

## Answer Key

### SECTION 1. THE CELL CYCLE

**Cell Cycle:** (1) Gap1 ( $G_1$ ): cells grow, carry out normal functions, and copy their organelles. (2) Synthesis (S): cells replicate DNA. (3) Gap 2 ( $G_2$ ): cells go through additional growth. (4) Mitosis (M): cells undergo cell division, which involves both the processes of mitosis and cytokinesis.

1. At the time that these stages were named, scientists could not observe any activity going on in cells, so they thought there were gaps in cellular activity.
2.  $G_1$  and  $G_2$
3. in the nucleus
4. mitosis and cytokinesis
5.  $G_1$
6. The rate of cell division is linked to the body's need for that cell type. Skin cells are typically exposed to more damaging conditions and must be replaced more often than liver cells.
7. the name that some scientists give to the stage where cells carry out their normal functions but are unlikely to divide
8. Answers will vary. Sample answer: Cell size is limited because all substances must cross the membrane. Enough material needs to enter and exit to keep the cell alive. Since volume tends to increase faster than surface area (in a sphere or cube), the volume could quickly become too large compared to the area available for exchange. In a similar way, people in a very large theater that holds thousands might not be able to exit quickly for an emergency. People in a smaller theater that seats fewer people could probably exit more quickly.
9. volume
10. growth and division
11. Answers will vary, but should relate the recurrence of something (steps, phases, the rotation of a wheel) to the repeating pattern of growth, DNA duplication, and cell division that occurs in eukaryotic cells.
12. cytokinesis; *cyto-* refers to a cell and *kinesis* refers to division or movement

13. mitosis

### SECTION 2. MITOSIS AND CYTOKINESIS

1. one long continuous thread of DNA that has many genes and regulatory information
2. so they can be more easily divided between the two nuclei
3. Proteins need to be able to access genes during other stages of the cell cycle so that they can be used to make proteins or so that the entire DNA sequence can be copied.  
**DNA Diagram:** Refer to Figure 2.2 for visual answer.
4. During interphase, a cell duplicates its DNA and organelles.
5. body cells
6. Answers will vary. Sample answer: Pat's mom ate tomatoes.  
**Cycle Diagram:** Refer to Figure 2.4 for visual answer. Labels (clockwise) metaphase, anaphase, telophase
7. In animal cells, the membrane pinches together, forming a cleavage furrow. In plant cells, the membrane cannot pinch together because of the cell wall. Instead, a cell plate is laid down between the two nuclei, which will develop into the new cell walls and cell membranes.
8. histones
9. chromatin
10. centromere
11. telomeres

### SECTION 3. REGULATION OF THE CELL CYCLE

1. cell division
2. platelet-derived growth factor
3. specific cells
4. cyclins
5. kinases
6. phosphorylate

7. cell division
8. programmed cell death
9. cancer

**Concept Map**

- a. tumors
  - b. benign
  - c. malignant
  - d. metastases
10. Mutations may be inherited, caused by chemicals and radiation, and carried by viruses.
  11. to spread and grow by breaking away from a tumor
  12. carcinogen
  13. Answers will vary.

**SECTION 4. ASEXUAL REPRODUCTION**

1. Asexual reproduction produces genetically identical offspring. Sexual reproduction produces genetically unique offspring.
2. The bacterial chromosome is copied. Both copies attach to the cell membrane.
3. As the cell elongates, the chromosomes separate.
4. The membrane is pinched inward and a new wall is laid down. Refer to the Visual Vocab in Section 4.
5. Advantages: Asexual reproduction can be more efficient under ideal circumstances. Disadvantages: Population may lack variety to survive in changing conditions.
6. Advantages: All organisms can potentially reproduce. Disadvantages: Not necessarily more efficient than sexual reproduction.
7. Advantages: No need to find a mate; no wasted energy attracting a mate. Disadvantages: Identical offspring all respond in same way to environment.
8. The two are genetically identical.
9. simpler plants and animals
10. budding, fragmentation, vegetative reproduction
11. sexually and asexually by dividing in half or breaking off small pieces from its base

12. Answers will vary. Students should recognize that “bi” indicates two. Binary fission is the division of a single-celled organism into two roughly equal parts.
13. asexual reproduction

