

Lesson 3.1 Cells: Basic Units of Life

This lesson will help you practice working with concepts related to cells. Use it with core lesson 3. 1 Cells: Basic Units of Life to reinforce and apply your knowledge

Key Concept

Your tissues, organs, and body systems all have one thing in common—they are composed of cells. Cells are the basic units of structure and organization of all living organisms.

Core Skills & Practices

- * Understand and Apply Scientific Models, Theories, and Processes
- Analyze Author's Purpose

Cell Discovery and Cell Theory

Cells are the smallest living units that carry on the activities of an organism.

Directions: Use the passage below to answer questions 1-3.

The discovery of the microscope in the seventeenth century helped lead scientists away from the theory of spontaneous generation. With careful experimentation, scientists discovered that even microbes such as bacteria could be killed by boiling, and once killed they did not lead to new life forms.

The death of the theory of spontaneous generation led to the work of the French biologist Louis Pasteur. Pasteur showed that if matter was sterilized and prevented from being contaminated, then bacteria and other microscopic life forms did not arise on their own. The same principle can be shown by the sterilization of hospital instruments, which keeps the instruments bacteria free and prevents the spread of harmful diseases.

1. Which statement best summarizes the author's purpose in this passage?
 - A. To describe the debate between two equally supported scientific views
 - B. To show the process by which the theory of spontaneous generation was rejected
 - C. To explain why Louise Pasteur is regarded as one of the most important scientists of the 19th century
 - D. To explore the importance of the discovery of the microscope
2. Which of the following best defines the concept of spontaneous generation as used in the passage?
 - A. a belief that living things come from nonliving matter
 - B. the theory that contaminated matter can become uncontaminated
 - C. the idea that energy can neither be created nor destroyed
 - D. a notion that microscopic life forms did not arise on their own
3. How does the author use the sterilization of hospital instruments to disprove the theory of spontaneous generation?

Directions: Use the passage and diagram below to answer questions 4-6.

Italian physician Francesco Redi proposed that maggots did not suddenly appear out of nowhere on rotting meat. Instead, he believed that maggots came from eggs laid by flies that land on the meat. To test his hypothesis, he set out jars: some were open to air and some were covered with cheesecloth. Air can pass through cheesecloth, but flies cannot.



4. Label the variables in Redi's experiment as independent or dependent.

Variable	Type
Time	
Cheesecloth	
Maggots	

5. Which of the following does the evidence from Redi's experiment serve to disprove?

A. cell theory
B. pasteurization
C. cell specialization
D. spontaneous generation

6. Why did Redi choose to use air-permeable cheesecloth for the experiment?

A. to show that air carries bacteria that can spoil meat
B. to allow the flies to lay eggs into the jar but not land on the meat
C. to show that maggots are not microscopic organisms floating in the air
D. to prove that air, not flies, causes the growth of maggots in unrefrigerated meat



Test-Taking Tip

When answering a multiple-choice test question, try to answer the question in your own words or generate a hypothetical answer first. Then use your answer to help eliminate answer choices that do not follow similar logic.

Lesson 3.1 Cells: Basic Units of Life

Specialized Cells and Cellular Organization

Different cells are equipped to do specific jobs.

Directions: Answer the questions below.

7. What type of tissue is mainly involved in carrying impulses to the brain?

A. muscle
B. nerve
C. epithelial
D. connective

8. Rank the following in order from the most basic to the most complex parts of the body.

A. cells
B. organs
C. tissues
D. body systems

1.

2.

3.

4.

9. Cells must maintain enough surface area to absorb the materials needed for metabolism. They can grow only so large before their surface area is too small compared to their volume. What is the underlying assumption behind this need for a small surface-area-to-volume ratio?

A. Large cells have more efficient metabolic reactions.
B. Small cells have more efficient metabolic reactions.
C. Small cells have more metabolic reactions to fuel than large cells.
D. Large cells have more metabolic reactions to fuel than small cells.

10. What type of tissue is the responsible for forming linings and coverings for body parts?

A. muscle
B. nerve
C. epithelial
D. connective

11. Blood is considered a type of _____ tissue.

12. Blood consists of red blood cells, which carry oxygen; white blood cells, which fight disease; and platelets, which assist with clotting. Explain the purpose of this type of specialization.

