Name _____ Date _____ Period _____

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Cell Division Study Guide

Biology

Show your work with units. Use complete sentences when a question asks you to explain.

Key relationships	**Cells after n cycles** = starting cells × 2^n	**Time in a stage** = (cells in the stage ÷ total cells) × cycle length	**Percent change** = (new − old) ÷ old × 100	**Sizes**: 1 µm = 1,000 nm; cube SA:V = 6/s

Part 1. The Cell Cycle

1. (a) A plant root cell spends 10 h in G_1, 7 h in S, 3.5 h in G_2, and 1.5 h in M. Find the cycle length, the percent of the cycle in S and in M, and the percent in interphase.

(b) A cell has 8 chromosomes. Fill in the table.

Cell	Chromosomes	DNA molecules
This cell in G_1	8	
This cell in G_2		
Each daughter cell after M		
Human body cell in G_2	46	

2. (a) A dish starts with 300 cells. Each cell divides once every 12 hours, and none die. How many cells are there after 3 days?

(b) After how many hours does the count first pass 1,000,000?

(c) A real dish of these cells had only 9,000 cells after 3 days. Give two reasons the real count is lower.

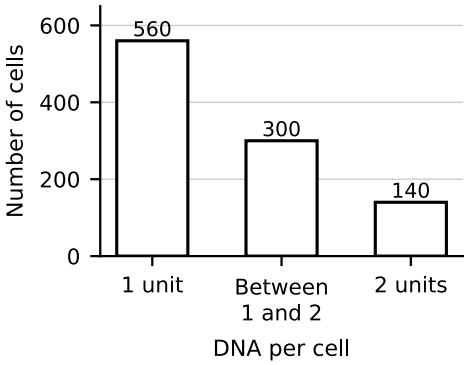
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3. A scientist measured the DNA in 1,000 cells from a dividing population (sample data). The cycle takes 16 hours.

(a) Which phase is each group of cells in?

(b) What percent of the cells are copying their DNA? Estimate how long S phase lasts.

(c) Why must the DNA reach 2 units before the cell divides?



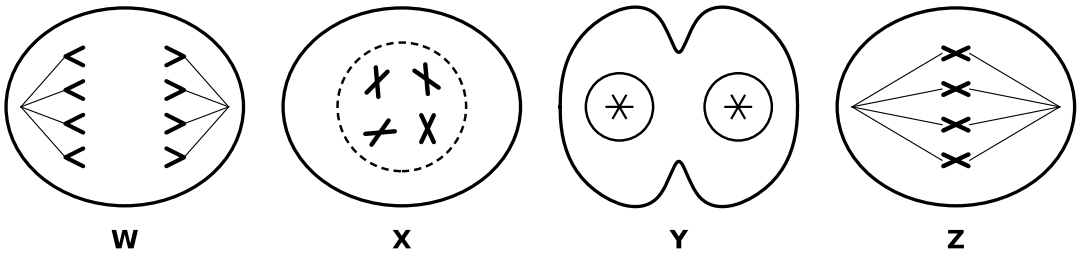
4. (a) A cell is modeled as a cube. It grows from 5 µm to 15 µm on a side. Find its SA:V before and after.

(b) Use your answer to explain why cells divide instead of growing larger and larger.

(c) Mature nerve cells grow and work but no longer divide. Which phase are they in?

Part 2. Mitosis

5. The model shows four cells from a whitefish embryo, each with 4 chromosomes.



(a) Name the stage shown in each cell, and put the cells in order. (b) In which cell do sister chromatids separate?

(c) A different cell has 10 chromosomes. How many chromatids are at its metaphase plate? How many chromosomes will each daughter cell have?

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6. A student counted 400 cells in a garlic root tip (sample data). The whole cycle takes 18 hours.

Stage	Interphase	Prophase	Metaphase	Anaphase	Telophase
Cells counted	320	40	16	8	16
Time (h)					

(a) Find the percent of cells and the time in each stage. Check that the times add up to 18 h.

(b) Which stage is shortest? How does the data show it?

