Chapter 9 Assessment

Section 1

Vocabulary Review

Match the correct vocabulary term from the Study Guide page to the following definitions.

1. the period in which the cell is not dividing
2. the process of nuclear division
3. the sequence of events in the life of a eukaryotic cell

Understand Main Ideas

4. Which is a reason why cells remain small?
   A. Large cells have difficulty diffusing nutrients rapidly enough.
   B. As cells grow, their ratio of surface area to volume decreases.
   C. Transportation of wastes becomes a problem for large cells.
   D. All of the above.

Use the hypothetical cell shown below to answer question 5.

5. What is the ratio of surface area to volume?
   A. 2:1 C. 4:1
   B. 3:1 D. 6:1

6. Of the surface area to volume ratio, what does the surface area represent in a cell?
   A. nucleus
   B. plasma membrane
   C. mitochondria
   D. cytoplasm

7. Which describes the activities of a cell that include cellular growth and cell division?
   A. chromatin C. mitosis
   B. cytoplasm D. cell cycle

8. As a cell's volume increases, what happens to the proportional amount of surface area?
   A. increases
   B. decreases
   C. stays the same
   D. reaches its limit

Constructed Response

9. MAIN IDEA 6.3b Why are cellular transport and cellular communication factors that limit cell size?

10. **Short Answer** Summarize the relationship between surface area and volume as a cell grows.

11. **Short Answer** What types of activities are going on in a cell during interphase?

Think Critically

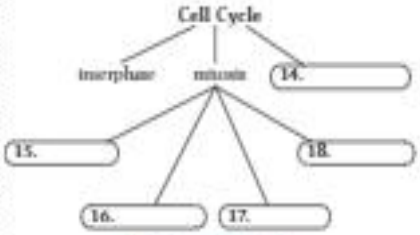
12. **Criticize** this statement: Interphase is a "resting period" for the cell before it begins mitosis.

13. **Explain** the relationship of DNA, a chromosome, and chromatin.

Section 2

Vocabulary Review

Complete the concept map using vocabulary terms from the Study Guide page.



Understand Main Ideas

19. Starting with one cell that underwent six divisions, how many cells would result?
   A. 11 C. 48
   B. 32 D. 64

Chapter 9 Assessment

Section 1

Vocabulary Review

1. interphase
2. mitosis
3. cell cycle

Understand Main Ideas

4. D
5. B
6. B
7. D
8. B

Constructed Response

9. Both are essential for cell survival. As the cell grows larger, it is harder for the nucleus to make proteins fast enough to control the cell and transport molecules around the cell.
10. As the cell grows, the ratio of surface area to volume decreases.
11. The cell is actively synthesizing proteins and carrying out its normal functions. It duplicates DNA and prepares for division.

Think Critically

12. During interphase, the cell is not "resting" but rather is producing proteins and carrying out the cell's normal functions.
13. A chromosome is composed of DNA. Chromatin is the relaxed form of a chromosome.

Section 2

Vocabulary Review

14. cytokinesis
15. prophase
16. metaphase
17. anaphase
18. telophase

Understand Main Ideas

19. D

20. C
21. B
22. A

Constructed Response

23. during the G_2 stage of interphase, prophase, and metaphase
24. On the top row of cells, starting on the left, the first cell is in interphase, the second cell is in prophase, the third cell is in anaphase, the fourth cell is in metaphase, and the fifth cell is in telophase.
25. During telophase, the chromosomes have reached the poles of the cell, the nuclear membrane reforms, the nucleolus reappears and chromosomes recondense.

Think Critically

26. The cell is a plant cell.
27. 1/4 of 24 h, or 6 h

Section 3

Vocabulary Review

28. Cancer cells undergo uncontrolled, unrestrained growth and division because their genes have been changed.
29. Apoptosis is a cellular response to DNA damage that results in cell death.
30. Carcinogens are substances that cause cancer.

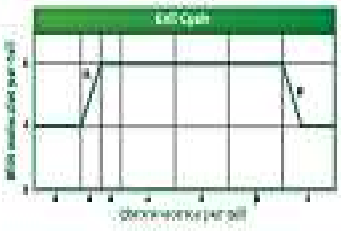
Understand Main Ideas

31. B
32. C

Chapter 9 Assessment

Section 1

The following graph shows a cell over the course of its cell cycle. Use this graph to answer questions 20 and 21.



