can a mutation affect the function of cells?

5. Is the following sentence true or false? DNA contains all the instructions necessary for life. _____

Treating and Preventing Cancer (pp. 66–67)

6. List three ways in which doctors usually treat cancer.

a. _____

b. _____

c. _____

7. Why is radiation used to treat cancer?

Cell Processes and Energy ▪ *Guided Reading and Study*

8. Why is chemotherapy an effective way to treat cancer?

9. Name two things that can cause cancer.

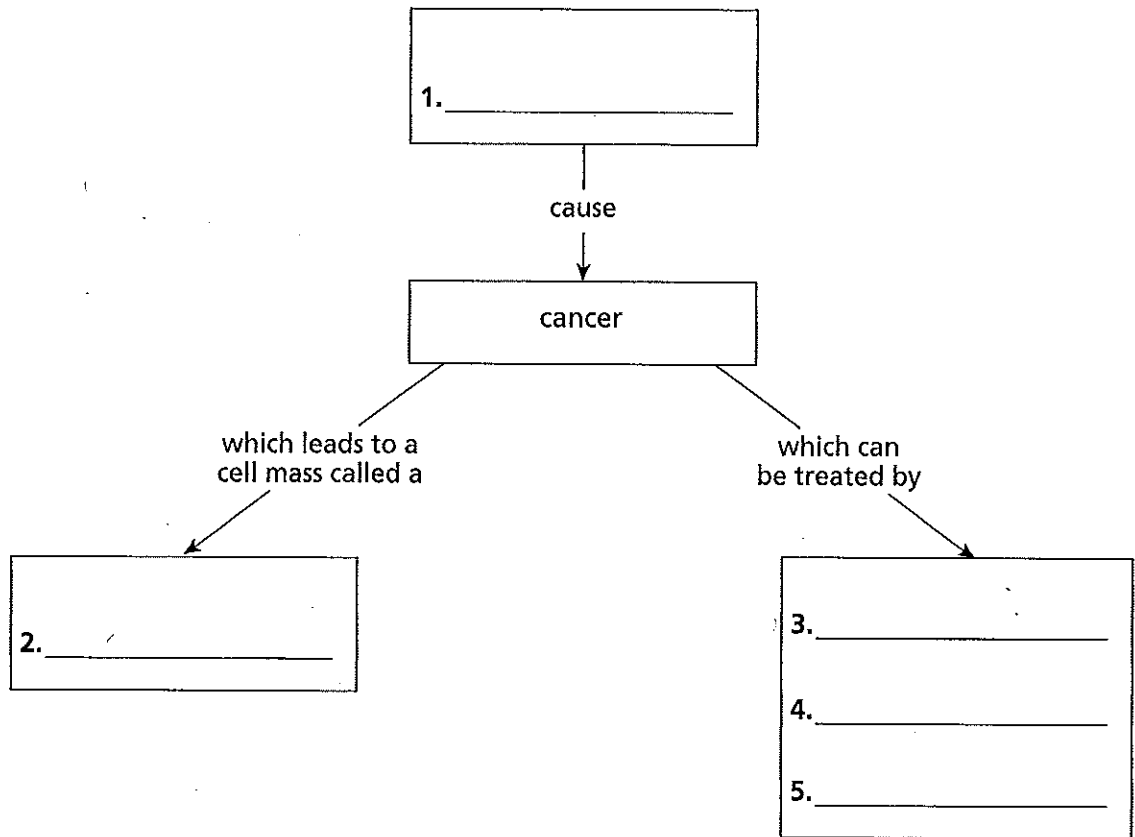
10. What kind of diet may help lower a person's risk of some kinds of cancer?

Cell Processes and Energy ▪ *Review and Reinforce*

Cancer

Understanding Main Ideas

Complete the concept map below. Then answer the questions that follow.



Write your answers on a separate sheet of paper.

6. How do mutations lead to cancer?
7. How can cancer spread from a tumor to other parts of the body?
8. What are two ways the risk of some types of cancer can be reduced?

Building Vocabulary

Fill in the blank to complete each statement.

9. _____ is a disease in which cells grow and divide uncontrollably.
10. A change in the DNA is called a(n) _____.
11. A(n) _____ is a mass of abnormal cells.
12. The use of drugs to kill cancer cells is called _____.

Cell Processes and Energy • Enrich

Deaths From Cancer

Cancer is a leading cause of death in the United States. Cancer death rates by age and sex in the United States for 1980 and 1990 are given in the table below.

Death Rates From Cancer, United States, 1980 and 1990

Age at Death (years)	Males		Females	
	1980	1990	1980	1990
25–34	13	13	14	13
35–44	44	39	53	48
45–54	197	163	172	166
55–64	521	533	362	376
65–74	1,093	1,122	607	677
75–84	1,791	1,915	903	1,010
85 and older	2,370	2,740	1,256	1,372

Note: The death rate is the number of deaths for that sex and age group per 100,000 people of that sex and age group in the United States population.