7. (a) A dividing cell builds a cell plate across its middle. Is it a plant or an animal cell? How does the other kind of cell split its cytoplasm?

(b) Explain why the two daughter cells have the same DNA as the parent cell.

(c) A drug stops spindle fibers from forming. Predict what happens to dividing cells, and explain.

8. A gardener tests a chemical on bean roots. In each group, 300 root tip cells were counted (sample data): control, 45 cells in mitosis; treated, 9 cells in mitosis.

(a) Find the percent of cells in mitosis in each group.

(b) Write a claim, evidence, and reasoning: what does the chemical do to cell division, and what would you expect to happen to root growth?

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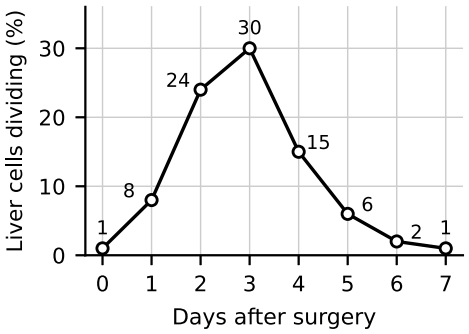
Part 3. Cell Cycle Regulation and Cancer

9. After part of a rat's liver is removed, the rest regrows. The graph shows the percent of liver cells dividing (sample data).

(a) On which day is division highest, and what percent is it?

(b) Why does division rise and then fall back to about 1%?

(c) What would the graph look like if the cells ignored the stop signals?



10. Two dishes start with 2,000 cells each (sample data).

Day	0	1	2	3	4
Dish P	2,000	4,000	8,000	16,000	32,000
Dish Q	2,000	3,800	6,500	8,600	9,000

(a) On day 4, how many times as many cells are in Dish P as in Dish Q?

(b) Find the percent increase for Dish Q from day 0 to 1 and from day 3 to 4. (c) Which dish has normal cells? Explain.

11. (a) Name the checkpoint (G_1, G_2, or M) that catches each problem: a chromosome is not attached to spindle fibers; the cell is too small and its DNA is damaged before S; DNA copying is not finished.

(b) Ultraviolet light damages DNA in a skin cell. What does a working G_1 checkpoint do? What could happen if a mutation has broken it?

12. (a) One cell with a broken checkpoint divides every 2 days, and none of its offspring die. How many cells are there after 30 days?

(b) Why do all the cells in this group carry the same mutation?

(c) How is a malignant tumor different from a benign tumor?

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Part 4. Viruses

13. (a) A virus is 50 nm across. How many would fit end to end along a bacterium 1,500 nm long? Along a plant cell 50 µm long?

(b) A light microscope can show objects down to about 200 nm. Could it show this virus? The bacterium? Explain.

14. A phage enters one bacterium by the lysogenic cycle. The bacterium then divides into a colony of 64 cells.

(a) How many cells in the colony carry the viral DNA? Explain.

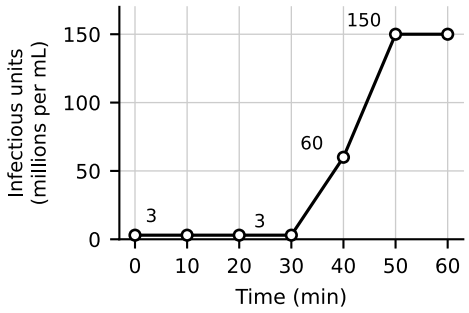
(b) A trigger switches every cell to the lytic cycle, and each releases 80 phages. How many phages are released? What happens to the colony?

15. Phages were mixed with bacteria at 3 million bacteria per mL, one phage per bacterium. An infected cell counts as one unit until it bursts (sample data).

(a) For how long does the count stay flat? What is happening inside the cells then?

(b) How many new phages did each infected cell release?

(c) Why does the count stop rising after 50 minutes?



16. (a) A virus infects cells lining the nose but not skin cells. Explain why.

(b) A student puts the virus in a dish of warm nutrient broth with no cells. Predict whether the number of viruses increases, and explain.

(c) Give one reason some scientists call viruses living and one reason others do not.

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