

## Meiosis Worksheet

**Identifying Processes** On the lines provided, **order** the different stages of meiosis I THROUGH meiosis II, including interphase in the proper sequence.

1. \_\_\_\_\_ homologous chromosome line up in the center of the cell
2. \_\_\_\_\_ spindle fibers pull homologous pairs to ends of the cell
3. \_\_\_\_\_ 4 haploid (N) daughter cells form
4. \_\_\_\_\_ cells undergo a round of DNA replication
5. \_\_\_\_\_ sister chromatids separate from each other
6. \_\_\_\_\_ 2 haploid (N) daughter cells form
7. \_\_\_\_\_ spindle fibers attach to the homologous chromosome pairs
8. \_\_\_\_\_ individual chromatids move to each end of the cell
9. \_\_\_\_\_ crossing-over (if any) occurs

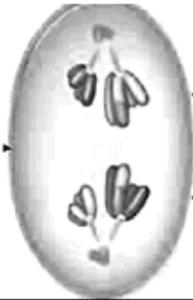
### Short Answer

10. Compare the number and type of cells that result from meiosis vs. mitosis.
  
  
  
  
  
  
  
  
  
  
11. How do the genetic contents of cells resulting from mitosis and meiosis differ?
  
  
  
  
  
  
  
  
  
  
12. **Comparing and Contrasting** Describe a similarity and a difference between meiosis I and meiosis II.
  
  
  
  
  
  
  
  
  
  
13. **Applying Concepts** If a diploid cell containing 28 chromosomes undergoes meiosis, how many chromosomes will each daughter cell have?
  
  
  
  
  
  
  
  
  
  
14. **Compare and Contrast:** How are mitosis and meiosis similar and different?

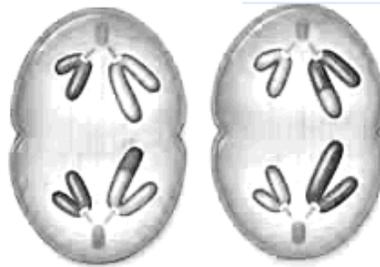
Read each statement, and then on the line write down the phase of mitosis or meiosis that the action occurs. IF the action occurs in both, write both. The first one is done for you

- |                       |                      |  |
|-----------------------|----------------------|--|
| 1. <b>metaphase I</b> | <b>meiosis</b> _____ | homologous chromosome line up in the center of the cell        |
| 2.                    | _____                | The individual chromosomes move apart.                         |
| 3.                    | _____                | spindle fibers pull homologous pairs to ends of the cell       |
| 4.                    | _____                | 4 haploid (N) daughter cells form                              |
| 5.                    | _____                | cells undergo a round of DNA replication                       |
| 6.                    | _____                | The chromosomes line up across the middle of the cell.         |
| 7.                    | _____                | Chromosomes become visible.                                    |
| 8.                    | _____                | sister chromatids separate from each other                     |
| 9.                    | _____                | 2 haploid (N) daughter cells form                              |
| 10.                   | _____                | Sister chromatids separate into individual chromosomes.        |
| 11.                   | _____                | Nuclear envelope re-forms.                                     |
| 12.                   | _____                | spindle fibers attach to the homologous chromosome pairs       |
| 13.                   | _____                | individual chromatids move to each end of the cell             |
| 14.                   | _____                | The nucleolus disappears and the nuclear envelope breaks down. |
| 15.                   | _____                | Each chromosome is connected to a spindle fiber.               |
| 16.                   | _____                | crossing-over (if any) occurs                                  |

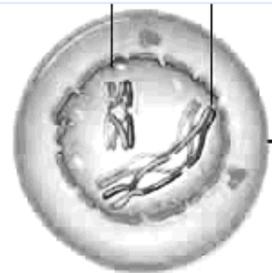
IDENTIFY THE PHASES OF MEIOSIS:



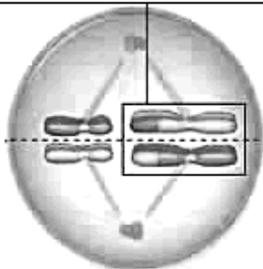
1.



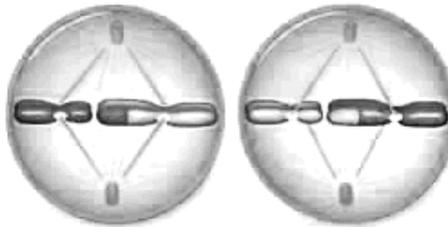
2.



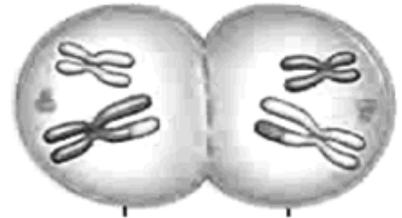
3.



