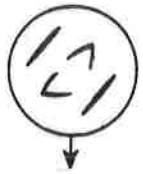
Name _____ Period _____

Due date _____

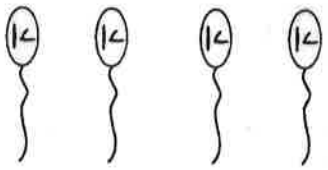
COMPARING MITOSIS AND MEIOSIS

Your body carries out two different kinds of cell division. One is called mitosis and results in formation of new body cells like skin and bone. A second process is called meiosis and results in formation of sperm and eggs (gametes) only. There are several important differences between mitosis and meiosis.



OBJECTIVES: - To simulate the processes of mitosis and meiosis
- To compare mitosis with meiosis

MATERIALS: Envelope with pages of cell outlines
4 short chromosomes
4 long chromosomes



PROCEDURE:

PART A: MITOSIS

1. Take the cell outline diagrams out of the envelope and place them in order on your desk.

2. Diagram A represents the outline of a cell before mitosis begins. Chromosomes are present in the nucleus of this cell. (NOTE: A cell may contain many more chromosomes than 4, but you will only use 4 to simplify this simulation.)

3. Place 2 long and 2 short chromosomes onto Diagram A.

   What is the total number of chromosomes present in this cell before mitosis? _____

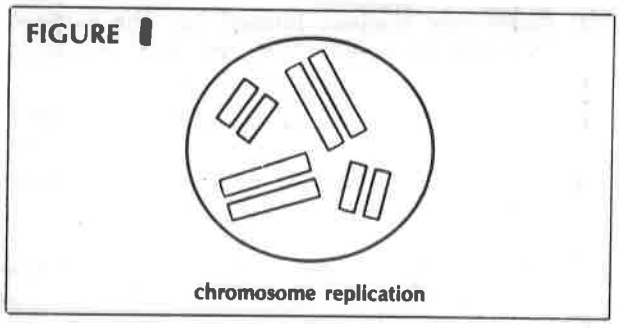
   How many long chromosomes are present? _____

   How many short chromosomes are present? _____

4. Before the cell begins mitosis, each chromosme makes an exact copy of itself. This process is called chromosome replication. To show chromosome replication, match new copies of chromosomes. Long should match with long, and short with short. (See Figure 1)

   Are the original copy and its replicated copy the same as each other or different?

   _____



5. Transfer your chromosomes to Diagram B, and position them within the dashed outlines. During mitosis, doubled chromosmes line up along the cell's center. Doubled chromosomes now separate; each half is pulled to one end of the cell. Move those chromosomes lined up along the left side toward the cell's left, and those on the right to the right. Use the arrows as guides.

Once the double chromosomes separate, the original cell begins to pinch in half down the center. This process forms two new cells.

6. Move the chromosomes on the left side of Diagram B to the left side of Diagram C. Move the chromosomes on the right side of Diagram B to the right side of Diagram C.

What is the total number of chromosomes in each new cell after mitosis? _____

How many long chromosomes are present in each new cell? _____ How many short? _____

Are the 2 new cells just formed the same in chromosome number as the original cell? _____

7. In summary:

A. Each new daughter cell has _____ chromosome number as the original parent cell. (the same, different)

B. Mitosis occurs in all body cells during growth and _____ (gamete production, tissue repair)

C. Mitosis produces daughter cells that are _____ the parent. (identical to, different from)

PART B: MEIOSIS

8. Diagram D represents the outline of a cell befor meiosis begins. Chromosomes are present inside the cell. Place two long and two short chromosomes onto cell Diagram D.

What is the total number of chromosomes present in this cell before meiosis? _____

How many long chromosomes are present? _____

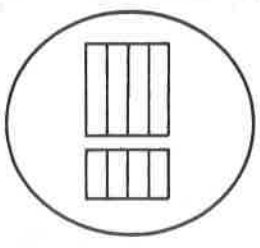
How many short chromosomes are present? _____

Check back to Step #3. Are there any differences so far between mitosis and meiosis? _____

9. Before meiosis begins, the chromosomes replicate. Match new chromosmes with each orginal (long with long and short with short). Before transferring your chromosomes to Diagram E, meiosis requires one additional process. The doubled long chromosomes pair with the other doubled long chromosomes and the short pair with with short pair. Each group of four is called a tetrad. (See Figure 2)

