

Name _____ Period _____ Date _____

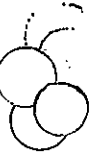
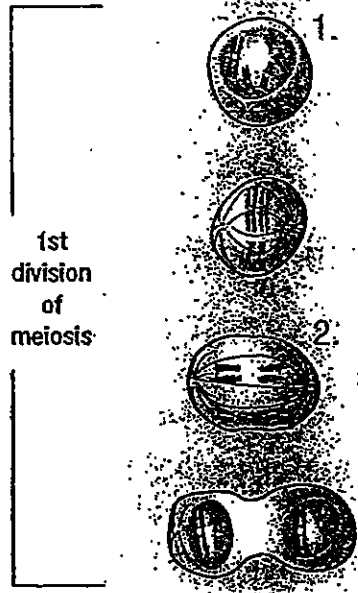
Notes: Meiosis

1. Meiosis is part of _____
2. Meiosis is defined as _____

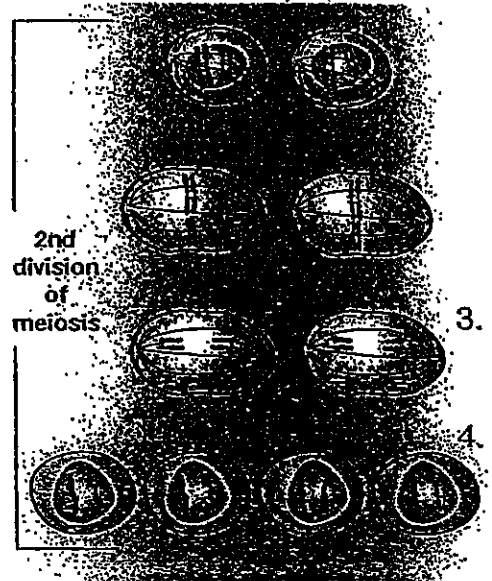
3. What is the result of meiosis?

4. Sex cells are also called _____
5. Male sex cells are called _____ or _____
6. Female sex cells are called _____ or _____
7. A complete set of chromosomes is called a _____ set.
8. A half set of chromosomes is called a _____ set.
9. Most body cells have a diploid set of chromosomes except in _____
10. Fertilization is the _____
11. Fertilization = _____ + _____ = _____
$$\begin{array}{ccccccc} & & n & & n & & 2n \\ & & \text{_____} & + & \text{_____} & = & \text{_____} \\ & & \text{_____} & & \text{_____} & & \text{_____} \end{array}$$
12. Human body cells have _____ chromosomes.
13. Human sex cells have _____ chromosomes.

14. 1st division of meiosis:



15. 2nd division of meiosis:



16. An _____ is an organism in its earliest stages of development.



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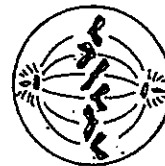
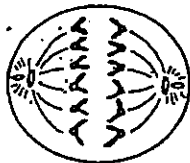
REVIEW: MITOSIS and MEIOSIS

1. What is mitosis? _____
2. What is cytokinesis? _____
3. What two stages are included in cell division? _____
4. What are two reasons that cell division is important in organisms? _____

5. Why are skin cells undergoing cell division continuously? _____

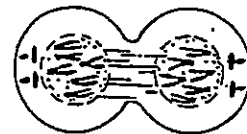
6. Once the chromosomes have been copied the cell is ready to _____.
7. How many chromosomes does each new daughter cell contain after cell division, if the parent had 50 chromosomes? _____
8. Why is cell division a form of ASEXUAL reproduction? _____
9. What is interphase? _____

Label the following diagrams with correct stage of mitosis.