20. What stage occurred in the area labeled A?
A. prophase C. S stage
B. G_1 stage D. G_2 stage

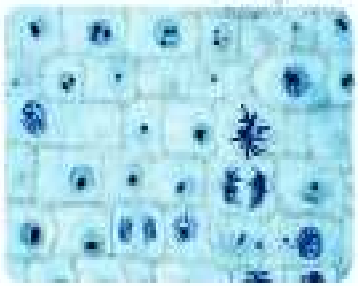
21. What process occurred in the area labeled B?
A. interphase C. mitosis
B. cytokinesis D. metabolism

22. The cancer drug vinblastine interferes with synthesis of microtubules. In mitosis, this would interfere with what?
A. spindle formation
B. DNA replication
C. carbohydrate synthesis
D. disappearance of the nuclear envelope

Constructed Response

23. MAIN IDEA Critical Thinking During the cell cycle, when would a chromosome consist of two identical sister chromatids?

24. **Short Answer** In the following image of a section of onion root tip, identify a cell in each of the following stages: interphase, prophase, metaphase, anaphase, and telophase.



25. **Short Answer** Describe the events that occur in telophase.

Think Critically

26. **Evaluate** While looking through a microscope, you see a cell plate forming. This cell is most likely what type of cell?

27. MAIN IDEA Biology A biologist examines a series of cells and counts 90 cells in interphase, 15 cells in prophase, 12 cells in metaphase, 5 cells in anaphase, and 2 cells in telophase. If a complete cycle for this type of cell requires 24 hours, what is the average duration of mitosis?

Section 3

Vocabulary Review

The sentences below include term(s) that have been used incorrectly. Replace the incorrect term(s) with vocabulary terms from the Study Guide page to make the sentences true.

28. Stem cells undergo uncontrolled, unrestrained growth and division because their genes have been changed.

29. Cancer is a cell response to DNA damage that results in cell death.

30. Cyclins are substances that cause cancer.

Understand Main Ideas

31. What is the role of cyclins in a cell?
A. to control the movement of microtubules
B. to signal for the cell to divide
C. to stimulate the breakdown of the nuclear membrane
D. to cause the nucleolus to disappear

32. What substances form the cyclin-cyclin dependent kinase combinations that control the stages in the cell cycle?
A. fats and proteins
B. carbohydrates and proteins
C. proteins and enzymes
D. fats and enzymes

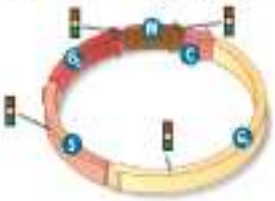
33. Which is a characteristic of cancer cells?
A. controlled cell division
B. contain multiple genetic changes
C. cytokinesis stage is skipped
D. cell cycling function normally

34. Which describes apoptosis?
A. occurs in all cells
B. is a programmed cell death
C. disrupts the normal development of an organism
D. is a response to hormones

35. Why have some stem cell researchers experienced roadblocks in their studies?
A. Stem cells cannot be found.
B. There are ethical concerns about obtaining stem cells.
C. There are no known uses for stem cells.
D. Stem cells do not become specialized cells.

Constructed Response

Refer to the diagram to answer question 36.



36. **THINK** **Explain** the relationship between cancer cells and the cell cycle.

37. **Short Answer** Distinguish between mitosis and apoptosis.

Think Critically

38. **Describe** how stem cells might be used to help a patient who has a damaged spinal cord.

39. **WRITE** **Explain** how the lack of cyclins would affect the cell cycle.

40. **Apply** Hundreds of millions of dollars are spent annually in the U.S. on the research and treatment of cancer, with much less being spent on cancer prevention. Compose a plan that would increase cancer prevention knowledge.

Summative Assessment

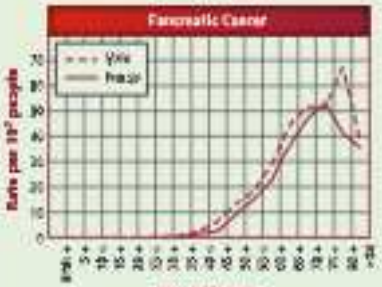
41. **BIG Idea** Besides reproduction, what factors cause cells to complete the cycle of interphase, mitosis, and cytokinesis?