**SECTION 5. MULTICELLULAR LIFE**

1. tissues
  2. organs
  3. organ systems
  4. photosynthetic tissue; conductive tissue (e.g., xylem); protective tissue
  5. shoot system; root system
  6. These systems help organisms carry out complex, specialized functions and maintain homeostasis.
  7. cell differentiation
  8. No. All cells have the same DNA, but different types of cells express different sets of genes.
  9. The location helps determine how the cell will differentiate.
- Concept map:**
- a. origin
  - b. totipotent
  - c. pluripotent
  - d. multipotent
  - e. embryonic
10. divide and renew themselves for long periods of time; remain undifferentiated in form; develop into a variety of specialized cell types
  11. Adult stem cells could avoid rejection issues and does not raise as many ethical concerns. Embryonic stem cells can develop into virtually any type of cell and can be grown indefinitely in culture.
  12. the process by which an unspecialized cell becomes specialized
  13. organ system, organ, tissue, cell

Section 1: The Cell Cycle

**KEY CONCEPT**

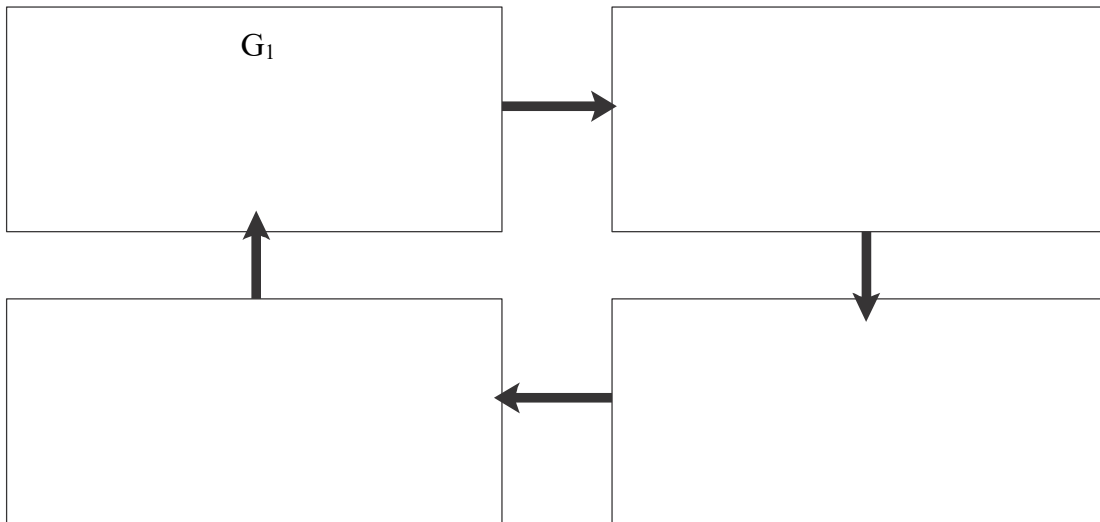
Cells have distinct phases of growth, reproduction, and normal functions.

**VOCABULARY**

cell cycle	cytokinesis
mitosis	

**MAIN IDEA:** The cell cycle has four main stages.

**Summarize what happens during each stage of the cell cycle in the boxes below.**



1. How did the G<sub>1</sub> and G<sub>2</sub> stages get their names?

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2. Cells must pass through a critical checkpoint during which two stages of the cell cycle?

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3. Where does DNA synthesis happen in eukaryotic cells?

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4. What two processes make up the M stage?

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**MAIN IDEA:** Cells divide at different rates.

5. Among different types of cells, which stage of the cell cycle varies most in length?

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6. Why does a skin cell divide more often than a liver cell?

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7. What is  $G_0$ ?

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**RESEARCH QUESTION!!! MAIN IDEA:** Cell size is limited.

8. Write an analogy to explain why cell size is limited.

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9. Which typically increases faster as a cell grows, surface area or volume?

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10. For cells to stay the same size from generation to generation, what two things must be coordinated?

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### Vocabulary Check

11. Think of an example of a cycle. What does this cycle have in common with the cell cycle?

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12. What process divides a cell's cytoplasm? How do the two word parts of your answer help you remember it?

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13. What process divides the cell nucleus and its contents?

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# Study Guide

## KEY CONCEPT

Cells divide during mitosis and cytokinesis.

