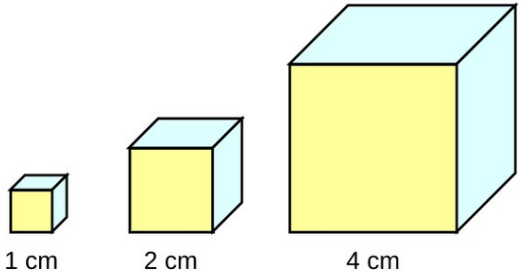
Essential Question

Why must a cell grow and copy its DNA before it divides?

Why Cells Divide

- Growth: more cells make a bigger organism
- Repair and replacement of damaged or worn-out cells
- A cell that grows too big has too little surface for its volume
- Dividing keeps cells small enough to work

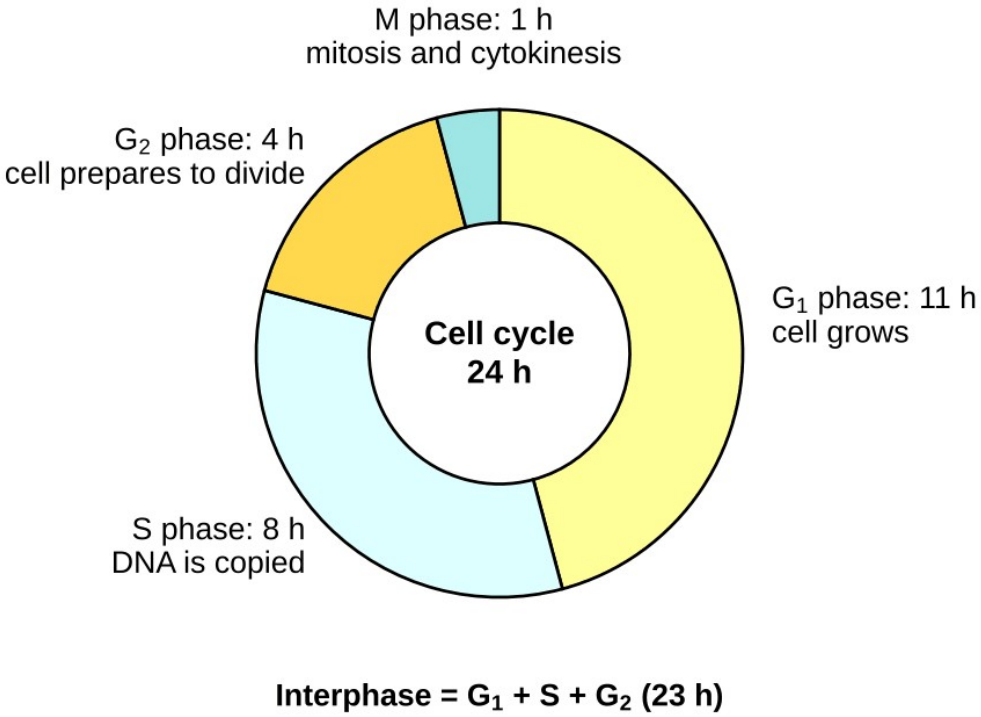


Cube side	1 cm	2 cm	4 cm
Area (cm^2)	6	24	96
Volume (cm^3)	1	8	64
Area ÷ volume	6	3	1.5

A bigger cube has less surface area for each unit of volume.

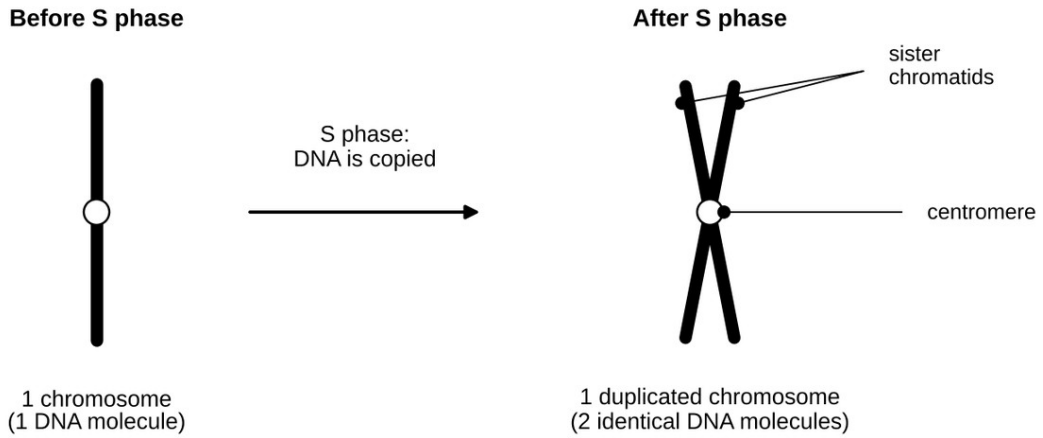
The Cell Cycle Has Phases

- Interphase: G_1, S, and G_2
- M phase: mitosis, then cytokinesis
- Most of the cycle is interphase
- Some cells leave the cycle and stop dividing (G_0)



