

Name _____ Period _____

Chapter 13: Meiosis and Sexual Life Cycles

Concept 13.1 Offspring acquire genes from parents by inheriting chromosomes

1. Let's begin with a review of several terms that you may already know. Define:

gene

locus

gamete

male gamete

female gamete

asexual reproduction

sexual reproduction

2. How many chromosomes are in human cells? What *is* a chromosome?
3. Which type of reproduction will result in genetically identical offspring?

Concept 13.2 Fertilization and meiosis alternate in sexual life cycles

4. What is a *somatic cell*? Give examples of two human somatic cell types.
5. How does a somatic cell compare to a gamete in terms of chromosome number?

6. Distinguish between *sex chromosomes* and *autosomes*. How many of each are found in human cells?

	Explanation	# in Human Cells
<i>Sex chromosome</i>		
<i>Autosome</i>		

7. What is a *karyotype*? How is it prepared? What are three things that can be determined from a karyotype?

8. Explain what is meant by *homologous chromosomes*.

9. Cells that have only one of each homologous pair are said to be *haploid*, a condition that is represented by n . Cells that have two of each homologous pair are said to be *diploid* or $2n$. For each of the following, is the cell haploid or diploid?

liver cell _____ gamete _____

egg _____ zygote _____

skin cell _____ sperm _____

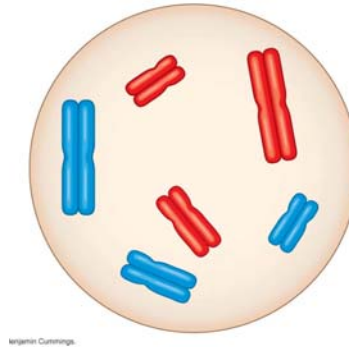
somatic cell _____ sex cell _____

10. The muscle cells of a dog have 78 chromosomes. Fill in the correct chromosome number in a:

bone cell _____ sperm _____ haploid cell _____ somatic cell _____ zygote _____

11. In the cell at right, the chromosomes are shaded in two colors to represent the parent of origin. On this sketch, label the following:

- a. *sister chromatids*
- b. *homologous chromosomes*
- c. *centromere*
- d. *replicated chromosome*
- e. *maternal chromosomes*



12. How many chromosomes does the cell above have?
How many homologous pairs?
How many chromatids?
Is this cell haploid or diploid?
13. Where are the *gametes* of an animal produced? Be specific as to male and female gametes.
14. By what process are gametes produced?
15. What is another term for a fertilized egg? _____ What is the chromosome number of the fertilized egg? (Answer this in general terms, haploid, n , or diploid, $2n$.)
16. What is the purpose of *meiosis*?
17. Study Figure 13.6. You will see that plants have a life cycle that involves spores, which form as a result of meiosis, so these spores are haploid. Notice also that *both* haploid and diploid cells can divide by mitosis. However, meiosis always begins with cells that are _____, and as a result of meiosis, daughter cells are formed that are always _____. These cells can be gametes (in animals) or spores (in plants).

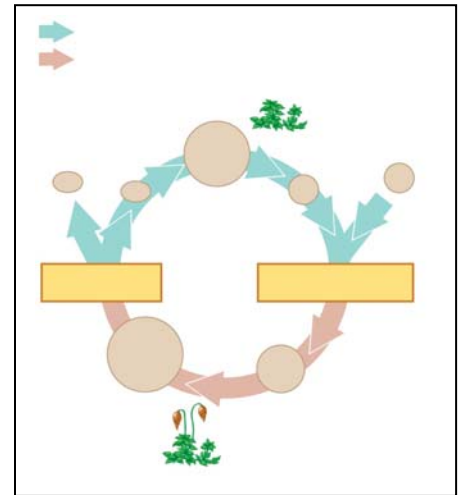
18. Your study of plants this year will include knowing that they exhibit *alternation of generations*.

What does this mean?

What are the two generations?

Which is haploid, and which is diploid?

Use this information to label the moss life cycle here.



Concept 13.3 Meiosis reduces the number of chromosome sets from diploid to haploid

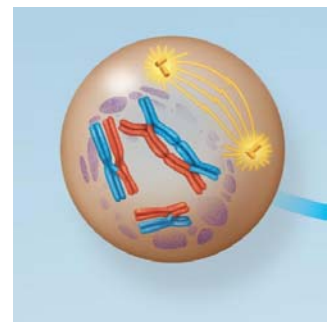
19. What are *alleles*? Give an example.
20. In meiosis, the DNA is replicated during interphase, followed by two divisions. The first division is meiosis I. Study the events of *prophase I* as they are significant. Explain each of these events:

synapsis

crossing over

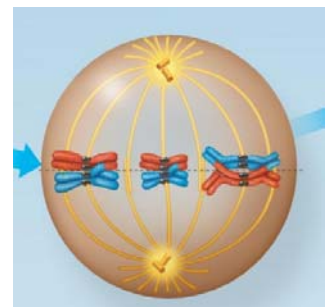
chiasmata

PROPHASE I



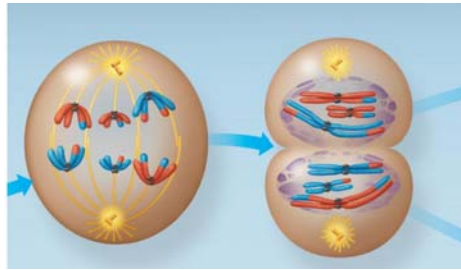
21. The figure at the right shows metaphase I. How is the arrangement of chromosomes different from metaphase of mitosis?