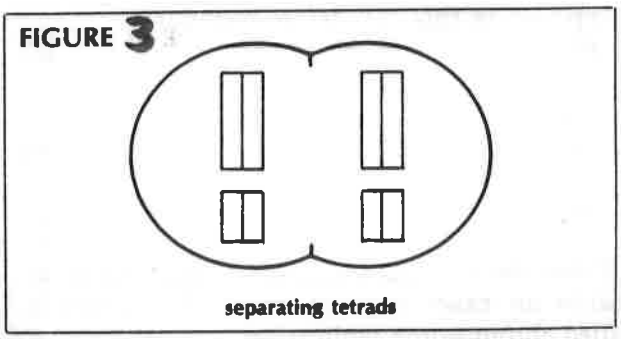
Did this step occur in mitosis? _____

FIGURE 2



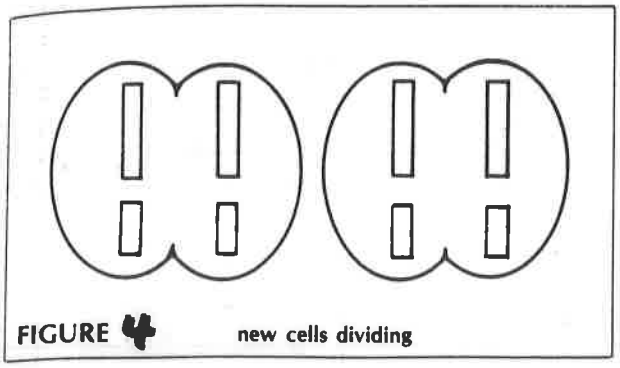
chromosome tetrads

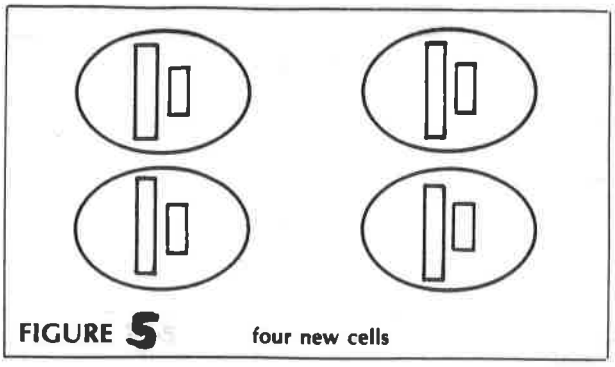
10. Place your chromosome tetrads onto Diagram E. Use the chromosome outlines to properly position them. During meiosis, the chromosome tetrads line up along the cell's center. Chromosomes then separate and are pulled toward opposite ends of the cell. They separate, however, in a certain way. Each tetrad separates into the two original doubled chromosomes. (See Figure 3)



11. Move the doubled chromosomes toward opposite cell ends. Use the arrows as guides. Two new cells are formed as the original cell pinches into two.

12. Transfer those chromosomes on the right side of Diagram E to the right side of Diagram F and position them within the dashed lines. Move those on the left side of Diagram E to the left circle of Diagram F and position them within the dashed lines. Each new cell just formed, quickly begins to divide again into two new cells. (See Figure 4) This step results in four new cells being formed from the original cell. (See Figure 5) The doubled chromosomes then separate leaving each new cell with half the number of chromosomes as the original parent cell.





13. Move your chromosomes from Diagram F to Diagram G. Position the chromosomes within the lines.

How many new cells are formed from one original cell by meiosis? _____

What is the total number of chromosomes present in each new cell? _____

How many total chromosomes were in the original parent cell? (Step #8) _____

14. In summary:

A. Every new cell formed by meiosis has _____ number of chromosomes as the original cell. (half, the same)

B. Meiosis occurs only in the _____ (pancreas, ovaries & testes)

C. Meiosis is responsible for producing _____ (brain cells, sperm & eggs)

ANALYSIS:

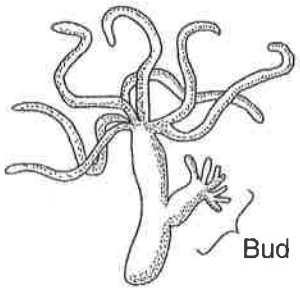
1. In humans, 46 chromosomes are in each body cell, and 23 chromosomes are in each sperm and egg (gamete). In the chart below, fill in the chromosome number and the process for each cell type.

CELL TYPE	NUMBER OF CHROMOSOMES IN CELL	PROCESS USED TO MAKE CELL (MITOSIS OR MEIOSIS)
stomach		
liver		
sperm		
heart		
egg		

2. When an organism reproduces asexually, it usually has

A) only one parent, and half as much DNA as the parent
B) only one parent, and the same chromosome number as the parent
C) two parents, and twice as much DNA as either parent
D) two parents, and the same chromosome number as each parent

The bud shown in the diagram below was produced by asexual reproduction.



3. Which process is responsible for the formation of the bud?

A) fertilization B) recombination
C) mitosis D) meiosis

The diagram below represents chromosomes in a zygote.

4. Which diagrams best illustrate the daughter cells that result from normal mitotic cell division of this zygote?

A)  B) 
C)  D) 

The diagrams below represent a cell process.