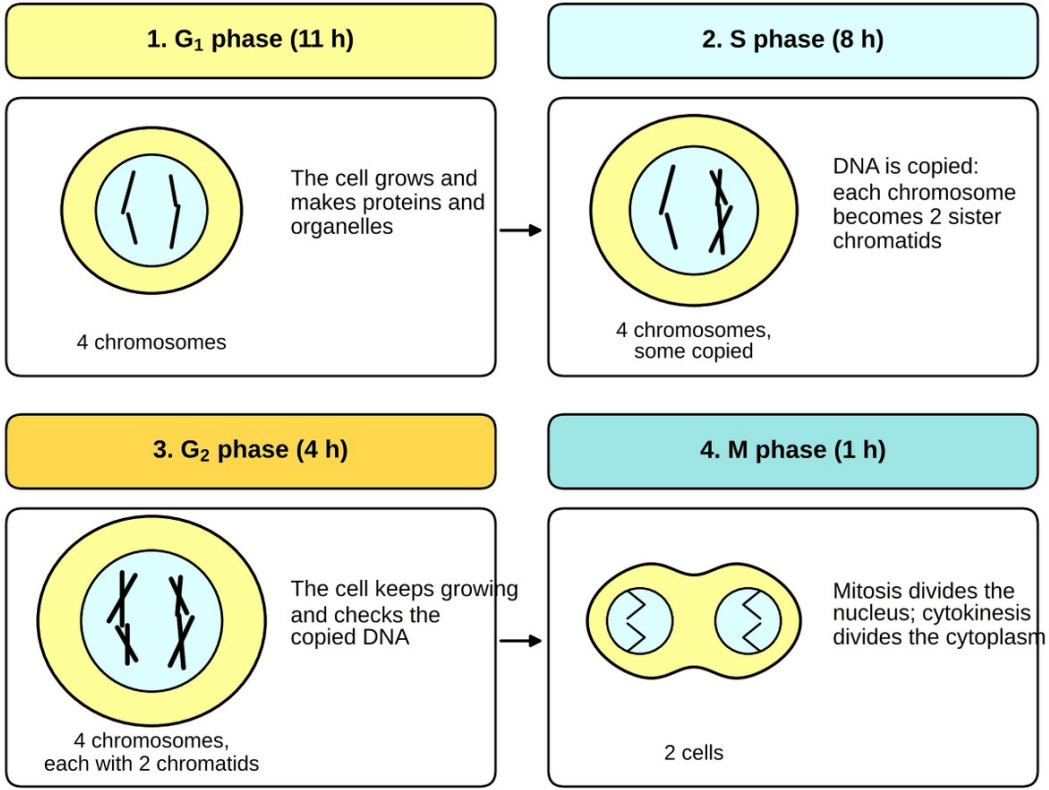
Copying the DNA in S Phase

- Each chromosome is one long DNA molecule
- S phase: each DNA molecule is copied
- A copied chromosome has 2 sister chromatids
- Sister chromatids are identical and joined at the centromere