13. Each type of tissue listed in the box below contributes to the functioning of the human digestive system. Write the letter of the function in the box with the corresponding tissue type.

A. Allows the body to swallow food
B. Lines the stomach and digestive tract
C. Signals the body to begin the digestive process
D. Generates contractions to move the food along the digestive tract

Tissue type	Function
Connective	
Epithelial	
Muscle	
Nervous	

Cell Structure and Function Lesson 3.2

This lesson will help you practice working with concepts related to cell structure and function. Use it with core lesson 3. 2 Cell Structure and Function to reinforce and apply your knowledge.

Key Concept

Animal and plant cells have many of the same cell parts. The parts of a cell help the cell carry out the functions of life.

Core Skills

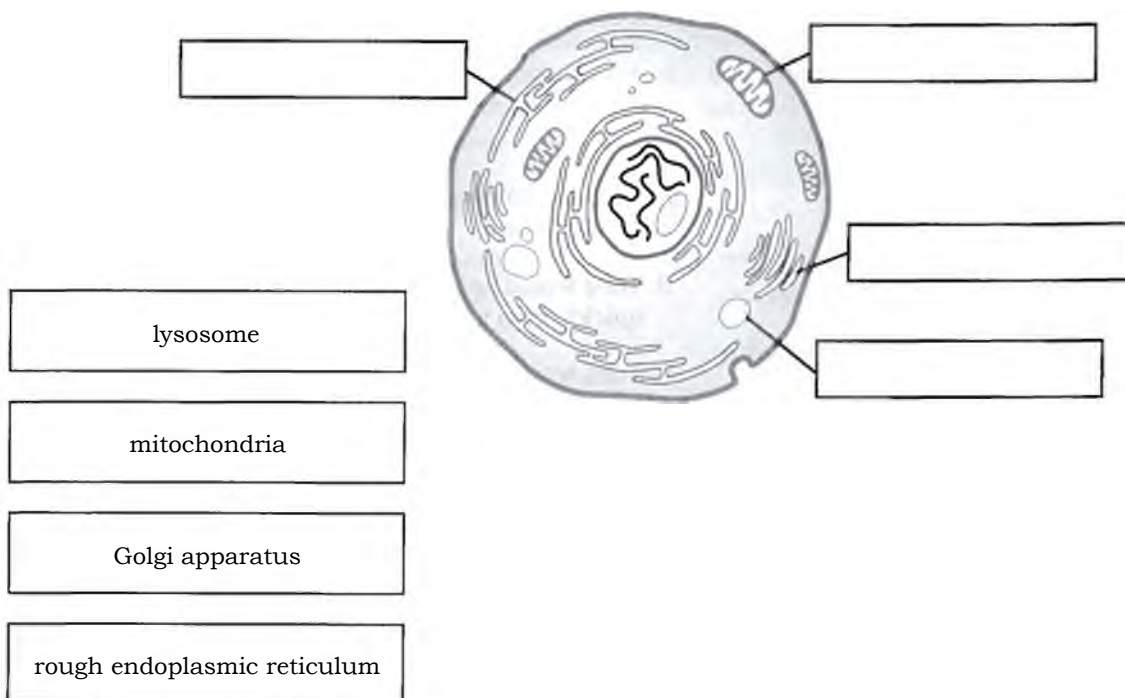
- * Determine the Meaning of Symbols, Terms, and Phrases
- Make Inferences

The Parts of a Cell

Different jobs are performed by structures within the cell called organelles.

Directions: Answer the questions below.

1. What is the function of the cell membrane?
 - A. control center for the cell
 - B. regulator of traffic passing into and out of the cell
 - C. manufacturer of proteins from amino acids
 - D. means of transportation for material within the cell
2. Which structure within the cell of an orange most likely holds the orange juice?
 - A. vacuole
 - B. ribosome
 - C. lysosome
 - D. Golgi apparatus
3. Label the parts of the cell. Write the appropriate term in each box.



Lesson 3.2 Cell Structure and Function

Distinguishing Between Cells

Directions: Answer the questions below.