1. _____

2. _____



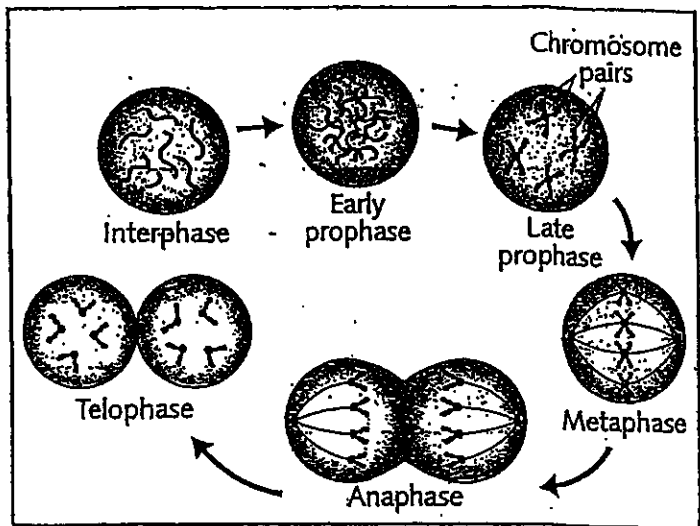
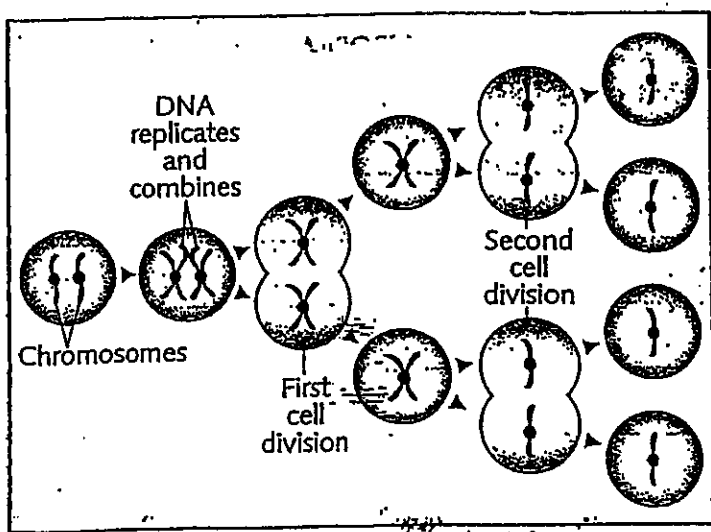
3. _____

4. _____

MEIOSIS:

1. What is meiosis? _____
2. What does diploid mean? _____
3. What does haploid mean? _____
4. What are gametes? _____
5. How many chromosomes does the gametes have if the parent cell has 50 chromosomes? _____
6. What is fertilization? _____
7. What name is given to the gametes or sex cell in male animals? _____
8. What name is given to the gametes or sex cell in female animals? _____

Label the diagrams below as either mitosis or meiosis:



LESSON 19

What is meiosis?

In asexual reproduction there is only one parent and one set of chromosomes. The chromosomes are duplicated. The offspring are just like the parent.

Sexual reproduction is different. In sexual reproduction, there are two parents—two sets of chromosomes. A new organism is formed with one set of chromosomes from each parent. The offspring inherits traits from both parents.

Think of yourself, for example. In some ways you are like your mother. In other ways you are like your father. You have inherited traits from both your parents.

How are chromosomes exchanged during sexual reproduction? The chromosomes of body cells are paired. The chromosomes of sex cells are not paired. Chromosomes of sex cells are single chromosomes. Therefore, a sperm or an egg cell has only half as many chromosomes as a body cell.

When fertilization takes place, the sperm chromosomes join the egg chromosomes. Together, they add up to the full number of chromosomes found in body cells.


The fertilized egg, or zygote, now has chromosomes from both parents. It also has traits from both parents.

Reproductive cells also are called gametes (GAM-eets). Gametes develop from special cells in the body. The process by which gametes form is called meiosis (my-oh-sis). You can see the process of meiosis on the next page.


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Meiosis


1. Original cell with two pairs of chromosomes.




2. Each pair of chromosomes doubles, and is now made of two chromatids (the original and an exact copy.)




3. Spindle fibers form in the cell. The pairs of chromosomes (called homologous chromosomes) attach to the spindle fibers, and line up at the center of the cell.




4. The chromosomes separate.




5. FIRST DIVISION—The cell splits in two, with each cell containing one double chromosome from each homologous pair.




6. Spindle fibers form in each new cell. Double chromosomes attach to the spindle fibers, and line up at the center of the cell.



7. The double chromosomes split. One chromosome goes to each side of the cell. Then, each cell splits.



8. SECOND DIVISION—Four cells are produced. Each cell has one chromosome pair. The cells are called sex cells, or gametes.



Meiosis I

Meiosis II

ONLY HALF THE STORY!

Body cells are produced by mitosis. But sperm and egg cells do not form this way. Reproductive cells are formed by meiosis: Each gamete has only half the usual number of chromosomes. But when the sperm and egg join, the zygote has the full number of chromosomes.

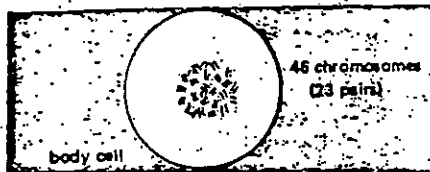


Figure B

A human body cell has 46 chromosomes. The chromosomes are paired. So there are 23 pairs.

