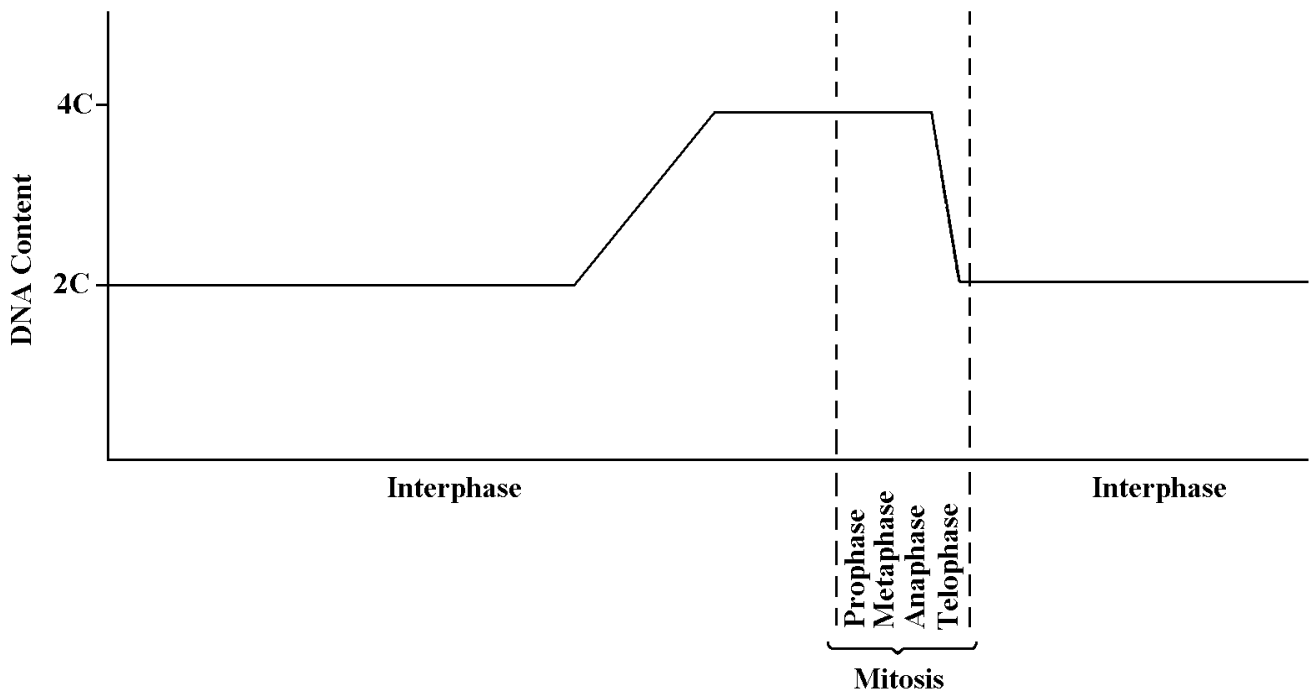


**Introduction**

The amount of DNA in a diploid cell is represented by the symbol  $2C$ . As a cell replicates the DNA in its chromosomes, the DNA content rises from  $2C$  to  $4C$ . At the next mitotic division, the separation of the chromosomes returns the DNA content of the daughter cells to  $2C$ . This information is represented in the graph below. Study the graph and answer the questions that follow.

**Questions**

- Place a  $G_1$  on the graph to mark the location of the first growth phase during interphase.
- Place an S on the graph to mark the location when the DNA content is going from  $2C$  to  $4C$ .
- Place a  $G_2$  on the graph to mark the location of the second growth during interphase.

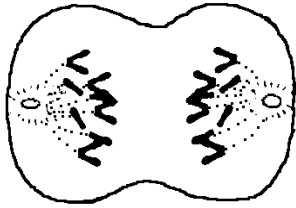
For each of the following questions, **circle** the letter that corresponds to the correct answer.

- The DNA content of the cell represented in the graph changes
  - once.
  - twice.
  - three times.
  - four times.
- Which of the following situations lasts for the longest time during the cell cycle?
  - DNA content remains steady at  $4C$ .
  - DNA content increases from  $2C$  to  $4C$ .
  - DNA content decreases from  $4C$  to  $2C$ .
  - DNA content remains steady at  $2C$ .