METAPHASE I



22. There will be two divisions in meiosis. What will separate in the first division in meiosis I?
23. Now study the chromosomes in *anaphase I* and *telophase I* carefully. How many chromosomes are in each cell at the end of the first meiotic division?

Are the resultant daughter cells haploid, or diploid?



ANAPHASE I TELOPHASE I

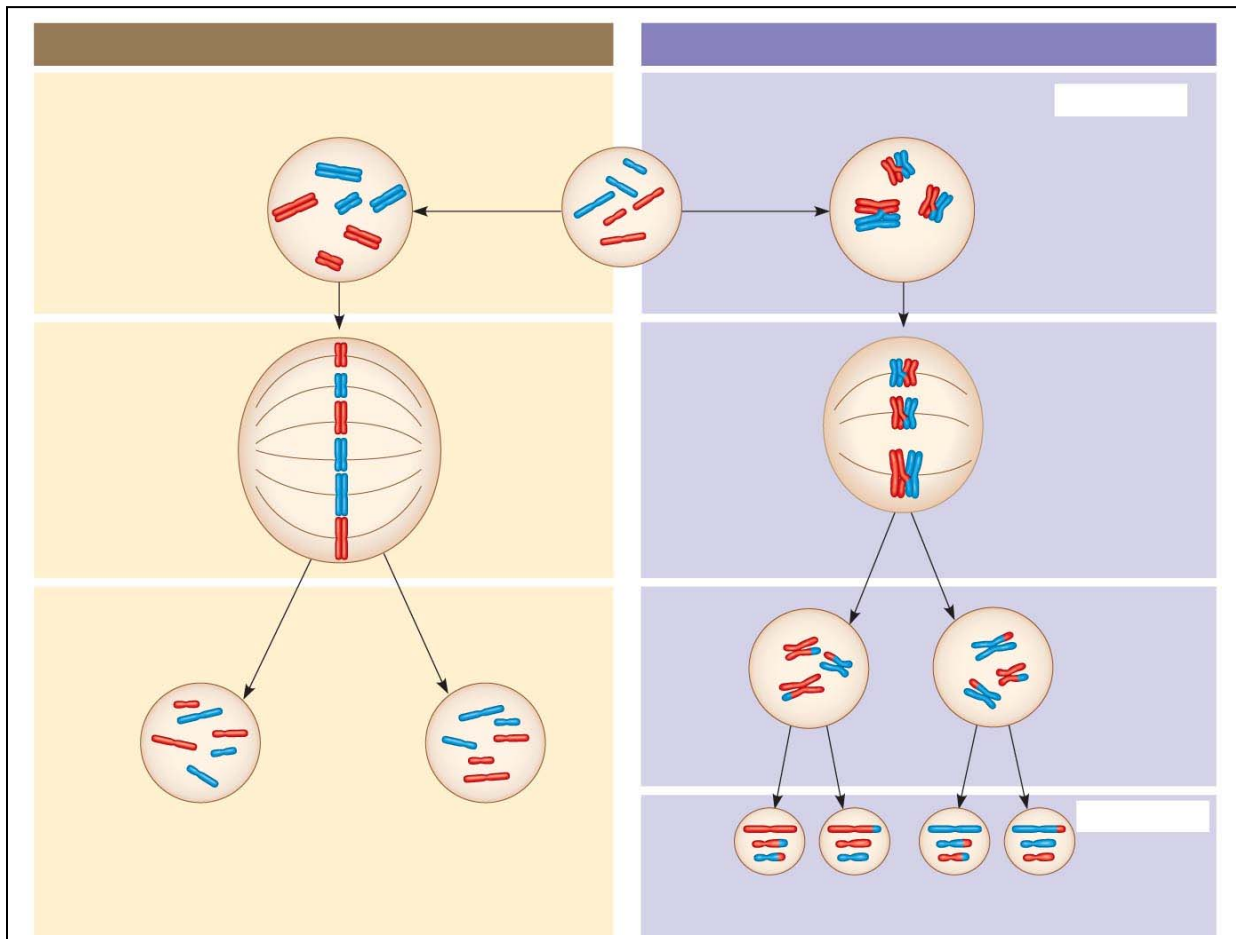
24. From this figure, you should see that chromosome number is reduced in meiosis I and that the daughter cells at the end of meiosis I are haploid. Remember this!
25. During meiosis I, homologous chromosomes separate. What separates during meiosis II?
26. To check that you have the big picture, here are some quick review questions.
- What happens to chromosome number in meiosis?
 - During which division is the chromosome number reduced?
 - What is the purpose of meiosis?
 - How many times does the cell divide in meiosis?
 - How many times do the chromosomes duplicate?
 - How many daughter cells are formed?
 - What is the chromosome number?