42. **WRITING in Biology** Write a skit using props and people to demonstrate mitosis.

43. Research chemicals that are carcinogens and write about how these chemicals can damage DNA.

Document-Based Questions

Dr. Chang and co-workers evaluated the risk of pancreatic cancer by studying its occurrence in a population group. Their data included age as shown on the graph below shows cancer diagnosis rates for African American men and women.



44. Summarize the relationship between the occurrence of cancer and age.

45. Considering what you know about cancer and the cell cycle, explain why incidences of cancer increase with age.

46. Compare the ages of men and women who are diagnosed with cancer.

47. At what age does diagnosis of pancreatic cancer decline?

Document-Based Questions

Chang, K. J., et al. 2005. Risk of pancreatic adenocarcinoma. Cancer 103: 349–357.

44. As age increases, the occurence rate of cancer increases until age 75–79 in females and age 80–84 in males, and then it declines.
45. As one ages, more cells accumulate mutations in their genes.
46. Sample answer: Men are generally diagnosed younger, and their diagnosis rates are higher than women's after age 70.
47. For women, age 70. For men, age 77

33. B
34. B
35. B

Constructed Response

36. They have unrestrained cell division and spend little time in interphase.
37. Mitosis produces new cells, whereas apoptosis causes cell death.

Think Critically

38. They may help nerves in the spinal cord regrow and enable paralyzed people to walk again.
39. The lack of cyclins would completely stop the cell cycle process; cyclins combine with cyclin-dependent kinase enzymes.
40. Answers will vary, but may include avoiding carcinogens such as radiation.

Summative Assessment

41. Cells grow too large to be able to effectively complete cellular processes such as communication and transportation.

WRITING in Biology

42. Answers will vary, but the skit should demonstrate an understanding of mitosis.
43. Answers will vary, but should include specific carcinogens and their effect on DNA.

Standardized Test Practice

Multiple Choice

1. C 5. D 9. A
2. A 6. A 10. D
3. D 7. B
4. C 8. D

Short Answer

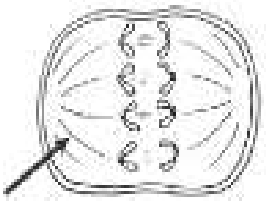
11. During interphase, the cell grows, carries out cellular functions, and prepares for mitosis to occur. These activities indicate that interphase is not a resting period.
12. At this checkpoint, the cell verifies that all the necessary tasks have occurred prior to mitosis and that the cell is ready for mitosis.
13. Mitosis requires many more steps—taking much longer to occur than cytokinesis.
14. It could be possible if the organism is a plant that has the ability to get energy from other organisms as well. (Answer may include the example of a carnivorous plant, such as a Venus flytrap, but this is not necessary.)
15. Ink: water-soluble ink would make a homogenous mixture, or solution, because the ink dissolves evenly throughout the water. Water-insoluble ink would make a heterogeneous mixture because the ink would not dissolve and would be unevenly mixed with the water. Pebbles: a heterogeneous mixture because the pebbles would not dissolve and would be unevenly mixed with the water. Salt: a homogenous mixture, or solution, because the salt dissolves evenly throughout the water.
16. ATP synthase pumps H^+ ions across the thylakoid membrane. Rubisco converts GAP molecules into RuBP molecules.
17. The volume of a cell increases much more rapidly than the surface area as the cell becomes larger. This causes the ratio of surface area to volume to decrease as a cell becomes larger.

Standardized Test Practice

Multiple Choice aligned with PISA

1. Carbon (C) has four electrons in its outer energy level, and fluorine (F) has seven. Which compound would carbon and fluorine most likely form?
   A. CF_2
   B. CF_3
   C. CF_4
   D. CF_5

Use the diagram below to answer questions 2 and 3.