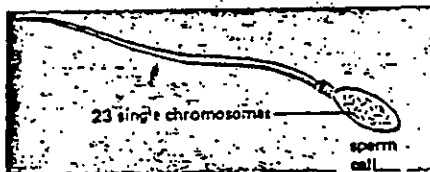


Figure C

Each human sperm cell has 23 single chromosomes.

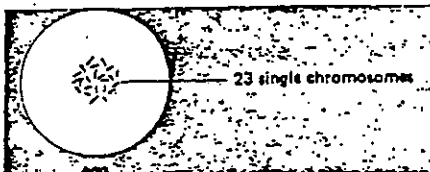


Figure D

Each human egg cell has 23 single chromosomes.

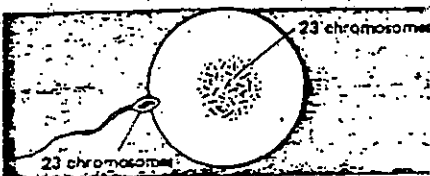


Figure E

Fertilization links the gamete chromosomes.

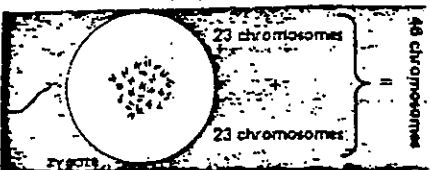


Figure F

The zygote, then has a total of 46 chromosomes. 23 are from the mother, 23 are from the father.

The zygote starts to divide after fertilization. It divides by mitosis. It divides over and over again as it develops.

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MEIOSIS WORKSHEET

True or False:

- _____ 1. The chromosomes of body cells are paired.
- _____ 2. The process by which gametes form is meiosis.
- _____ 3. Human body cells have 23 chromosomes.
- _____ 4. In sexual reproduction, the offspring inherits traits from only one parent.
- _____ 5. Fertilization combines the chromosomes of gametes.
- _____ 6. Every organism has the same number of chromosomes.
- _____ 7. A gamete has the same number of chromosomes as a body cell
- _____ 8. A gamete has twice the number of chromosomes as a body cell
- _____ 9. A frog gamete has 13 chromosomes, so a frog body cell has 26 chromosomes.

Fill In The Blanks: Complete each sentence using the terms below.

one set
half
two

parent
traits
meiosis

just like
paired

1. In asexual reproduction there is only one _____.
2. In asexual reproduction, _____ of chromosomes is passed on from parent to offspring.
3. In asexual reproduction, offspring are _____ the parent.
4. In sexual reproduction, there are _____ parents. Offspring inherit _____ from both parents.
5. Gamete cells are produced by cell division called _____.
6. A sperm or egg cell has only _____ as many chromosomes as a body cell.
7. Chromosomes in a body cell are _____.

More About Meiosis:

Scientists often study fruit flies because they have only a few, large chromosomes, making it easy to count.

- Every body cell of a Fruit Fly has 8 chromosomes
- Every Fruit Fly gamete (egg or sperm) has 4 chromosomes

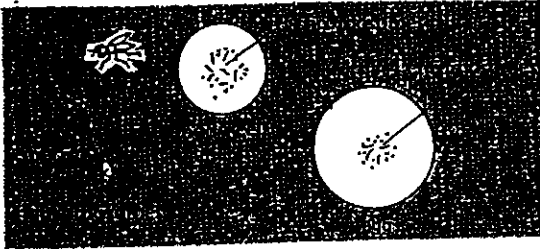


Figure G

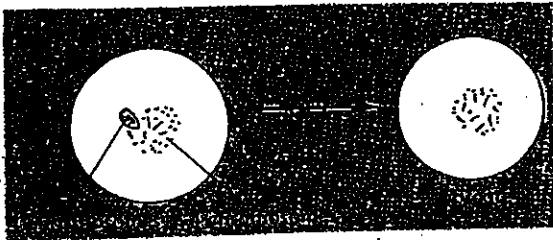


Figure H A sperm fertilizes an egg.

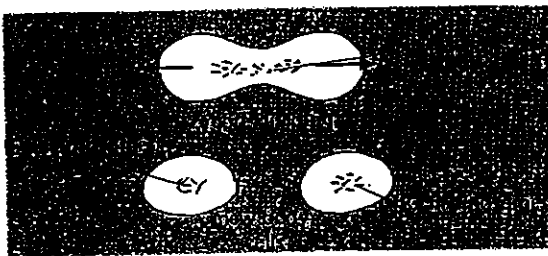


Figure I The zygote divides. Then each new cell divides.