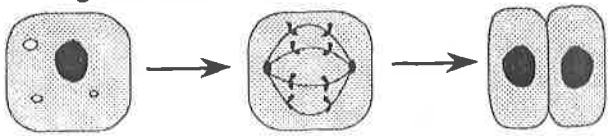
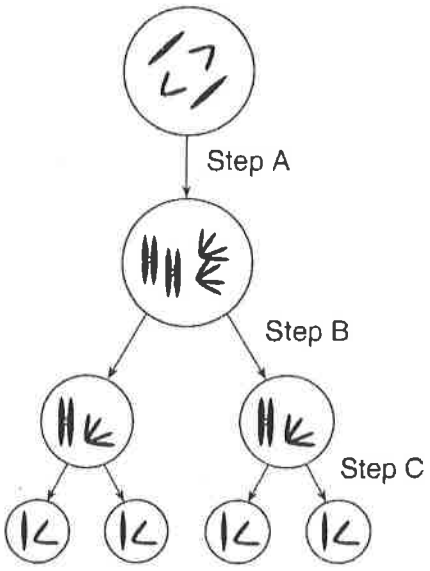


Diagram 1 Diagram 2 Diagram 3

5. If the cell in diagram 1 contains 4 chromosomes, what is the total number of chromosomes in each cell in diagram 3?

A) 8 B) 2 C) 16 D) 4

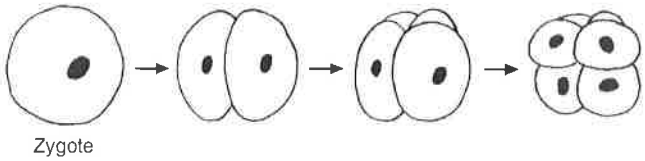
Part of a process necessary for reproduction in complex organisms is represented below.



6. Step *C* results in the production of

A) four zygotes that will develop into embryos
B) embryonic cells that could unite and develop into an organism
C) four cells that will recombine to form two offspring
D) gametes that could be involved in the formation of a zygote

The diagram below represents some stages of early embryonic development.



8. Which process is represented by the arrows in the diagram?

A) meiosis
B) fertilization
C) mitosis
D) evolution

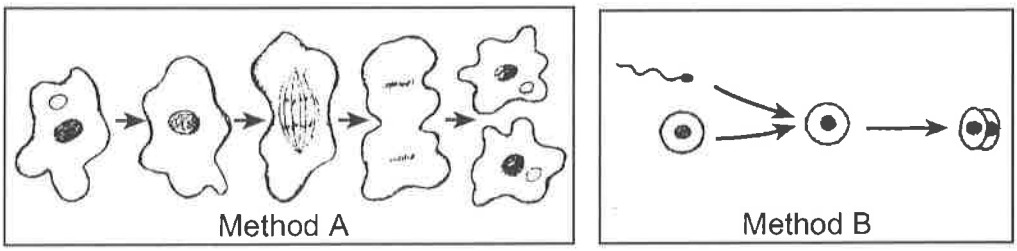
9. Which process allows a mammal to continue to grow in size?

A) mitosis of sex cells
B) mitosis of body cells
C) meiosis of sex cells
D) meiosis of body cells

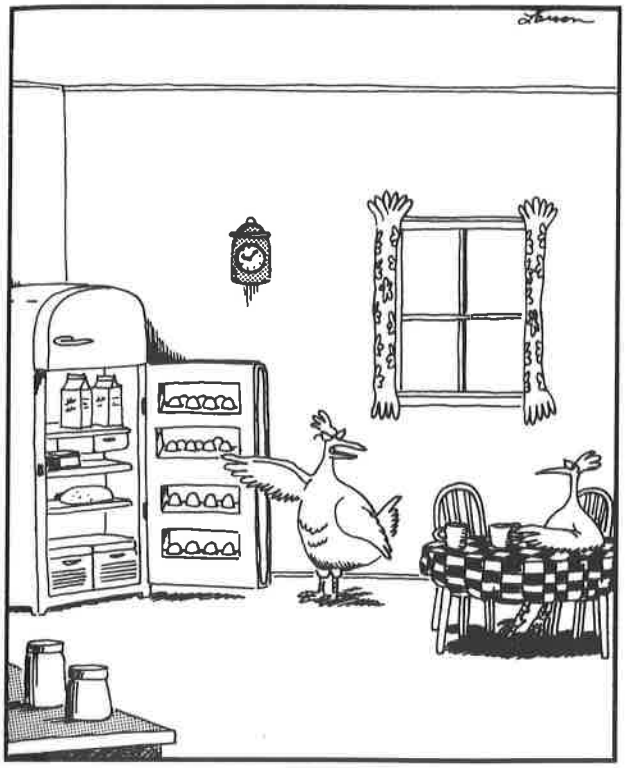
10. Compared to a normal body cell, a normal egg cell contains

A) the same number of chromosomes
B) half the number of chromosomes
C) twice the number of chromosomes
D) four times the number of chromosomes

7. How does the type of reproduction shown in method *A* in the diagram below differ from the type of reproduction shown in method *B*?



A) Method *A* illustrates sexual reproduction, and method *B* illustrates asexual reproduction.
B) Offspring produced by method *B* will be genetically alike, but offspring produced by method *A* will be genetically different.
C) The two cells shown in the last step of method *A* are genetically alike, but the two cells shown in the last step of method *B* are genetically different.
D) Offspring produced by method *A* will be genetically like the parent, but offspring produced by method *B* will be genetically different from the parents.



"Well, here's your problem, Marge — if you and Bob really want kids, next time try sittin' on these little guys."