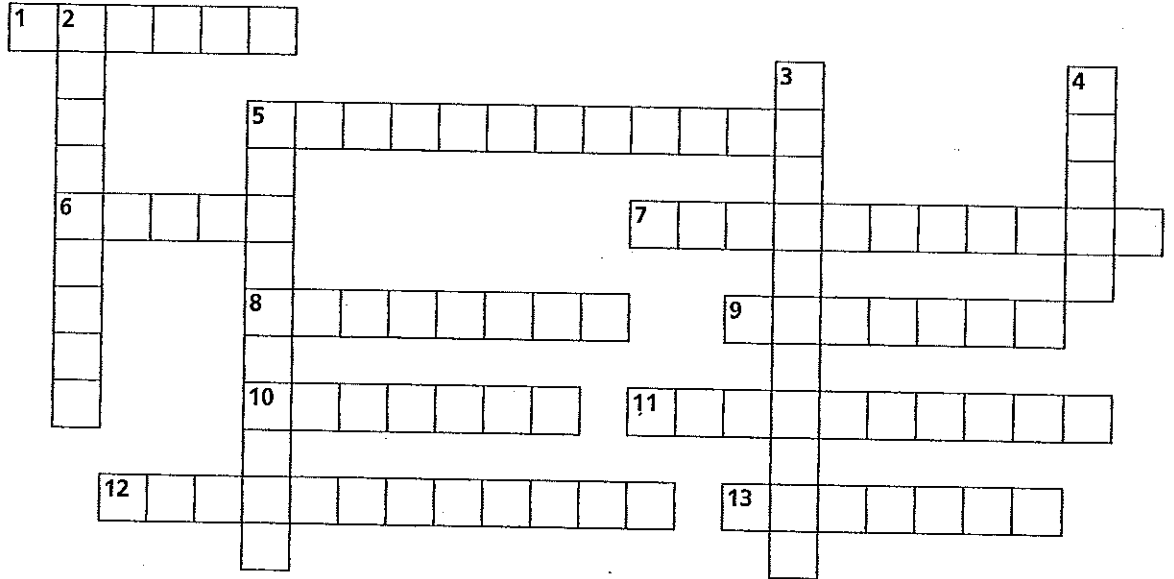
Answer the following questions on a separate sheet of paper.

1. In which age groups of males were there declines in cancer death rates between 1980 and 1990?
2. In which age groups of females were there declines in cancer death rates between 1980 and 1990?
3. Which sex had higher death rates from cancer at all ages over 54 years of age in both 1980 and 1990?
4. Which sex and age group had the biggest increase in cancer death rates from 1980 to 1990?
5. What percent of males aged 85 years and older died from cancer in 1980? In 1990?

Cell Processes and Energy • Key Terms

Key Terms

Answer the clues to solve the crossword puzzle.



Clues down

2. An organism that makes its own food
3. The final stage of the cell cycle in which the cytoplasm divides
4. The regular sequence of growth and division that cells undergo is the cell _____.
5. Condensed genetic material, or chromatin, that is double stranded

Clues across

1. A disease in which cells grow and divide uncontrollably
5. The use of drugs to kill cancer cells
6. A mass of abnormal cells
7. A pigment found in chloroplasts
8. A change in DNA
9. Colored chemical compound in plants that absorbs light
10. Openings on the undersides of leaves
11. The first stage of the cell cycle in which the cell prepares to divide
12. Provides energy for cells without using oxygen
13. The stage of the cell cycle in which the cell's nucleus divides

Name _____ Class _____ Date _____

Cell Processes & Energy Test Review

Complete the outline for phases of mitosis:

I.

A.

B.

II.

A.

B.

III.

A.

B.

IV.

A.

B.

V.

A.

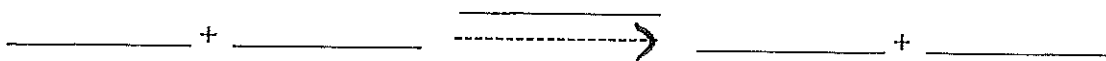
VI.

A.

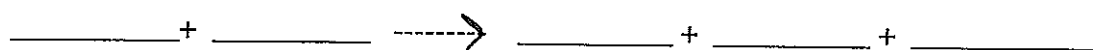
B.

Use words in the blanks to complete the equations:

Photosynthesis:



Respiration:



Know two products that are only produced from fermentation:

Know the difference between autotrophs and heterotrophs:

Know the purpose of chlorophyll:

Know 3 steps in the growth and spread of cancer:

1)

2)

3)

Know 3 ways cancer is treated:

Know 3 ways the risks of some types of cancer can be reduced:

Know all the Key Terms.