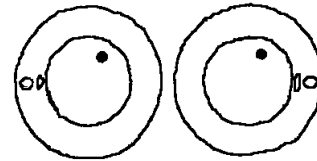
6. Which of the following statements is correct?
- The decrease from 4C to 2C occurs more rapidly than the increase from 2C to 4C.
  - The decrease from 4C to 2C occurs more slowly than the increase from 2C to 4C.
  - The changes in a and b occur at the same rate.
  - The changes in a and b cannot be compared.
7. The DNA content increases
- throughout interphase.
  - at the beginning of the G<sub>1</sub> phase during interphase.
  - during the S phase of interphase.
  - at the end of the G<sub>2</sub> phase during interphase.
8. The DNA content decreases
- throughout mitosis.
  - during prophase.
  - during metaphase.
  - from anaphase to telophase.
9. DNA content is at 4C during
- the end of interphase and the beginning of mitosis.
  - interphase.
  - mitosis.
  - the end of mitosis and the beginning of interphase.
10. The graph shows that DNA content falls to 1C
- when gametes are produced.
  - at no time during mitosis or interphase.
  - during the second half of meiosis.
  - during the second half of mitosis.
11. Which of the following statements most accurately describes the graph?
- The graph shows how a cell expresses its genes as a result of changes in DNA content.
  - The graph shows why the DNA content of a cell changes.
  - The graph shows that the DNA content of a cell changes during interphase and mitosis.
  - The graph shows how DNA is replicated.
12. What are the three phases that occur in interphase? Describe what happens to the cell at each phase.
13. Mitosis is the division of the nucleus. What phase must follow mitosis if two daughter cells are to be produced?

**Recognizing the Stages of Mitosis and Interphase**

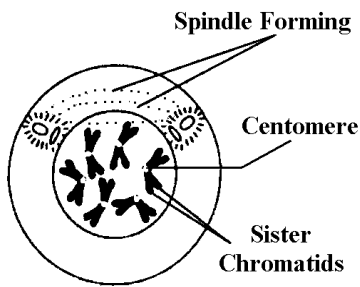
1. Below are diagrams of interphase and mitosis in animal cells. According to the descriptions given on the next page, assign one of the six names to each of the diagrams.



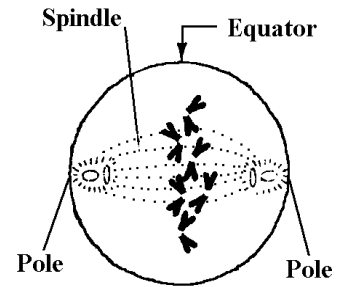
a. \_\_\_\_\_



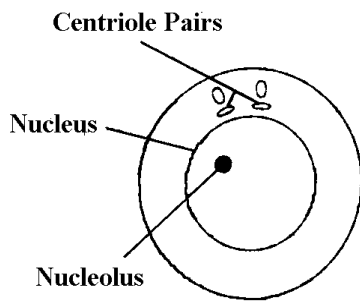
b. \_\_\_\_\_



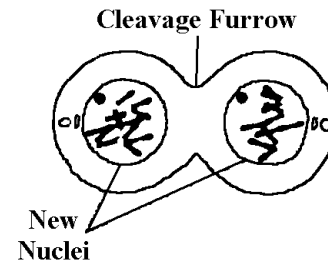
c. \_\_\_\_\_



d. \_\_\_\_\_



e. \_\_\_\_\_



f. \_\_\_\_\_

Interphase I	Nucleus is bound by membrane. One or more nucleoli are present. Chromosomes are not obvious and the centrioles are at right angles to the nucleus.
Prophase	Centriole pairs move towards opposite poles. Sister chromatids become visible. Aster rays begin to form around the centrioles.
Metaphase	Sister chromatids are lined up at the equator. At the end of metaphase the centromeres begin to split forming separate chromosomes.
Anaphase	Chromosomes move towards opposite poles. Sister chromatids will never be together again.
Telophase	Spindle and aster rays disappearing. Nuclear membrane begins to form around the chromosomes. Nucleoli reappear and cytokinesis may be displayed as a cleavage furrow in animal cells.
Interphase II	Two new daughter cells form and each is in the interphase stage of the cell cycle.

2. Complete the following flow chart, given the information from the preceding exercise.



Using the information in this table, answer the following questions. Assume that the chromosome number is 46 as in human cells.

Stage	Chromosomes / Cell	Sister Chromatids / Cell	Mitotic Spindle Present
Interphase ( G <sub>1</sub> )	46	0	No
Interphase ( S )	46	92	No
Interphase ( G <sub>2</sub> )	46	92	No
Prophase	46	92	Yes
Metaphase	46	92	Yes
Anaphase	46	0	Yes
Telophase	46	0	No

- How many chromosomes are present at the end of the metaphase stage?
- How many sister chromatids are present at the end of the metaphase stage?
- Is the mitotic spindle present during prophase?
- What happened to the number of sister chromatids per cell during anaphase?