Study Guide for Mitosis & Meiosis Quiz – Monday, March 17
(as related to the human body)

MITOSIS:

MAIN IDEA: The process used to produce new body cells (such as skin cells, blood cells, liver cells, etc.). Mitosis is used for the body's growth, development, and repair.

PROCESS: <u>One</u> single parent cell divides <u>once</u> to produce <u>two</u> genetically-<u>identical</u> daughter cells.

The parent cell has a full set of 46 chromosomes and therefore is a <u>2n diploid</u> cell. The offspring daughter cells are also <u>2n diploid</u> cells and are identical to each other and the original parent cell.

Interphase ⇨ Prophase ⇨ Metaphase ⇨ Anaphase ⇨ Telophase ⇨ Cytokinesis

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MEIOSIS:

MAIN IDEA: The process used to produce male and female sex cells (such as sperm and egg cells). Meiosis is used for the reproductive system and is necessary in order for sexual reproduction to occur.

PROCESS: One single parent cell divides twice to produce four genetically-similar (but not identical) daughter cells. Meiosis I (first division) and Meiosis II (second division).

The original parent cell has a full set of 46 chromosomes and therefore is a 2n diploid cell. Each offspring daughter cell, however, has only half the number (23) of the parent's original chromosomes and therefore each is a 1n haploid cell.

Sexual Reproduction involves genetic material from a mother <u>and</u> a father. Each contributes a matching but genetically different chromosome to make a homologous pair. The mother contributes 23 chromosomes and the father contributes 23 chromosomes for a total of 46 chromosomes (which become organized into 23 homologous pairs).

Sex cells are called "gametes." Male gametes are sperm. Female gametes are eggs.

*Fertilization: Fertilization occurs when a sperm cell combines with an egg cell.
Sperm (23 chromosomes, 1n haploid cell)
+ Egg (23 chromosomes, 1n haploid cell)
= Zygote (46 chromosomes, 2n diploid cell)

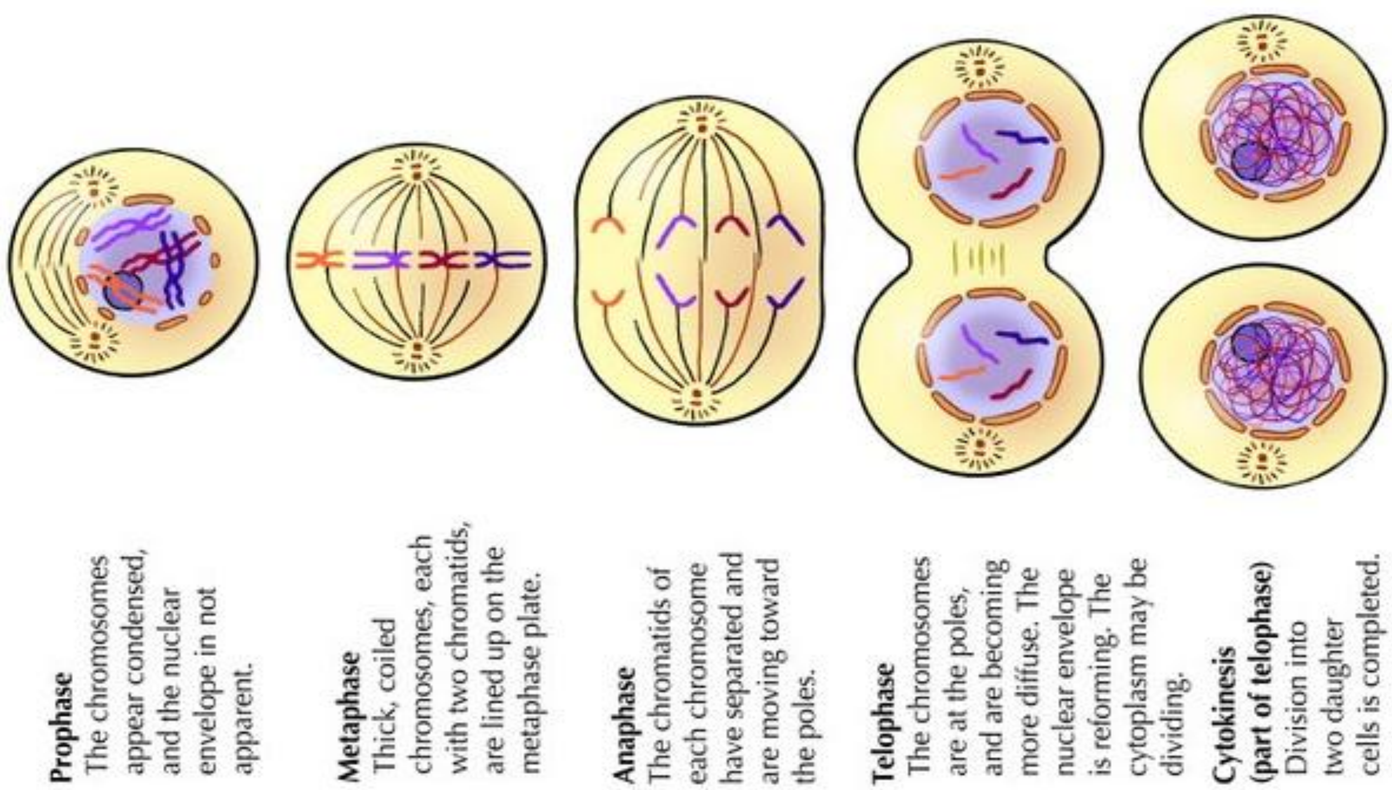
(*Note: Fertilization is NOT part of Meiosis, but could not occur at all if Meiosis did not first create sperm and egg cells.)