## VOCABULARY

chromosome	centromere	metaphase
histone	telomere	anaphase
chromatin	prophase	telophase
chromatid		

**MAIN IDEA:** Chromosomes condense at the start of mitosis.

1. What is a chromosome?

\_\_\_\_\_

2. Why do chromosomes condense at the start of mitosis?

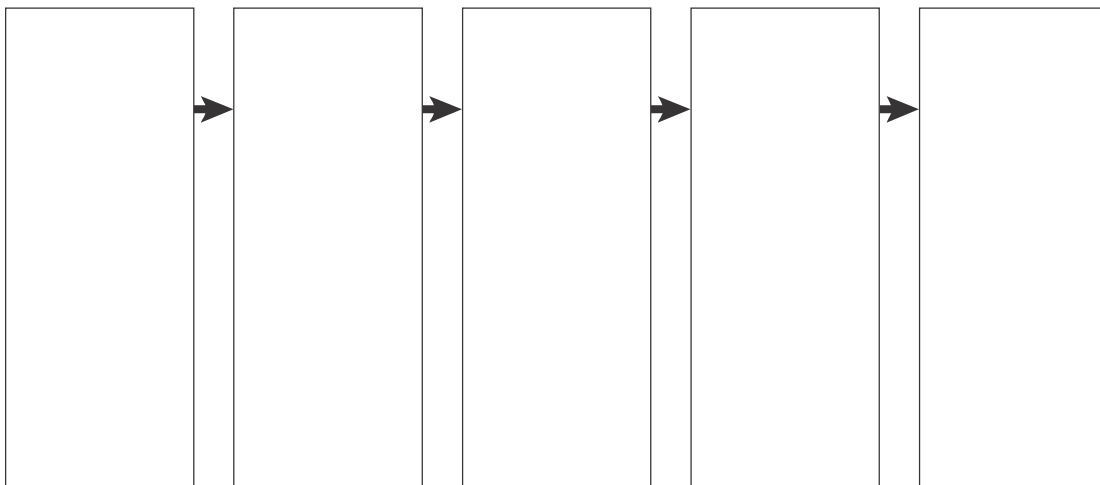
\_\_\_\_\_

3. Why are chromosomes not condensed during all stages of the cell cycle?

\_\_\_\_\_

\_\_\_\_\_

Refer to Figure 2.2 to sketch how DNA goes from a long stringy form to a tightly condensed form. Label the parts of the condensed, duplicated chromosome.



**MAIN IDEA:** Mitosis and cytokinesis produce two genetically identical daughter cells.

4. How does interphase prepare a cell to divide?

\_\_\_\_\_

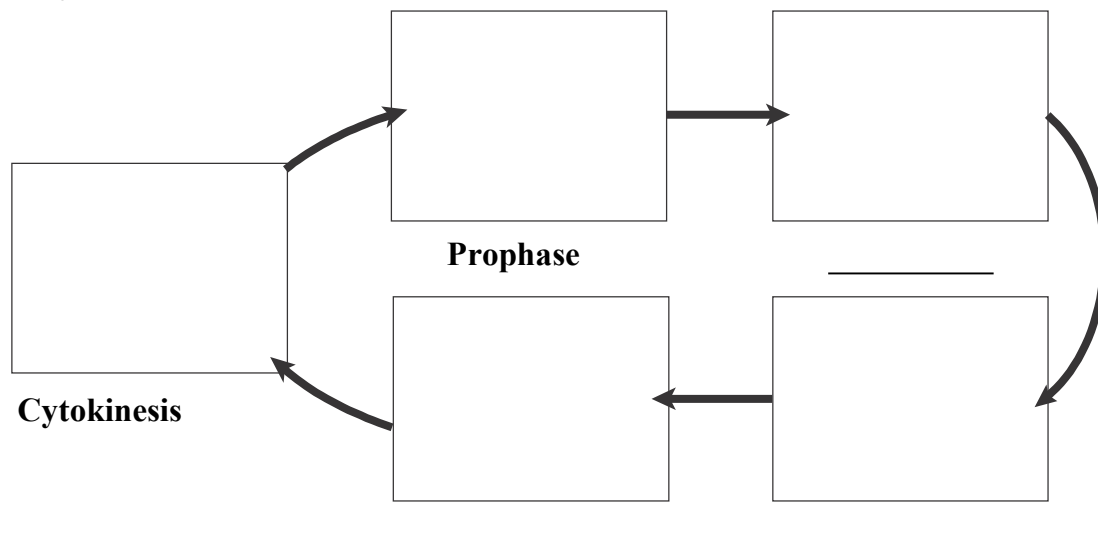
5. Mitosis occurs in what types of cells?