4. Mushrooms, like other fungi, do not use energy from the sun to produce glucose. Instead, they obtain their nutrients by absorbing them from other living or dead organisms. Knowing this, which cell structure would likely be absent from a mushroom cell?
 - A. nucleus
 - B. cell wall
 - C. cytoplasm
 - D. chloroplast
5. Unlike prokaryotic cells, _____ cells have a nucleus and organelles enclosed by membranes.
6. Which cell structure makes a raw carrot crunchy to eat?
 - A. vacuole
 - B. cell wall
 - C. chloroplast
 - D. mitochondria
7. Which structure is found in plant cells but not in animal cells?
 - A. nucleus
 - B. cell wall
 - C. cytoplasm
 - D. cell membrane

Directions: Use the passage below to answer questions 8-9.

There is a type of single-celled organism called prokaryotes. Prokaryotes are organisms in which the cells do not contain a nucleus or any other specialized cell structures. Bacteria and mildew are examples. However, although bacterial cells do not contain a nucleus, they do contain genetic material. Bacteria reproduce by a process called binary fission. During binary fission, a bacteria cell divides into two identical cells, each cell receiving one copy of the genetic material.

8. According to the passage, what makes prokaryotes unlike most other plant cells?
 - A. the absence of a nucleus
 - B. the absence of a cell wall
 - C. their smaller than normal size
 - D. the presence of genetic material
9. In eukaryotic cells, genetic information is contained in a nucleus. How might this impact the way they reproduce?
 - A. They would only be able to create cells without nuclei.
 - B. They would be able to reproduce more quickly than prokaryotes.
 - C. They would require a carrier protein to release their genetic information.
 - D. They would not be able to reproduce using binary fission.

Transport Across the Cell Membrane

Cell membranes are selectively permeable. Some substances can move through cell membranes whereas others cannot.

Directions: Answer the questions below.

10. How does the process of diffusion function in the human body?

- A. It is initiated in times of extreme illness and stress.
- B. It regulates blood flow between organs through veins and arteries.
- C. It concentrates materials, where needed in the body, through stockpiling.
- D. It allows certain substances to pass into and out of cells without using energy.

11. In _____ transport, carrier proteins are needed to move materials across the cell membrane. Explain the reason for this phenomenon.



Test-Taking Tip

When answering a combination fill-in-the-blank and short-answer question, first identify the words that could plausibly fill in the blank. Take a moment to consider how each one would affect the answer you would give for the short-answer part of the question. Choose the answer that best completes the sentence and provides a logical foundation for the short-answer portion.

Directions: Use the passage below to answer questions 12-13.

A cell's cytoplasm contains many substances in varying degrees of concentration. These concentrations differ sharply from those in the fluid surrounding the cell. Such differences are so essential that the cell can die if the differences are not maintained. Given the opportunity, diffusion would quickly eliminate these critical differences by moving the substance from an area of high concentration to an area of lower concentration. Therefore, the cell must be able to negate, and sometimes even reverse, the process of diffusion.

12. Which of the following best describes the meaning of diffusion in this passage?

- A. the passage of light through the fluid surrounding the cell
- B. the maintenance of differences in concentration across a cell membrane
- C. the softening of the cell membrane to allow for active transport
- D. the movement of a substance from an area of high to low concentration

13. Which is a way in which cells reverse the process of diffusion?

- A. by using the Golgi apparatus to manufacture hormones
- B. by using the endoplasmic reticulum to move molecules through the cell
- C. by using carrier proteins to push materials back across the cell membrane
- D. by using mitochondria to generate more energy

Lesson 3.3 Plant Structure and Function

This lesson will help you practice working with concepts related to plant varieties and the parts of plants essential to their growth and survival. Use it with core lesson 3. 3 Plant Structure and Function to reinforce and apply your knowledge.

Key Concept

The parts of a plant work together to promote and sustain the life of the plant. The functions of the plant structures provide mechanisms for all of the plant's life processes.

Core Skills & Practices

- Design a Scientific Investigation
- Analyze Relationships Between Sources

Types of Plants

Plants provide people with essential materials for physical comfort while adding beauty to their lives. Most plants can be classified as flowering or non-flowering.

Directions: Answer the questions below.

