Mitosis, Meiosis, and the Cell Cycle

Use this key to check answers and read the explanations.

1. Which process supplies new nuclei with the same chromosome sets when animal tissue grows?
   - A. Mitosis
   - B. Meiosis I
   - C. Fertilization
   - D. Crossing over

   Correct answer: A. Mitosis

   Mitosis separates copied chromosomes between two nuclei and normally preserves the number of chromosome sets.

2. Which type of nuclear division reduces the number of chromosome sets when an animal forms reproductive cells?
   - A. DNA replication
   - B. Mitosis
   - C. Meiosis
   - D. Binary fission

   Correct answer: C. Meiosis

   Meiosis reduces a diploid starting cell to haploid products. Animal gametes carry one chromosome set.

3. During which phase of the cell cycle does a typical cell copy its chromosomal DNA before mitosis?
   - A. G1 phase
   - B. S phase
   - C. Metaphase
   - D. Telophase

   Correct answer: B. S phase

   The S phase of interphase is when each chromosome is replicated. The resulting sister chromatids will be separated during mitosis.

4. An animal cell has formed two new nuclei. The membrane then pinches inward and separates the cell into two. What is the separation step called?
   - A. Metaphase
   - B. Chromosome replication
   - C. Synapsis
   - D. Cytokinesis

   Correct answer: D. Cytokinesis

   Cytokinesis partitions the cytoplasm. In animal cells a cleavage furrow pinches the cell into two.

5. After a chromosome is replicated, what are the two joined copies of that chromosome called?

A. Homologous chromosomes
B. Sister chromatids
C. Spindle poles
D. Chromosome sets

Correct answer: B. Sister chromatids
Sister chromatids are the joined products of replication of one chromosome. Homologous chromosomes are paired chromosomes that carry the same types of genes.

6. A cell undergoing mitosis has condensed chromosomes arranged individually across its middle. Sister chromatids are still joined. Which stage fits this image?

A. Metaphase
B. Anaphase
C. Telophase
D. G1 phase

Correct answer: A. Metaphase
In mitotic metaphase, chromosomes line up at the middle. Their chromatids move toward opposite poles in anaphase.

7. A teacher pauses a mitosis animation just as sister chromatids begin moving toward opposite poles. Which stage is shown?

A. Telophase
B. Prophase
C. Metaphase
D. Anaphase

Correct answer: D. Anaphase
Mitotic anaphase begins when sister chromatids separate. Later, new nuclear envelopes form during telophase.

8. Two maternal and paternal copies of a chromosome are paired before the first meiotic division. What separates at anaphase I?

A. The two strands of each DNA molecule
B. The sisters within each chromosome
C. The homologous chromosomes
D. The ends of each chromosome

Correct answer: C. The homologous chromosomes
Meiosis I separates homologous chromosomes. The sister chromatids within each chromosome generally stay together until meiosis II.

9. Which two DNA copies can exchange corresponding segments during ordinary crossing over in prophase I?

A. Nonsister chromatids in a homologous pair
B. The two DNA strands within a single chromatid
C. Chromatids from unrelated chromosome pairs
D. The centromere and the spindle fiber

Correct answer: A. Nonsister chromatids in a homologous pair
During pairing, corresponding regions of nonsister chromatids on homologous chromosomes can exchange segments.

10. What event makes anaphase II of meiosis resemble anaphase of mitosis?

A. A diploid nucleus becomes haploid as homologs separate
B. Homologous chromosomes pair
C. Chromosomes undergo DNA replication
D. Sister chromatids separate

Correct answer: D. Sister chromatids separate
Sister chromatids separate in both mitosis and meiosis II. Homolog separation occurred during meiosis I.

11. A diploid cell has eight chromosomes before S phase. After ordinary mitosis and cytokinesis, how many chromosomes does each daughter nucleus have?

A. Sixteen
B. Four
C. Eight
D. Two

Correct answer: C. Eight
Replication creates sister chromatids. Mitosis sends a copy of each of the eight chromosomes to each daughter nucleus.

12. A diploid starting cell has six chromosomes. After normal meiosis I, what is present in each new nucleus?

A. Six chromosomes, each still made of two sister chromatids
B. Three chromosomes, each still made of two sister chromatids
C. Three chromosomes each made of a single chromatid
D. Six chromosomes each made of a single chromatid

Correct answer: B. Three chromosomes, each still made of two sister chromatids
Each nucleus gets one homolog from each of the three pairs. Each chromosome is still replicated at the end of the first division.

13. A cell has just completed meiosis I. Which event normally happens before it completes meiosis II?

A. It pairs maternal and paternal homologs again
B. It goes through another S phase before homologs separate
C. It returns to a diploid state by fusing with the other daughter cell
D. It separates its sister chromatids without copying all its DNA again

Correct answer: D. It separates its sister chromatids without copying all its DNA again
There is no new S phase between the two meiotic divisions. Meiosis II separates chromatids that were produced before meiosis I.

14. Which event explains why different meiotic divisions can distribute different combinations of whole maternal and paternal homologs, even if there is no crossing over?

A. Homologous pairs orient independently in meiosis I
B. Every maternal homolog goes to the same pole
C. Sister chromatids undergo an extra round of DNA replication
D. All homologs fuse into one chromosome before division

Correct answer: A. Homologous pairs orient independently in meiosis I
A pair can orient either way at metaphase I. The orientation of one pair does not determine the orientation of another.

15. Starting with one normal diploid cell, which comparison describes the usual outcomes after one round of mitosis or after both meiotic divisions?

A. Both form two diploid nuclei
B. Mitosis forms four haploid nuclei, while meiosis forms two diploid nuclei
C. Mitosis forms two diploid nuclei, while meiosis forms four haploid nuclei
D. Both form four diploid nuclei

Correct answer: C. Mitosis forms two diploid nuclei, while meiosis forms four haploid nuclei
Mitosis preserves the chromosome-set count in two new nuclei. Meiosis reduces it during the first of two divisions and produces four haploid nuclei.