- h. What are *homologs* (*homologous chromosomes*)?
- i. What occurs in *synapsis*?
- j. What is *crossing over*?

27. Use Figure 13.9 to compare of mitosis and meiosis. Add these labels:

Parent cell, Mitosis, Meiosis, Synapsis, Homologous chromosomes, Replicated chromosomes, Sister chromatids, Daughter cells, Meiosis I, Meiosis II, Crossing over

As you label the drawing, carefully think about each process and review its important features.



28. Students often get confused about the differences between mitosis and meiosis. To help with this, work through the following chart:

	Mitosis	Meiosis
Role in the animal body		
Number of DNA replications		
Number of divisions		
Number of daughter cells		
Chromosome number of daughter cells		

29. Synapsis and crossing over are unique to meiosis. During what specific phase do these occur?
30. Explain the physical events of crossing over. You may wish to make a sketch of the event. Include these terms: *synaptonemal complex*, *chiasmata*, *homologs*, *sister chromatids*.

Concept 13.4 Genetic variation produced in sexual life cycles contributes to evolution

31. An important idea for you to understand is that new alleles arise by changes in the DNA or mutation, but genetic diversity occurs when the deck that is dealt is simply reshuffled. So, there are three ways that sexually reproducing organisms “shuffle the deck.” They are listed below. Explain what occurs in each, and how this increases diversity.

independent assortment of chromosomes

crossing over

random fertilization

32. Here is a fun exercise to drive this point home. Pull out your calculator, and try your hand at this: When you were conceived, what were the odds that of the many possibilities, your parents would come up with *you*?

a. The number of different gametes that can be formed because of independent assortment is

$2n$, where n = the number of homologous pairs

Therefore, since humans have 46 chromosomes or 23 homologous pairs, what is the number of possible gametes that can be formed due to independent assortment of chromosomes?

b. Now, this is the number of unique gametes your mom could have made. Your father could have made the same number. To see the effect of random fertilization, multiply the number of gametes one parent could make by the number of unique gametes the other parent could make.

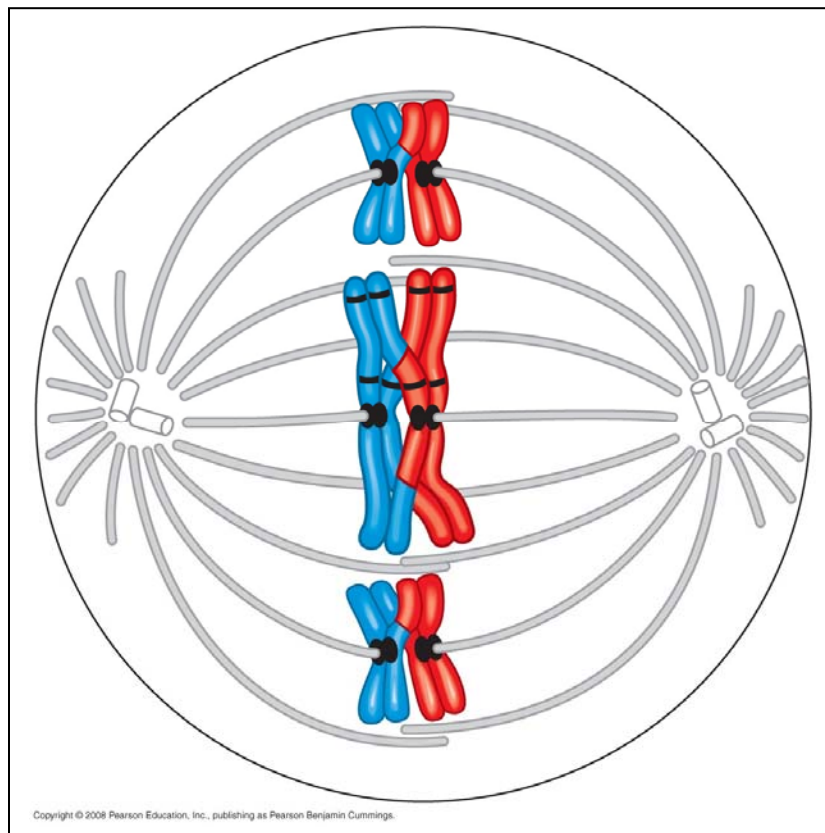
Your answer should be in the *trillions*, and all of this is *without* crossing over. See how special you are?

Testing Your Knowledge: Self-Quiz Answers

Now you should be ready to test your knowledge. Place your answers here:

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____

Follow the directions for Self-Quiz question 10, **DRAW IT** by labeling the appropriate structures with these terms, drawing lines or brackets as needed: chromosome (label as replicated or unreplicated), centromere, kinetochore, sister chromatids, nonsister chromatids, homologous pair, homologs, chiasma, sister chromatid cohesion, and then answer questions 8 and 9.



8. _____

9. _____