1. Which types of plant require a wet environment for their survival?
A. mosses
B. seed plants
C. angiosperms
D. gymnosperms
2. Junipers are cone-bearing evergreens with needle-like or scale-like leaves. In which plant group does the juniper belong?
A. seedless
B. angiosperms
C. gymnosperms
D. nonvascular plants
3. A student wants to perform an investigation to find out how young plants respond to the movement of a light source. Which of these is the dependent variable for this scientific investigation?
A. age of plants
B. amount of light
C. height of plants
D. plant movement
4. Ferns, redwoods, and orchids are all examples of plants classified as _____

5. Describe two similarities and two differences between gymnosperms and angiosperms.

6. The maple tree fruit is a two-sided winged fruit. A student wants to study the dispersal range of the maple tree seeds. When designing the investigation, which question would yield the most relevant data?
A. How much sunlight will the seeds receive daily?
B. Has flood or fire recently disrupted the ecosystem?
C. How will the seeds interact with freezing temperatures?
D. How does the wind interact with the plant traits?

Directions: Use the passage below to answer questions 7-8.

Osmosis

Most cell membranes are selectively permeable membranes, which means that some particles can pass across them while others cannot. Perhaps the most important substance that passes through the cell membrane is water. Water molecules pass through a selectively permeable membrane by a type of diffusion known as osmosis. During osmosis, water molecules move from a place of higher concentration of water to a place of lower concentration of water—either into or out of the cell.

When there is a difference in the concentration of a solution outside a cell compared with the material inside the cell, osmosis will occur. If the concentration of solute particles outside the cell is higher than the concentration inside the cell material, water diffuses out of the cell, causing the cell to shrivel. If the concentration of solute particles inside the cell material is higher than the concentration outside the cell, water diffuses into the cell. This causes the cell to swell.

7. Explain how osmosis relates to water absorption and use by non-vascular plants.

8. Predict what will most likely occur with nonvascular plants during hot, dry weather.

- A. They will lose water from their cells.
- B. They will halt the process of diffusion.
- C. They will slow the process of diffusion.
- D. They will store extra water in their cells.

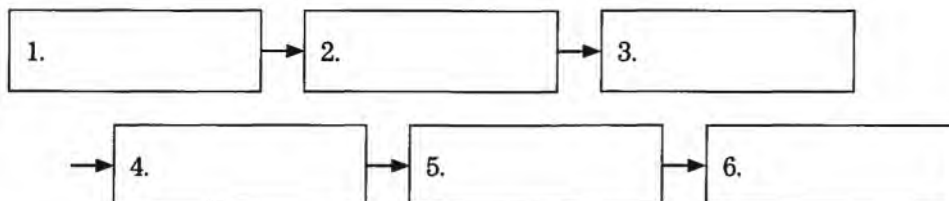
Parts of Plants

Plants have various parts that support the essential functions of life. Cells, tissues, and organs work together to ensure the growth and survival of the plant.

Directions: Answer the question below.

9. Summarize the life cycle of an angiosperm by writing the steps in this process in the correct order in the boxes below.

pollination	flower production	germination	seed dispersal	seedling growth	seed development
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Lesson 3.3 Plant Structure and Function

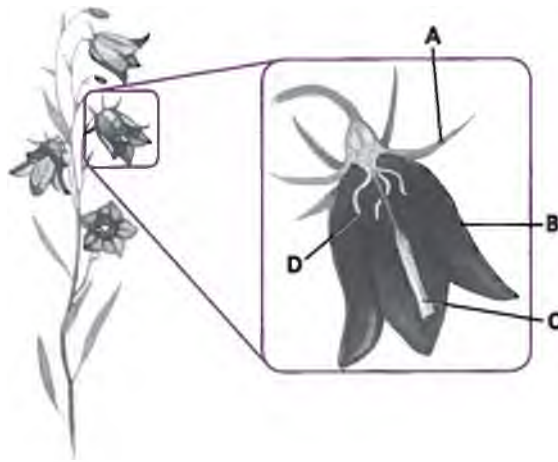
10. Which is an example of an “organic molecule” produced by photosynthesis?

- A. oxygen gas
- B. chloroplast
- C. carbohydrate
- D. carbon dioxide gas

11. In which part of a plant would unused energy most likely be stored?

- A. the xylem
- B. the taproot
- C. the stomata
- D. the epidermis

Directions: Use the illustration below to answer questions 12-13.



12. What is an important function of the flower part labeled A?

- A. to catch sunlight
- B. to aid pollination
- C. to store nutrients
- D. to protect the bud

13. Study the lettered areas of the illustration.

In which part of the flower are pollen grains produced?

