Name _____ **Period** _____

Chapter 12: The Cell Cycle

This chapter will be essential to your understanding of how heritable information is passed to the next generation and provides for the continuity of life. The cell cycle is an integral part of Big Idea 3 and included in LOs 3.7–3.11.

Overview

1. What are the three key roles of cell division? State each role, and give an example.

Key Role	Example

2. What is meant by the *cell cycle*?

Concept 12.1 Most cell division results in genetically identical daughter cells

3. What is the meaning of *genome*?

4. How many chromosomes are in a human *somatic cell*? Name two types of somatic cells in your body.

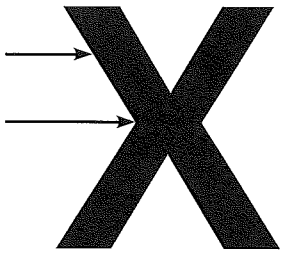
5. What is a *gamete*? Name the two types of gametes.

6. How many chromosomes are present in a human gamete?

7. Describe a eukaryotic chromosome.

8. How many DNA molecules are in each of your somatic cells? Think carefully!

9. You are going to have to learn the difference between several similar-sounding terms. The following sketch that looks like an X represents a *replicated chromosome* that has two *sister chromatids*. The narrow "waist" represents the location of the *centromere*. The centromere is a region of DNA, a part of the chromosome where one sister chromatid will attach to the other sister chromatid. A single chromosome has one centromere; replicated chromosomes therefore have two centromeres, adhering to each other in this region. Students often get all these terms confused, so take time now to label the indicated areas of the figure and then define each of the terms below.



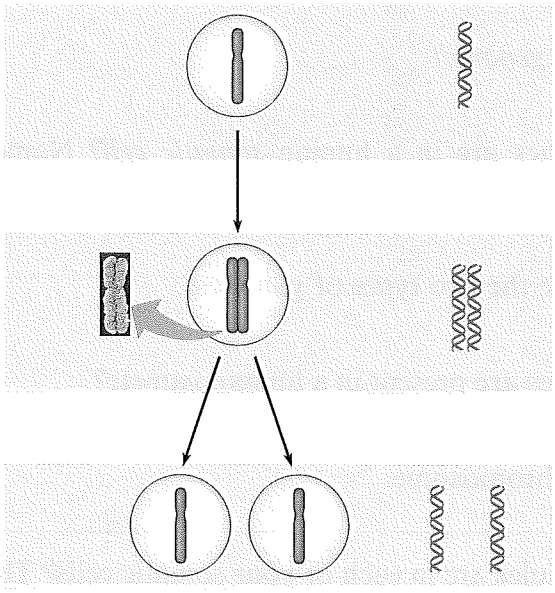
chromosome

chromatid

centromere

chromatin

10. Study Figure 12.5 in your text. Label the following figure, and summarize what occurs at the DNA level in each stage. The top figure shows one chromosome. The middle figure shows a replicated chromosome with two sister chromatids. It is still considered one chromosome. When the sister chromatids have separated in the bottom figure, they are now considered individual chromosomes. Run through this again! Top picture, 1 chromosome. Middle picture, 1 chromosome (replicated). Bottom picture, 2 chromosomes.