1. Body cells reproduce by a process called _____
2. Gamete cells are formed by a process called _____
3. How many chromosomes does an egg cell of a fruit fly have? _____
4. How many in a sperm cell? _____
5. What do chromosomes control?

6. How many chromosomes does a fruit fly zygote have? _____
7. How many chromosomes does each body cell have? _____
8. Why do the fruit fly offspring have traits of both the mother and father?

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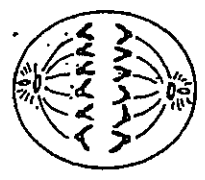
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9. What is interphase? _____

Label the following diagrams with correct stage of mitosis.



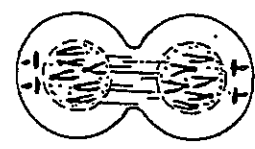
1. _____



2. _____



3. _____

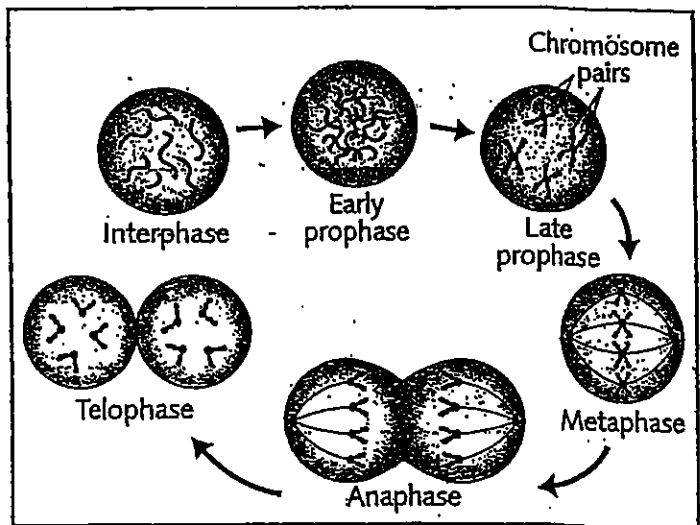
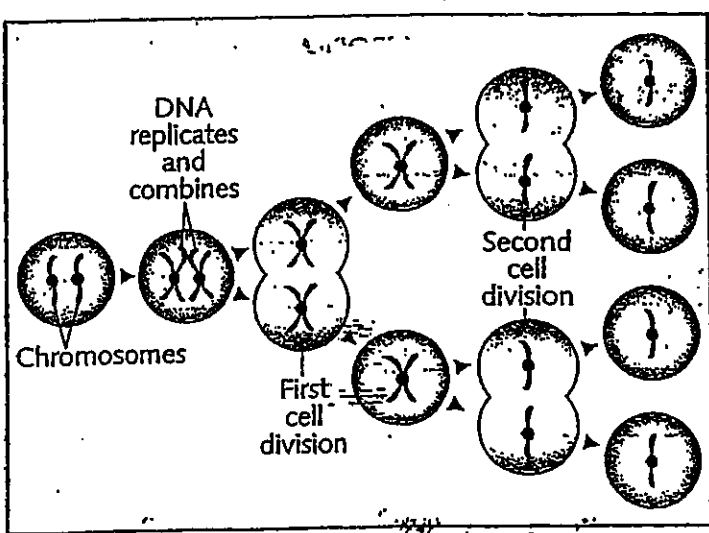


4. _____

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Label the diagrams below as either mitosis or meiosis:



At this very moment, about 25 million cells are dividing in your body. Cell division is coded into the DNA of every living thing. It's how life replaces and repairs worn-out cells, grows, and reproduces.

In fact, prokaryotic organisms like bacteria reproduce *only* by cell division. There are no females or males. The DNA just replicates itself. The "mother" cell pinches in two to form two identical "daughter" cells. Where there was one life, now there are two.

In eukaryotic cells, it's more complicated. When a cell divides, the result is the same—two cells with identical DNA, but the process takes place inside the cell nucleus. It's called *mitosis* (my•TOE•sis).

In all eukaryotic life, DNA is arranged in *chromosomes* (CROW•muh•zomes) in every cell nucleus. Chromosomes always occur in pairs. Each form of life has a consistent number of them. Corn, for instance, has 10 pairs. Fruit flies have four, and humans have 23. Between cell divisions, the chromosomes are unwound, but they don't appear as separate when seen through a microscope. This "resting" stage of mitosis is called *interphase*. Before the cell divides, the chromosomes are replicated, each joined to its copy.