- A. Part A
- B. Part B
- C. Part C
- D. Part D



Test-Taking Tip

Some hot spot items may ask you to identify a structure or region on a diagram. On a computer-based test, you would answer the question by clicking on the correct structure or region. Evaluate the diagram and eliminate the hot spots you know are incorrect before selecting your answer.

This lesson will help you practice working with concepts related to energy and cells. Use it with core lesson 3.4 Energy and Cells to reinforce and apply your knowledge

Key Concept

Plant cells use energy from the Sun to make sugars. Plant and animal cells break down sugars and other food molecules to release energy that cells can use.

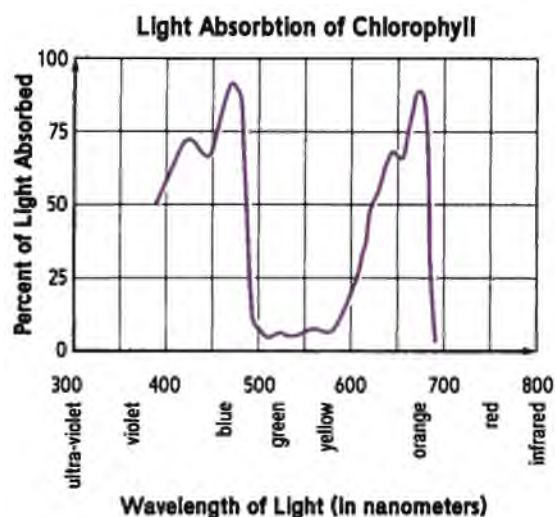
Core Skills & Practices

- Express Scientific Information Symbolically
- Distinguish between Facts and Speculation

Photosynthesis

The process by which organisms capture light energy from the Sun and change it into chemical energy is called photosynthesis.

Directions: Use the diagram below to answer questions 1-3.



1. During the process of photosynthesis, which two colors of light are absorbed most by chlorophyll?

- A. blue and green
- B. blue and orange
- C. green and yellow
- D. violet and yellow

2. Which of the following is an example of a speculative statement based on this graph?

- A. The color of chlorophyll is greenish-yellow.
- B. Chlorophyll that absorbs blue light is a product of evolution.
- C. Photosynthesis relies on energy from the Sun.
- D. Chlorophyll absorbs more blue light than green light.

3. Light that is not absorbed by chlorophyll is reflected off the plant, giving it its color. Which of the following would be least likely to have a light-absorption graph similar to the graph above?

- A. ferns
- B. broccoli
- C. lawn grass
- D. mushrooms

Lesson 3.4 Energy and Cells

Cellular Respiration

Plants, animals, and other organisms release the energy stored in the organic molecules of food through cellular respiration.

Directions: Use the passage below to answer questions 4-5.

The proper balance of carbon dioxide and oxygen gases in the atmosphere is needed for life to be possible on Earth. The carbon-oxygen cycle relies on two processes: cellular respiration and photosynthesis.

During cellular respiration, cells in a plant or animal use oxygen to break down sugar and release energy. Carbon dioxide gas is a byproduct.

Photosynthesis is the process in which plants take in carbon dioxide from the atmosphere. During photosynthesis, plant cells using sunlight as an energy source combine carbon dioxide gas and water to produce sugar. Oxygen gas is given off as a byproduct.

4. Which definition best matches the use of the word photosynthesis as used in the passage?
- A. The process of absorbing oxygen gas and changing it into chemical energy.
 - B. The process of capturing light energy and changing it into chemical energy.
 - C. The process of capturing light energy and using it to release chemical energy.
 - D. The process of absorbing oxygen gas and using it to release chemical energy.
5. Which of the following is an example of a speculative statement?
- A. Photosynthesis does not take place in animals, only in plants.
 - B. Plants produce sugar, which is used as a source of energy in animals.
 - C. Energy released during respiration can be harnessed to power medical devices.
 - D. Carbon dioxide gas is a natural byproduct of breathing.

Directions: Answer the questions below.

