Diagram
1. Label the side that is mitosis and meiosis.
2. Draw an arrow indicate DNA replication (S-stage).
3. Label the place where crossing over occurs.
4. On mitosis: label metaphase anaphase and cytokinesis.
5. On meiosis: label metaphase1, anaphase1, cytokinesis1. What stages are missing in the mitosis diagram?

Situational Vocabulary Circle the letter of the situation that most closely relates to each vocabulary word.
1) fertilization: a) union of gametes; b) division of chromosomes
2) diploid: a) a dollar; b) fifty cents
3) sexual reproduction: a) produces genetically identical offspring; b) produces genetically unique offspring
4) trait: a) inheriting your father’s laugh; b) inheriting your father’s watch
5) homologous chromosomes: a) carry the same genes; b) carry identical alleles
6) genome: a) like a computer hard drive; b) like a computer screen
7) polar body: a) becomes a baby; b) becomes broken down by the body
8) meiosis: a) preserves chromosome number; b) reduces chromosome number
### Comparing Mitosis and Meiosis

<table>
<thead>
<tr>
<th>Topic</th>
<th>Mitosis</th>
<th>Meiosis</th>
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</thead>
<tbody>
<tr>
<td>How chromosomes line up in metaphase (1)</td>
<td>Individually</td>
<td>In tetrads, or homologous pairs</td>
</tr>
<tr>
<td>Number of DNA replications</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Number of nuclear divisions</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Number of chromosomes in daughter cells</td>
<td>diploid - 2n - 46</td>
<td>haploid - n - 23</td>
</tr>
<tr>
<td>Genetic similarity to parent cell</td>
<td>Identical</td>
<td>Unique</td>
</tr>
<tr>
<td>Process of nuclear division</td>
<td>Chromosomes condense, line up, are pulled to the poles, and the nucleus reforms and DNA relaxes.</td>
<td></td>
</tr>
<tr>
<td>Number of cells produced</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Reasons for division</td>
<td>growth &amp; repair</td>
<td>gamete production</td>
</tr>
</tbody>
</table>

Fill in what you know about chromosomes:

- 46 chromosomes in human body cells
  - half come from mother
  - include sex chromosomes
    - include X
  - include Y
  - consist of 22 homologous pairs
- include autosomes
  - consist of 22 homologous pairs
  - father
Cell divides again without duplicating DNA
DNA duplicates
Growth, development and normal cell function (use this twice)
Daughter cells are haploid
Chromosomes are pulled to opposite poles of the cell.

---

DNA duplicates

---

growth, development and normal cell function

---

Chromosomes line up individually
Daughter cells are diploid
Prophase - Condenses into chromosomes
The rest of the cell divides.
Chromosomes line up in tetrads

---

Growth, development and normal cell function

---

Chromosomes line up individually

---

Chromosomes condense to chromosomes

---

Chromosomes are pulled to poles

---

Chromosome divide again w/o. DNA duplication

---

Daughter cells are haploid

---

Daughter cells are diploid

---

The rest of the cell divides.
Name the phase of meiosis in the description or in the picture.

<table>
<thead>
<tr>
<th>Name of Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>prophase 1</strong></td>
<td>Homologous chromosomes pair up and form tetrad</td>
</tr>
<tr>
<td>2. <strong>anaphase 1</strong></td>
<td>Spindle fibers move homologous chromosomes to opposite sides</td>
</tr>
<tr>
<td>3. <strong>telophase &amp; cytokinesis 2</strong></td>
<td>Nuclear membrane reforms, cytoplasm divides, 4 daughter cells formed</td>
</tr>
<tr>
<td>4. <strong>metaphase 2</strong></td>
<td>Chromosomes line up along equator, not in homologous pairs</td>
</tr>
<tr>
<td>5. <strong>prophase 1</strong></td>
<td>Crossing-over occurs</td>
</tr>
<tr>
<td>6. <strong>anaphase 2</strong></td>
<td>Chromatids separate</td>
</tr>
<tr>
<td>7. <strong>metaphase 1</strong></td>
<td>Homologs line up alone equator</td>
</tr>
<tr>
<td>8. <strong>cytokinesis 2</strong></td>
<td>Cytoplasm divides, 2 daughter cells are formed</td>
</tr>
</tbody>
</table>
For each of the following statements write in the blank if it applies to mitosis or meiosis.

1. Makes 4 daughter cells __________________
2. Has 2 phases __________________
3. Has one nuclear division __________________
4. Is used to make gametes __________________
5. Is used for division of somatic cells __________________
6. Has 2 nuclear division __________________
7. Allows for crossing over __________________
8. Daughter cells are diploid __________________
9. Daughter cells are all genetically identical __________________
10. Daughter cells are haploid __________________
11. Daughter cells have half the chromosomes of the parent cell __________________
12. Makes 2 daughter cells __________________
13. Daughter cells have 2 sets of chromosomes __________________
14. In humans, makes cells that have 23 chromosomes __________________
15. In humans, makes cells that have 46 chromosomes __________________

Explain crossing over:

The exchange of genetic information. A piece of two homologous chromosomes are swapped at a synapse during prophase 1 of meiosis.

The relationship between DNA, genes and chromosomes. DNA is made up of nucleic acids. Genes are made up a selected set of DNA. Chromosomes are many genes put together.

Analogy – It is like a bookcase – The words in the book are like DNA – made up of letters (nucleic acids) to tell a story or give directions. A book is a gene. It is a set of DNA that is put together and all works together to give one big set of directions. The chromosome is the whole bookcase. It is many genes put together.

Make up your own analogy for DNA, genes, and chromosomes. It can’t be a bookcase. Tell what part of your analogy corresponds to the DNA, the gene and the chromosome and explain why that works. (It should look just like the one above)
The cell model used in this exercise has two pairs of homologous chromosomes, one long pair and one short pair. Match the descriptions to the letters beneath each picture in the following sketches.

1) C One cell at the beginning of meiosis II
2) F A daughter cell at the end of meiosis II
3) D Metaphase I of meiosis
4) B G1 in a daughter cell after mitosis
5) A/E Prophase of mitosis

6) How many chromosomes are present in cell E? 4
7) How many chromatids are present in cell E? 8
8) How many chromatids are present in cell C? 4
9) How many chromatids are present in cell D? 8
10) How many chromosomes are present in cell F? 2

Meiosis is like mitosis in some ways, but the result is different. As in mitosis, a(n) diploid cell duplicates its DNA in S stage. The two DNA molecules and associated protein stay attached at the centromere, the notably constricted region along their length. For as long as they remain intact we call them sister chromatids.

With meiosis, however, the chromosomes go through two consecutive division that end with the formation of four haploid nuclei. The germ cell does not enter interphase between the two nuclear divisions, where are known as meiosis I and meiosis II.

In meiosis I, each duplicated chromosome aligns with its homologue to homologue. After the two chromosomes of every pair have lined up with each other, they are moved apart. Next, during meiosis II, the sister chromatids of each chromosome are separated from each other.

Matching: Match the terms with the appropriate statement

1) D Haploid
2) E Diploid
3) B Sister chromatids
4) A Homologous chromosomes
5) C Asexual reproduction
6) F Sexual reproduction

A) A pair of chromosomes that have the same assortment of genes
B) Duplicated chromosomes that are attached at the centromere
C) Occurs when off spring inherit the same number and kids of genes from a single parent
D) A cell that contains one of each type of chromosomes
E) A cell that contains two of each type of chromosome
F) Involves meiosis, gamete formation, and fertilization