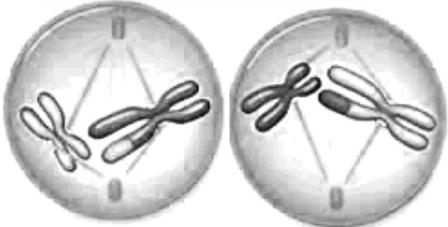
4.



5.



6.



7.



8.

**VOCABULARY:**

- \_\_\_\_\_ 1. **Asexual reproduction**
- \_\_\_\_\_ 2. **Asters**
- \_\_\_\_\_ 3. **Cell cycle**
- \_\_\_\_\_ 4. **Cell plate**
- \_\_\_\_\_ 5. **Centromere**
- \_\_\_\_\_ 6. **Chiasma**
- \_\_\_\_\_ 7. **Chromatid**
- \_\_\_\_\_ 8. **Chromatin**
- \_\_\_\_\_ 9. **Chromosomes**
- \_\_\_\_\_ 10. **Clone**
- \_\_\_\_\_ 11. **Crossing over**
- \_\_\_\_\_ 12. **Cytokinesis**
- \_\_\_\_\_ 13. **Diploid**
- \_\_\_\_\_ 14. **Fertilization**
- \_\_\_\_\_ 15. **Gamete**
- \_\_\_\_\_ 16. **Haploid**
- \_\_\_\_\_ 17. **Interphase**
- \_\_\_\_\_ 18. **Karyotype**
- \_\_\_\_\_ 19. **Kinetochores**
- \_\_\_\_\_ 20. **Meiosis**
- \_\_\_\_\_ 21. **Metaphase**
- \_\_\_\_\_ 22. **Mitosis**
- \_\_\_\_\_ 23. **Prophase**
- \_\_\_\_\_ 24. **S phase**
- \_\_\_\_\_ 25. **Sexual reproduction**
- \_\_\_\_\_ 26. **Spindle**
- \_\_\_\_\_ 27. **Synapsis**
- \_\_\_\_\_ 28. **Telophase**
- \_\_\_\_\_ 29. **Tetrad**
- \_\_\_\_\_ 30. **Zygote**

- A. Division of the cell nucleus, results in two daughter nuclei, each have the same number of chromosomes as the parent nucleus.
- B. One two identical halves of a duplicated chromosome
- C. Clusters of microtubules radiating out from the poles in dividing cells. They are present in animal cells, but not in the cells of flowering plants and most gymnosperms.
- D. The breaking and rejoining of homologous (non sister) chromatids during early meiotic prophase I, resulting in an exchange of genetic material.
- E. The  $2n$  cell that results from the union of  $n$  gametes in sexual reproduction. Species that are not polyploidy have haploid gametes and diploid zygotes.
- F. The stage of mitosis, and of meiosis I and II, in which the chromosomes line up on the equatorial plane of the cell.
- G. The condition of having one set of chromosomes per nucleus.
- H. The complex of DNA, proteins and some RNA that makes up eukaryotic chromosomes.
- I. Structures in the cell nucleus, composed of chromatin and containing the genes
- J. Cyclic series of events in the life of a dividing eukaryotic cell; consists of stages of interphase, mitosis and cytokinesis
- K. The first stage of mitosis, and of meiosis I and II; chromosomes become visible as distinct structures, the nuclear envelope breaks down, and a spindle forms
- L. An X-shaped site in a tetrad marking the location where homologous chromatids previously underwent crossing over
- M. A sex cell; in plants and animals, an egg or sperm.
- N. Type of reproduction in which two gametes (usually, but not necessarily, contributed by two different parents) fuse to form a zygote.
- O. The chromosomal constitution of an individual; generally prepared by photographing the chromosomes and arranging the homologous pairs according to size, centromere position and pattern of bands.
- P. Structure consisting mainly of microtubules that provides the framework for chromosome movement during cell division
- Q. Process in which a  $2n$  cell undergoes two successive nuclear divisions, potentially producing four nuclei; leads to the formation of gametes in animals and spores in plants.
- R. A type of reproduction involving only one parent (genetically identical offspring.)
- S. Stage of the cell cycle between successive mitotic divisions; Its subdivisions are the  $G_1$  (first gap), S (DNA synthesis) and  $G_2$  (second gap) phases.
- T. Stage in interphase of the cell cycle during which DNA and other chromosomal constituents are synthesized.
- U. Chromosome complex formed by the synapsis of homologous chromosomes during meiotic prophase I.
- V. A population of cells descended by mitotic division from a single ancestral cell, or a population of genetically identical organisms asexually propagated from a single individual.
- W. The condition of having two sets of chromosomes per nucleus.
- X. Stage of cell division in which the cytoplasm is divided to form two daughter cells.
- Y. Portion of the chromosome centromere to which the mitotic spindle fibers attach.
- Z. The process of physical association of homologous chromosomes during prophase I
- AA. The structure that forms during cytokinesis in plants, separating the two daughter cells produced by mitosis.
- BB. Fusion of  $n$  gametes; results in the formation of a  $2n$  zygote.
- CC. Specialized constricted region of a chromatid; contains the kinetochore.  
In cells at prophase and metaphase, sister chromatids are joined in the vicinity of their centromeres.
- DD. The last stage of mitosis, and of meiosis I and II, when, having reached the poles, chromosomes become decondensed, and a nuclear envelope forms around each group.