The next stage of mitosis is called *prophase*, when the chromosomes shorten and become

distinct, and the protein "envelope" around the nucleus begins to break up.

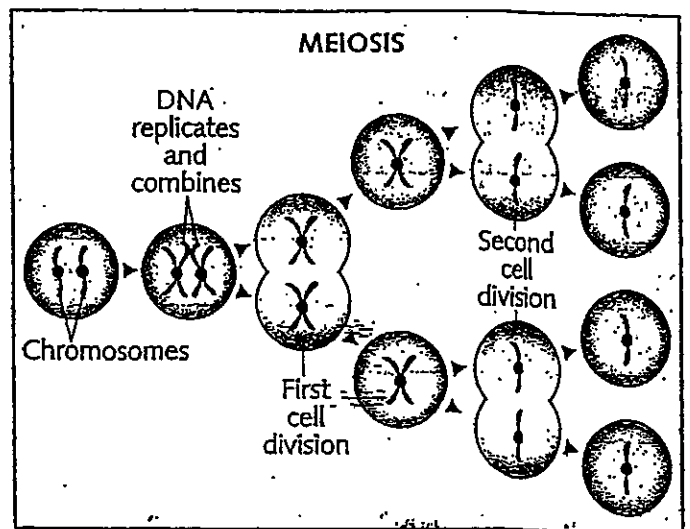
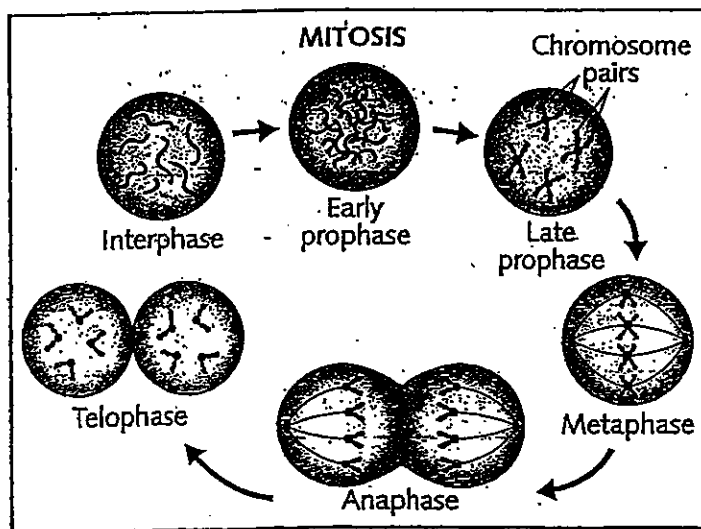
In the next stage, *metaphase*, the nuclear envelope is gone, and the chromosomes line up in the middle of the cell.

Then comes *anaphase*. The duplicate chromosomes separate from one another and are pulled to opposite ends of the cell.

The last stage of mitosis is *telophase*, when two "daughter" nuclei form. Each has a complete set of DNA and a nuclear envelope. The cell divides around the new nuclei, and the two cells enter interphase until their next division.

There's another kind of cell division that takes place in some human cells and in other forms of life, called *meiosis* (my•OH•sis). It follows the same stages as mitosis, but with important differences. In meiosis, chromosomes divide twice. The first time, DNA from one of each pair may randomly exchange with DNA from the other. The second time, the chromosomes themselves randomly divide, one from each pair, into separate cells, so each daughter cell (in humans) has 23 chromosomes, not 23 pairs.

These are the sex cells—eggs or sperm. One may join with the other, forming a new cell with 23 pairs of chromosomes, which contains a random mix of DNA, half from each parent. Now you know why people, dogs, or oak trees display more variety than any species of bacteria.



1. Each human cell has _____ pairs of chromosomes.
 10 23 32 46
2. This article mostly describes _____.
 mitosis meiosis cell processes chromosomes
3. Because of meiosis, you can conclude that _____.
 a daughter will always look like her mother
 a brother and sister will have an exact replica of their parents' DNA
 a child might not have 23 pairs of chromosomes
 a child might not look exactly like either parent
4. In mitosis, which of these steps happens *last*?
 anaphase metaphase prophase telophase
5. Which of these is the best explanation of why cell division takes place?
 Cell division is happening in your body, too.
 It's coded into the DNA of every living thing.
 It's how life replaces and repairs worn-out cells.
 Mitosis takes place inside the cell nucleus.
6. In paragraph 2, the word replicates means _____.
 copies exactly grows and develops
 moves around communicates



Write your answer to the following question on the lines below.

How does the article explain why people display more variety than any species of bacteria?