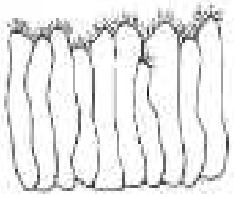
2. Which stage of mitosis is shown in this diagram?
   A. anaphase
   B. interphase
   C. metaphase
   D. telophase

3. To which structure does the arrow in the diagram point?
   A. centromere
   B. chromosome
   C. nucleolus
   D. spindle

4. Which stage of photosynthesis requires water to complete the chemical reaction?
   A. action of ATP synthase on ADP
   B. conversion of GAP molecules into RuBP
   C. conversion of $NADP^+$ to $NADPH$
   D. transfer of chemical energy to form GAP molecules

5. Which carbon-containing compound is the product of glycolysis?
   A. acetyl CoA
   B. glucose
   C. lactic acid
   D. pyruvate

Use the diagram below to answer question 6.



6. What are the structures projecting from the cells in the diagram?
   A. cilia
   B. flagella
   C. microfilaments
   D. villi

7. Which cellular process stores energy?
   A. the breaking of lipid chains
   B. the conversion of ADP to ATP
   C. the synthesization of proteins from RNA codons
   D. the transportation of ions across the membrane

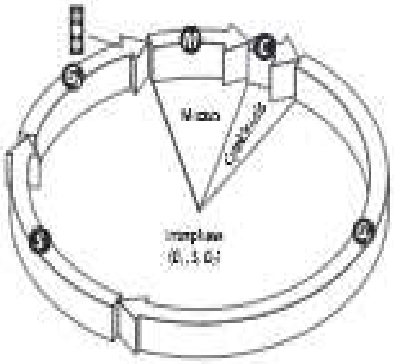
8. Which contributes to the selective permeability of cell membranes?
   A. carbohydrates
   B. ions
   C. minerals
   D. proteins

9. If data from repeated experiments support a hypothesis, which would happen next?
   A. A conclusion would be established.
   B. The data would become a law.
   C. The hypothesis would be rejected.
   D. The hypothesis would be revised.

10. Which type of heterotroph is a mouse?
    A. carnivore
    B. decomposer
    C. herbivore
    D. omnivore

Short Answer aligned with PISA

Use the diagram below to answer questions 11–13.



11. In the past, interphase often was called the "resting" phase of the cell cycle. Explain why this is inaccurate.

12. Explain what the cell does at the checkpoint indicated by the spotlight in the diagram.

13. Use the diagram to compare the relative rates at which mitosis and cytokinesis occur.

14. Hypothesize how an organism could be both a heterotroph and an autotroph.

15. Suppose you had ink, pebbles, and table salt. Describe what kind of mixture each one of these would make if stirred with water. Explain your answers.

16. Name two enzymes involved in photosynthesis, and describe their roles.

17. Infer how the ratio of surface area to volume changes as a cell grows larger.

Extended Response aligned with PISA

Use the diagram below to answer questions 18 and 19.

18. Analyze the diagram and describe the importance of the spindle fibers to chromatids during prophase.

19. Describe the function of the centromere and predict what might happen if cells did NOT have centromeres.

Essay Question aligned with PISA

The same organelles are found in many different types of cells in an animal's body. However, there are differences in the number of organelles present, depending on the function of the different cells. For instance, the cells that require a great amount of energy to carry out their work would contain more mitochondria.

Using the information in the paragraph above, answer the following question in essay format.

20. How do you think two types of animal cells would differ in terms of the kinds of organelles they contain? Write a hypothesis about the cellular differences between two types of animal cells and then design an experiment to test your hypothesis.

Extended Response

18. The spindle fibers attach to the chromatids and pull them to their respective poles. Without the spindle fibers, the chromatids would not go to the correct poles.

19. The centromere is the location where the sister chromatids are connected. Without a central point, the chromatids might be pulled apart unevenly. This would cause the cell's genetic material to be divided unevenly and the daughter cells to be dysfunctional.

Essay Question

20. Answers will vary, depending on the types of cells selected for the essay. The answer should, however, reflect an understanding of the roles played by different organelles, even if the hypothesis does not reflect a complete understanding of cells found in animals. An example hypothesis: Muscle cells would contain more mitochondria than blood cells because they are involved in using energy for moving the body all the time. This could be tested by getting samples of the two kinds of cells and observing them under the microscope to see which kind of cell contains a greater number of mitochondria.