6. Most of the process of cellular respiration occurs in the organelles known as _____. Explain why the enzymes in these organelles are necessary for the process of energy transformation.
- _____
- _____
- _____
- _____
7. Put the following stages of cellular respiration in the order in which they occur. Write the letter of the process in the space provided in the boxes.
- A. glycolysis
 - B. Krebs cycle
 - C. oxidative phosphorylation
 - D. transformation of pyruvate

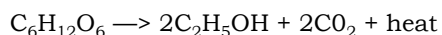
Stages of Cellular Respiration

Fermentation

When cells cannot get the oxygen they need, they use a process called fermentation to release the energy stored in organic molecules.

Directions: Use the information below to answer questions 8-9.

The chemical equation for the fermentation of alcohol is as follows:



8. Which of the following best describes the chemical process shown above?

A aerobic because oxygen is required
B. anaerobic because carbon dioxide is not required
C. anaerobic because oxygen is not required
D. aerobic because carbon dioxide is required

9. Cells use fermentation to release stored energy when oxygen is not available. Using the equation shown, explain why fermentation is useful in such a situation.



Test-Taking Tip

Before answering a short answer question, rule out what the question is not asking. Then, organize your thoughts around what you do know about the topic. After you have written your answer, check back over the question to be sure you followed all directions accurately.

Directions: Answer the questions below.

10. How does the energy yield from fermentation compare to the energy yield from cellular respiration?

A Fermentation yields less energy than cellular respiration.
B. Fermentation yields more energy than cellular respiration.
C. Fermentation yields energy that is only usable by animals.
D. Fermentation yields energy that is only usable by plants.

11. Which of the following products does not rely on the process of fermentation for its manufacture?

A butter
B. cheese
C. yogurt
D. alcohol

12. During lactic acid fermentation, which of the following is converted into lactic acid?

A ATP
B. glucose
C. pyruvate
D. acetyl coenzyme A

Lesson 3.5 Mitosis and Meiosis

This lesson will help you practice working with concepts related to mitosis and meiosis. Use it with core lesson 3. 5 Mitosis and Meiosis to reinforce and apply your knowledge.

Key Concept

Cells divide through the process of mitosis or meiosis. Mitosis produces daughter cells that are identical to the parent cell. Meiosis produces sex cells that combine to produce offspring that are genetically different from parent cells.

Core Skills & Practices

- Analyze Events and Ideas
- Understand and Explain Non-Textual Scientific Presentations

Cell Growth and Division

The process by which one parent cell divides into two daughter cells is known as cell division, or cell reproduction.

Directions: Answer the questions below.

- Prokaryotes reproduce through binary fission, while _____ undergo a process known as the cell cycle. What is the reason for the difference in the methods of cell division used by each group of organisms?

- Which of the following characterizes both of the gap phases of the cell cycle?
 - cell growth
 - cell division
 - nuclear division
 - DNA replication
- During interphase, cells increase in size and their DNA is copied. What is the purpose of this stage of the cell cycle?
 - to prepare the cell for division
 - to protect the cell against pathogens
 - to reduce the number of chromosomes by half
 - to restore normal functioning after division
- Several stages of the cell cycle are listed. Put the stages of the cell cycle in order from first to last (cell division) by writing the letter of the phase in the appropriate box.

- mitosis
- synthesis
- Gap 1 (G_1)
- Gap 2 (G_2)
- cytokinesis

First
Last



Test-Taking Tip

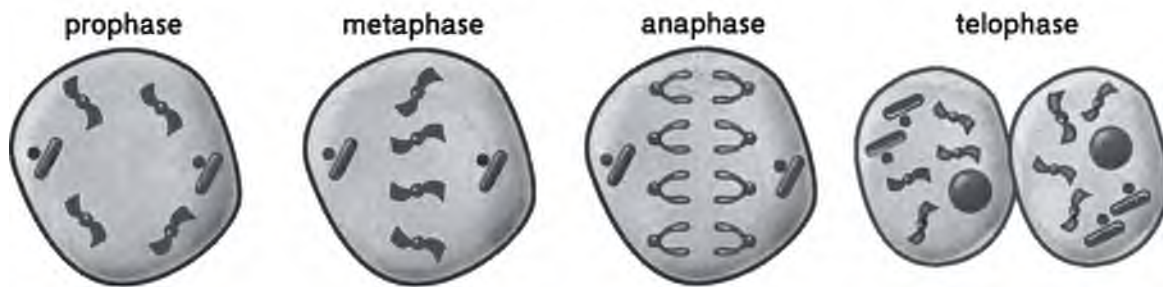
When answering a drag-and-drop sequencing question, begin by identifying the first or last item in the sequence. If you do not know the first or last item in the sequence, start with two items that you know are adjacent to each other in the sequence.