MULTIPLE CHOICE:

1. During which phase of the meiotic cell cycle does DNA replication occur?
  - a. interphase
  - b. prophase
  - c. metaphase
  - d. anaphase
  - e. telophase
  
2. When does crossover take place in meiosis?
  - a. interphase
  - b. prophase
  - c. metaphase
  - d. anaphase
  - e. telophase
  
3. During which phase of meiosis does the nuclear membrane reform around chromosomes?
  - a. interphase
  - b. prophase I
  - c. metaphase II
  - d. anaphase I
  - e. telophase II
  
4. A human cell containing 22 autosomes and a Y chromosome is...
  - a. a somatic cell of a male
  - b. a zygote
  - c. a somatic cell of a female
  - d. a sperm cell
  - e. an ovum
  
5. Homologous chromosomes move towards opposite poles of a dividing cell during...
  - a. mitosis
  - b. meiosis I
  - c. meiosis II
  - d. fertilization
  - e. binary fission
  
6. Meiosis II is similar to mitosis in that...
  - a. homologous chromosomes synapse
  - b. DNA replicates before the division
  - c. the daughter cells are diploid
  - d. sister chromatids separate during anaphase
  - e. the chromosome number is reduced
  
7. Metaphase of meiosis I and meiosis II differ in that...
  - a. chromosomes line up at the equator
  - b. homologues line up in meiosis I and duplicated chromosomes line up in meiosis II
  - c. sister chromatids line up in meiosis I and chromosomes line up in meiosis II
  - d. there are the same number of chromosomes

8. Asexually reproducing organisms produce offspring that are genetically identical to each other and to the parents. What type of cell division are the offspring a product of?
- mitosis
  - meiosis
  - binary fission
  - fertilization
9. At which stage of meiosis do chromatids separate and become daughter chromosomes?
- metaphase I
  - anaphase I
  - metaphase II
  - anaphase II
  - telophase II
10. The process in which haploid gametes are formed in diploid organisms is called:
- cytokinesis
  - interphase
  - meiosis
  - mitosis
  - nuclear division
11. Which of the following correctly ranks nucleic acid structures in order of size, from smallest to largest?
- chromosome, nucleotide, gene, codon
  - nucleotide, codon, gene, chromosome
  - chromosome, gene, codon, nucleotide
  - codon, nucleotide, chromosome gene
12. A human cell containing 44 autosomes and two X chromosomes is...
- a somatic cell of a male
  - a zygote
  - a somatic cell of a female
  - a sperm cell
  - an ovum
13. Independent assortment is one of the factors that contributes to genetic diversity. Independent assortment is associated with which stage of meiosis?
- anaphase I
  - prophase I
  - metaphase I
  - anaphase II
  - metaphase II
14. The fertilized egg (zygote) of a human contains how many chromosomes?
- 1
  - 22
  - 46
  - 23
  - 48

15. Which cells of the human body are made through the process of meiosis?

- a. gametes
- b. somatic cells
- c. all cells of the body
- d. X and Y chromosomes
- e. autosomes

16. A \_\_\_\_\_ is the complete set of chromosomes of an organism, arranged and displayed in pairs and ordered by size. (Select the BEST answer.)

- a. genome
- b. karyotype
- c. nucleus
- d. heredity
- e. gene

17. Which 2 cells would be more genetically similar to each other?

- a. two gametes produced by the same person
- b. two somatic cells produced by the same person
- c. two eggs produced by the same woman
- d. two sperm produced by the same man

18. If a diploid organism has a genome consisting of 22 chromosomes, its gametes will have \_\_\_\_\_ chromosomes.

- a. 44
- b. 11
- c. 22
- d. 88
- e. 19

19. When does DNA replication occur during meiosis?

- a. interphase I
- b. prophase I
- c. interphase II
- d. prophase II
- e. interphase I and II

20. The term 'synapsis' is associated with which process?

- a. crossing over
- b. independent assortment
- c. mitosis
- d. anaphase
- e. fertilization