\_\_\_\_\_

6. Develop a device, such as a short sentence or phrase, to help you remember the order of the steps of mitosis: prophase, metaphase, anaphase, telophase.

\_\_\_\_\_

**Complete the diagram illustrating the four phases of mitosis and one phase of cytokinesis.**



7. How does cytokinesis differ between plant and animal cells?

\_\_\_\_\_

\_\_\_\_\_

### Vocabulary Check

8. DNA wraps around organizing proteins called \_\_\_\_\_.

9. The suffix -tin indicates that something is stretched and thin. \_\_\_\_\_ is the loose combination of DNA and proteins that looks sort of like spaghetti.

10. Sister chromatids are held together at the \_\_\_\_\_, which looks pinched.

11. The ends of DNA molecules form structures called \_\_\_\_\_ that help prevent the loss of genes.

# Study Guide

## KEY CONCEPT

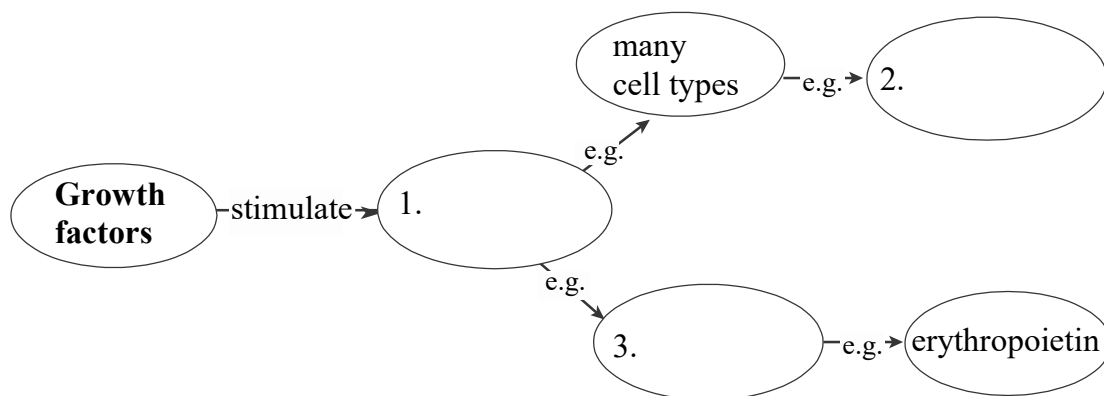
Cell cycle regulation is necessary for healthy growth.

## VOCABULARY

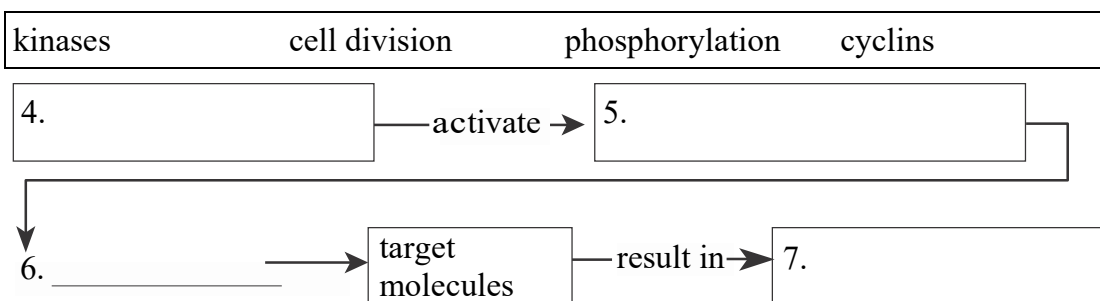
growth factor	benign	carcinogen
apoptosis	malignant	
cancer	metastasize	

**RESEARCH QUESTION - MAIN IDEA:** Internal and external factors regulate cell division.

Complete the concept map below to show important ideas about growth factors.



Use the word bank to complete the sequence diagram below.