Chromosomes and Cell Division

Chromosomes are made up of DNA wrapped with proteins and can contain thousands of genes.

Directions: Use the diagram below to answer questions 5-6.

Four Stages of Mitosis



5. Which part of the cell is the main focus of the diagram?
- A. nucleus
 - B. chromosomes
 - C. cell membrane
 - D. nuclear membrane
6. During which stage do sister chromatids move to opposite ends of the cell?
- A. prophase
 - B. anaphase
 - C. telophase
 - D. metaphase

Directions: Use the passage below to answer questions 7-8.

Sometimes, exposure to radiation and certain kinds of chemicals can cause an error when a cell duplicates its chromosomes before mitosis. This error results in a change in a gene that is passed on to new cells. A change in the genes or chromosomes of a cell is called a mutation. Some mutations are minor and have no visible effect. Other mutations, however, are major and cause loss of function or other harm to the organism. Inherited mutations cause such conditions as muscular dystrophy, hemophilia, and sickle-cell anemia.

7. Which of the following summarizes the main idea of this passage?
- A. Mutations are destructive to cells.
 - B. Mutations are inherited changes to the chromosomes.
 - C. Cell replication can sometimes result in mutations.
 - D. Radiation and chemicals can make mitosis impossible.
8. Based on the passage, what is the relationship between genes and chromosomes?
- A. Chromosomes are the determinants of the severity of a genetic mutation.
 - B. Chromosomes are the proteins responsible for activating genes.
 - C. Chromosomes are the structures on which genes are located.
 - D. Chromosomes are responsible for initiating mutations in genes.

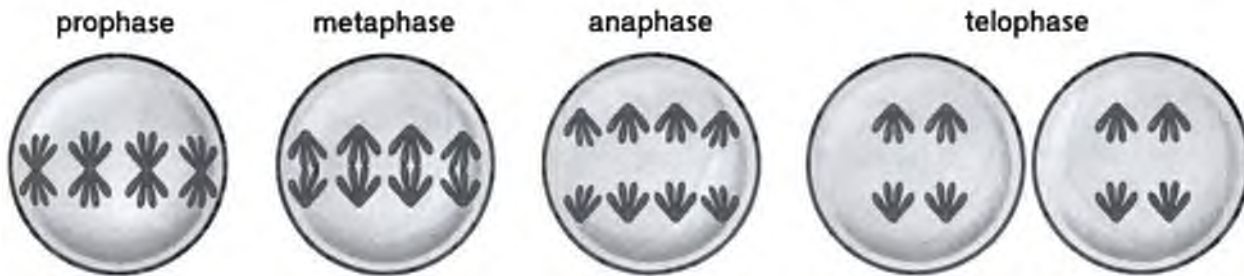
Lesson 3.5 Mitosis and Meiosis

Sexual Reproduction

Sexual reproduction involves meiosis, a form of cell division in which the nucleus divides twice to reduce the number of chromosomes by half.

Directions: Use the diagram below to answer questions 9-10.

Four Stages of Meiosis



9. During which stage are two nuclei created?

- A. prophase
- B. anaphase
- C. telophase
- D. metaphase

10. The end result of meiosis is four cells. Explain what occurs after the final stage shown in the diagram in order to accomplish this end. How do the cells at the end of this process differ from those shown in the final stage represented in the diagram?

Directions: Answer the questions below.

11. Which of the following best describes the purpose of meiosis II?

- A. to split sister chromatids
- B. to unite two different sex cells
- C. to prepare the nucleus for replication
- D. to separate homologous chromosomes

12. The protein structures responsible for pulling apart the chromosomes during cell division are known as _____ fibers.

13. All of the cells in the human body contain 46 chromosomes except for the _____, which cannot carry the same number of chromosomes as those of other parts of the body.

14. How does the division of gametes differ from the division of zygote cells?

- A. Gametes divide by mitosis; zygote cells divide by meiosis.
- B. Gametes divide by meiosis; zygote cells divide by mitosis.
- C. Gametes divide by meiosis; zygote cells divide by binary fission.
- D. Gametes divide by binary fission; zygote cells divide by meiosis.