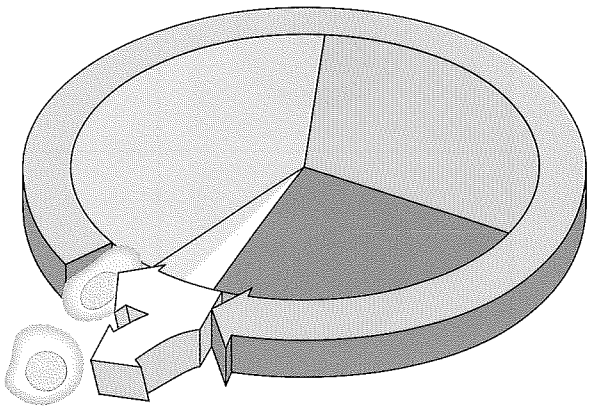


11. What is *mitosis*? How is it different from *cytokinesis*?

12. What occurs in *meiosis*? How is the chromosome number of daughter cells different?

Concept 12.2 The mitotic phase alternates with interphase in the cell cycle

13. Label each of the parts of the cell cycle listed below, and give a brief explanation of what happens in each phase.



G_1

S

G_2

M

14. What are the components of the *mitotic spindle*? What is the source of these components?

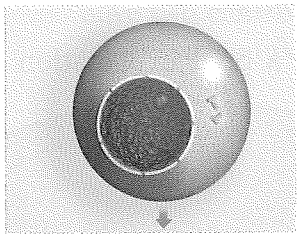
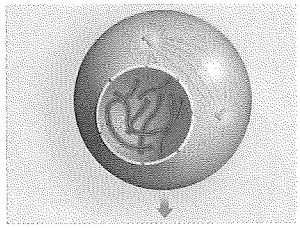
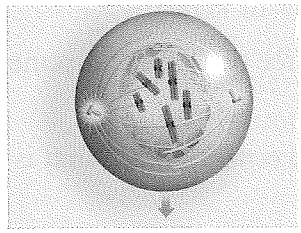
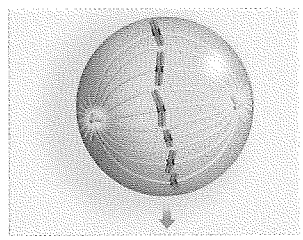
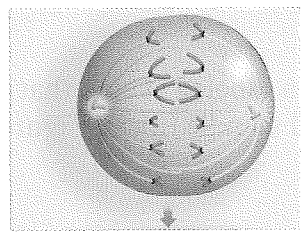
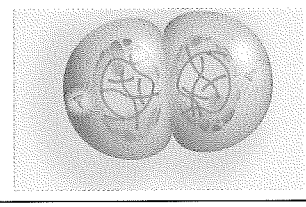
15. In animal cells, the assembly of spindle microtubules starts at the *centrosome*. What is another name for the centrosome?

16. Sketch and label a centrosome with two centrioles.

17. Describe what happens to the centrosome during interphase and then prophase.

18. What is a *kinetochore*? Read your text carefully, and then make a labeled sketch that shows a replicated chromosome with two kinetechores and some attached spindle fibers. Figure 12.8 in your text will help.

19. Use Figure 12.7 in your text to help you complete this chart. Label each phase by name; then label the smaller structures. Finally, make two or three summary statements that indicate important features to note about the phase.

	Phase	Important Features of Phase
		
		
		
		
		
		

20. Explain the difference between *kinetochore* and *nonkinetechore* microtubules. What is the function of each?

21. Using Inquiry Figure 12.9, explain how evidence was gathered to justify the claim that microtubules depolymerise from the kinetochore end during anaphase. (Note that additional work was later completed that indicated the microtubules could shorten from the kinetochore or the polar end! It is easy to see why scientists are cautious about concluding what their research shows.)

22. Describe *cytokinesis* in an animal cell. Use a labeled sketch that shows the *cleavage furrow*.

23. Describe cytokinesis in a plant cell. Use a labeled sketch that shows the *cell plate*.

24. How is the cell plate formed? What is the source of the material for the cell plate?

25. Prokaryote reproduction does not involve mitosis, but instead occurs by *binary fission*. This process involves an *origin of replication*. Describe binary fission.

26. Notice that now you are learning a number of differences between prokaryotic and eukaryotic cells. Besides the fact that prokaryotes lack a membrane-bounded nucleus, describe the following differences:

    Mode of reproduction?

    Number of chromosomes?

    Shape of the bacterial chromosome?

Concept 12.3 The eukaryotic cell cycle is regulated by a molecular control system

27. What controls the cell cycle? Study Inquiry Figure 12.14 in your text to help you answer this question.

28. What is a cell-cycle *checkpoint*?

29. Summarize what happens at each checkpoint. You may add to this chart as you study this section.

Checkpoint	What Happens? How Is It Controlled?
G_1	
G_2	
M	

30. What is the function of a *protein kinase*?

31. Kinases drive the cell cycle, but they must be activated by attachment of what molecules?

32. The activity of *cyclin-dependent kinases (Cdks)* rises and falls. Why?

33. What does *MPF* trigger? What are some specific activities that it triggers?

34. What is the *G_0 phase*? Describe this phase. What cell types remain in this phase throughout their life spans?

35. What happens if all the chromosome kinetochores are not attached to spindle fibers? When this occurs, which checkpoint is not passed?

36. What are *growth factors?* How does *platelet-derived growth factor (PDGF)* stimulate fibroblast division?

37. Cancer cells exhibit different behaviors than normal cells. Here are two normal behaviors they no longer show. Explain each behavior and tell how its loss affects normal cell behavior.

density-dependent inhibition

anchorage dependence

38. Cancer cells also show loss of cell-cycle controls and may divide without being checked. The story of HeLa cells is worth noting. What is their source? How old are they? Note that, unlike normal cells, HeLa cells are immortal!

39. What is *transformation?* What is *metastasis*?

40. Distinguish between a *benign tumor* and a *malignant tumor*.

41. List two specific cancer treatments, and tell how each treatment works.

Test Your Understanding Answers

Now you should be ready to test your knowledge. Place your answers here:

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____

7. _____ 8. _____