8. What is apoptosis?

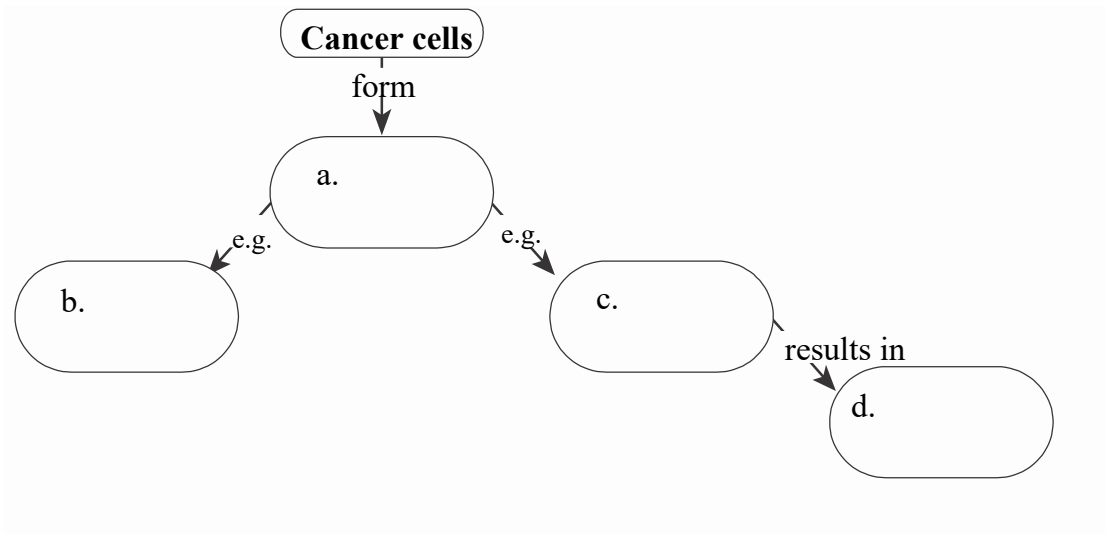
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**MAIN IDEA:** Cell division is uncontrolled in cancer.

9. What type of disease may result if cell division is not properly regulated?

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Complete the concept map below about cancer cells.



10. List three ways mutations can occur in genes involved in cell-cycle regulation.

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### Vocabulary Check

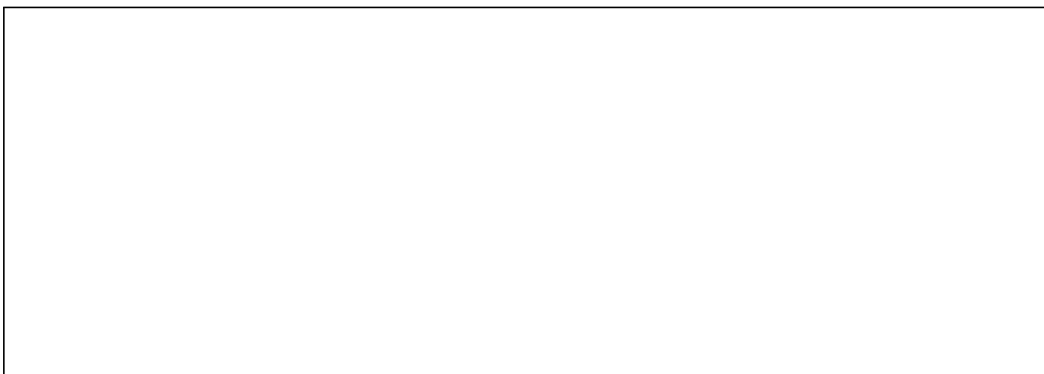
11. What does metastasize mean?

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12. What is a substance known to produce or promote the development of cancer?

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13. Draw a cartoon to help you remember the difference between benign and malignant.





# Study Guide

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## KEY CONCEPT

Many organisms reproduce by cell division.

## VOCABULARY

asexual reproduction

binary fission

**MAIN IDEA:** Binary fission is similar in function to mitosis.

1. Offspring resulting from asexual reproduction and those resulting from sexual reproduction differ in one major way. What is the difference?

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**Sketch the steps of binary fission in the boxes below. Beside each sketch, write a brief description of what is occurring.**



2. \_\_\_\_\_  
\_\_\_\_\_



3. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



4. \_\_\_\_\_  
\_\_\_\_\_

Fill in chart below to highlight the advantages and disadvantages of asexual reproduction.