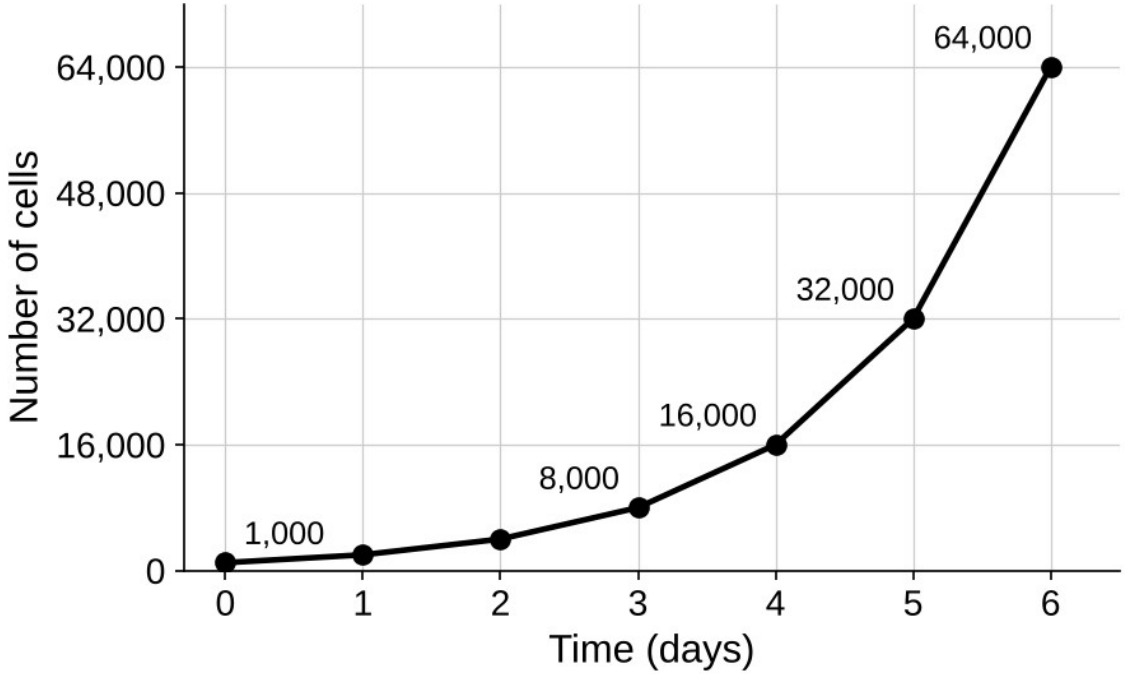
Following One Cell Through the Cycle

- G_1: the cell grows and makes proteins
- S: the DNA is copied
- G_2: the cell checks the copies and prepares
- M: the cell divides into two cells



Populations Grow by Doubling

- One trip through the cycle: 1 cell becomes 2
- Each cycle doubles the number of cells
- After n cycles: 2^n times as many cells
- Real populations grow more slowly



Example: Percent of Time in Each Phase

In a human cell growing in a dish, the phases last 11 h (G_1), 8 h (S), 4 h (G_2), and 1 h (M). Find the length of the whole cell cycle, the percent of the cycle spent in each phase, and the percent spent in interphase.

Phase	Time (h)
G_1	11
S	8
G_2	4
M	1

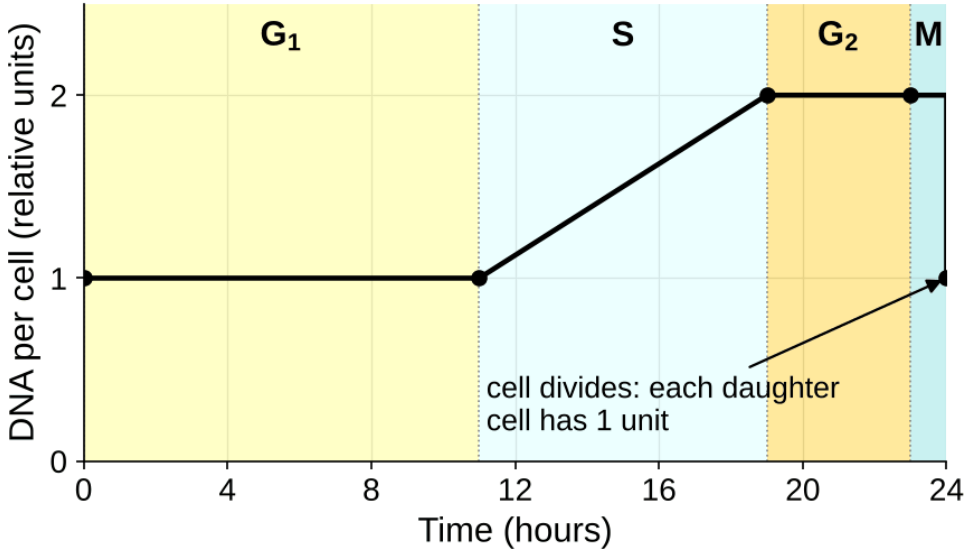
Example: A Population of Dividing Cells

A dish starts with 1,000 cells. Every cell divides once every 24 hours, and no cells die. How many cells are in the dish after 6 days? How many days until there are more than 100,000 cells?

Day	Cells
0	1,000
1	2,000
2	4,000
3	8,000
4	16,000
5	32,000
6	64,000

Example: When Does the DNA Double?

The graph shows the amount of DNA in one cell during a 24-hour cell cycle. Write a claim, evidence, and reasoning: during which phase does the cell copy its DNA, and why must it do this before it divides?



The Cell Cycle

Big Ideas

- Cells divide to grow, repair tissue, and stay small enough to work
- The cell cycle has interphase (G_1, S, G_2) and M phase
- S phase copies the DNA, so each chromosome has 2 sister chromatids
- Most of the cycle is spent in interphase
- Each trip through the cycle doubles the number of cells