Name _____ Date _____

Meiosis and Genetic Variation: From One Diploid Cell to Four Different Haploid Cells

Directions: Complete the word bank sentences and put each set of meiosis events in order, then answer the remaining questions; one group uses a table of chromosome combinations.

1. Use the word bank to complete these sentences about the chromosomes in human cells.

Word bank
diploid • homologous • sister • haploid • identical

A typical human body cell is _____: it has 22 pairs of _____ autosomes (chromosomes that are not sex chromosomes) plus one pair of sex chromosomes, with one chromosome of each pair inherited from each parent. A human egg or sperm cell is _____, with just one chromosome from each pair.

2. Order these events of meiosis I, the first of the two divisions, from prophase I through telophase I. Label each event First, Second, Third or Fourth.

Write the letter of the matching answer on each line.

1. _____ Homologous chromosomes separate, and one chromosome from each pair moves to each end of the cell.
2. _____ Homologous chromosomes pair up and exchange segments by crossing over.
3. _____ The cell divides into two cells, each with one chromosome from every pair.
4. _____ The pairs of homologous chromosomes line up along the middle of the cell.

Choices for question 2

A. First
B. Fourth
C. Third
D. Second

3. Order these events of meiosis II, the second division, from prophase II through telophase II. Label each event First, Second or Third.

Write the letter of the matching answer on each line.

1. _____ Four cells form, each with a single copy of every chromosome.
2. _____ In each of the two cells, the chromosomes line up one by one along the middle.
3. _____ The sister chromatids of each chromosome are pulled apart, one to each end of the cell.

A. Second
B. Third
C. First

4. How many times is the DNA copied, and how many times does the cell divide, as one cell goes through meiosis?

A. The DNA is copied twice, and the cell divides once.
B. The DNA is copied twice, and the cell divides twice.
C. The DNA is copied once, and the cell divides once.
D. The DNA is copied once, and the cell divides twice.

5. When homologous chromosomes are paired, a segment of one chromatid can swap places with the matching segment of a chromatid from the partner chromosome. What is the result of this crossing over?

A. Twice as many chromosomes in the cell
B. Chromatids that carry new combinations of alleles
C. Homologous chromosomes that become identical to each other
D. Chromatids with all of their harmful alleles removed

6. Each pair of homologous chromosomes lines up at the middle of the cell with either partner facing either end, no matter how the other pairs line up. What does this independent assortment produce?

A. Every gamete receives only chromosomes that the individual inherited from their mother
B. Gametes that are all genetically identical to one another
C. Gametes that carry two copies of each chromosome
D. Gametes with many different mixtures of chromosomes from the two parents

7. A human skin cell divides by mitosis, and a cell in a human testis divides by meiosis. How do the cells they produce compare?

A. The skin cell makes 4 genetically different haploid cells; the testis cell makes 2 identical diploid cells.
B. The skin cell makes 2 identical diploid cells; the testis cell makes 4 haploid cells that can differ genetically.
C. Both cells make 2 identical diploid cells, but the testis cells are smaller.
D. Both cells make 4 haploid cells, but only the testis cells can become sperm.

8. Why does it matter that human egg and sperm cells carry only 23 chromosomes each, half the number in body cells?

A. Cells with 23 chromosomes live longer than body cells, so they last until fertilization.
B. Cells with 23 chromosomes can go through meiosis again to make more eggs and sperm.
C. When an egg and a sperm join, the zygote has 46 chromosomes, the normal number.
D. When an egg and a sperm join, the zygote has 92 chromosomes, which it needs to grow.

Counting Chromosome Combinations

The table shows how many different combinations of chromosomes one gamete could receive if only independent assortment is counted, for different numbers of chromosome pairs.

Number of different chromosome combinations one gamete can receive from independent assortment alone

Number of chromosome pairs	Possible combinations in one gamete
1	2
2	4
3	8
4 (fruit fly)	16
7 (pea plant)	128
23 (human)	8,388,608 (about 8.4 million)

9. Based on the pattern in the table, how many combinations could independent assortment alone produce in a species with 5 pairs of chromosomes?

A. 64 B. 25 C. 32 D. 10

10. The table counts only independent assortment. Which process during meiosis would make the real number of genetically different gametes even larger?

A. Cytokinesis dividing the cytoplasm into separate cells
B. The cell growing before its DNA is copied
C. The nuclear envelope forming again around each new nucleus
D. Crossing over between homologous chromosomes