Advantages	Disadvantages
5.	
6.	
7.	

**MAIN IDEA:** Some eukaryotes reproduce through mitosis.

8. If a eukaryotic organism reproduces through mitosis, what is true about the offspring and the parent organism?

\_\_\_\_\_

9. In what types of organisms is mitotic reproduction most common?

\_\_\_\_\_

10. List three examples of mitotic reproduction.

\_\_\_\_\_

11. What forms of reproduction does the sea anemone use?

\_\_\_\_\_

### Vocabulary Check

12. Write a word that starts with the letters “bi.” Explain what is similar between the meaning of the word you wrote and the meaning of “binary fission.”

\_\_\_\_\_

\_\_\_\_\_

13. What is the creation of offspring from only one parent organism called?

\_\_\_\_\_

# Study Guide B

## KEY CONCEPT

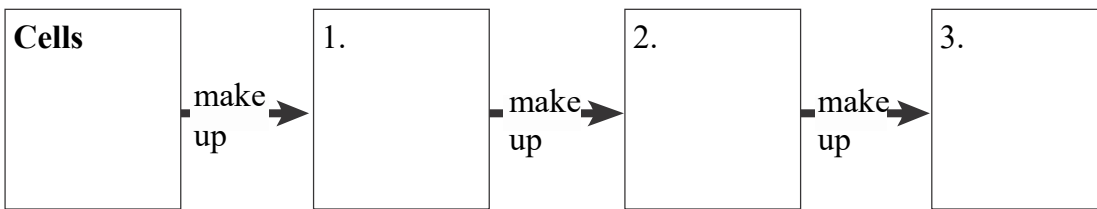
Cells work together to carry out complex functions.

## VOCABULARY

tissue	organ system	stem cell
organ	cell differentiation	

**MAIN IDEA:** Multicellular organisms depend on interactions among different cell types.

Complete the diagram below that represents organization in multicellular organisms.



4. List two examples of tissues found in plants.

\_\_\_\_\_

5. List two examples of organ systems found in plants.

\_\_\_\_\_

6. How does an organism benefit from organ systems that work together and communicate?

\_\_\_\_\_

**MAIN IDEA:** Specialized cells perform specific functions.

7. What is the process by which unspecialized cells develop into specialized cells?

\_\_\_\_\_

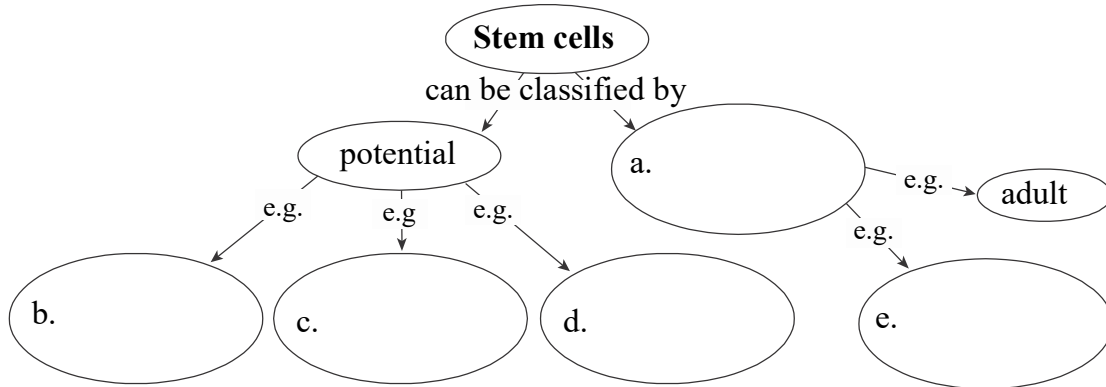
8. Do different types of cells have different DNA? Explain.

\_\_\_\_\_

9. What role does cell location play within a developing embryo?

\_\_\_\_\_

**SPECIAL TOPIC --- MAIN IDEA:** Stem cells can develop into different cell types.  
**Complete the concept map below about stem cell classification.**



10. List the three identifying characteristics of stem cells.

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11. List one advantage of using adult stem cells and one advantage of using embryonic stem cells.

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### Vocabulary Check

12. What is cell differentiation?

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13. Write the following words in order from the largest structure to the smallest structure: cell, organ, organ system, tissue

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