Interphase ⇨ Prophase I ⇨ Metaphase I ⇨ Anaphase I ⇨ Telophase I ⇨ Cytokinesis *(first division)*
and then
Prophase II ⇨ Metaphase II ⇨ Anaphase II ⇨ Telophase II ⇨ Cytokinesis *(second division)*

MITOSIS	MEIOSIS I	MEIOSIS II
Begins with one single parent cell that has 46 chromosomes (DNA strands), which is a 2n diploid cell.	Begins with one single parent cell that has 46 chromosomes (DNA strands), which is a 2n diploid cell. (23 matching pairs; one chromosome from the cell's mother, one matching but not identical chromosome from the cell's father)	
INTERPHASE • An extra copy of the cell's DNA is being made to get ready for cell division (replication of DNA). DNA in the nucleus is spread-out and thread-like. Cannot be seen with a light microscope.	INTERPHASE I • An extra copy of the cell's DNA is being made to get ready for cell division (replication of DNA), which actually starts Meiosis with 92 strands of DNA (46 x 2 = 96). DNA in the nucleus is spread-out and thread-like. Cannot be seen with a light microscope.	(There is no "Interphase" for Meiosis II.)
PROPHASE • DNA strands coil and condense to form chromosomes which are now visible with a light microscope. • Each chromosome is composed of two sister chromatids (identical to each other) which are held together by a centromere. Nuclear membrane starts to dissolve away, allowing the chromosomes to move around in the cell's cytoplasm. • Spindle fibers start to form from the centrioles.	PROPHASE I • DNA strands coil and condense to form chromosomes which are now visible with a light microscope. • Matching homologs from the mother and father find each other and stay together through "synapse." • "Crossing-over" takes place, where the homologous pair exchange genetic material (some from the mother moves to the father's chromosome and vice versa). ***The chromatids in each chromosome are no longer identical.*** • Nuclear membrane starts to dissolve away, allowing the chromosomes to move around in the cell's cytoplasm. • Spindle fibers start to form from the centrioles.	PROPHASE II • DNA strands in the two daughter cells coil and condense to form chromosomes which are now visible with a light microscope. • Each chromosome has two chromatids. The chromatids are similar but not identical. • Nuclear membrane starts to dissolve away, allowing the chromosomes to move around in the cell's cytoplasm. • Spindle fibers start to form from the centrioles.
METAPHASE • Chromosomes line up in the middle of the cell. • Centrioles have moved to opposite ends of the cell. Spindle fibers stretch out from the centrioles and attach to the centromere of each chromosome.	METAPHASE I • Homologous pairs line up in the middle of the cell. • Centrioles have moved to opposite ends of the cell. Spindle fibers stretch out from the centrioles and attach to the centromere of each chromosome.	METAPHASE I • Chromosomes line up in the middle of the cell. • Centrioles have moved to opposite ends of the cell. Spindle fibers stretch out from the centrioles and attach to the centromere of each chromosome.
ANAPHASE • Each centromere splits apart and the spindle fibers pull the sister chromatids to opposite ends of the cell.	ANAPHASE I • In each homologous pair, one chromosome is pulled toward one side of the cell and the matching one is pulled to the other side of the cell.	ANAPHASE I • Each centromere splits apart and the spindle fibers pull the chromatids to opposite ends of the cell.

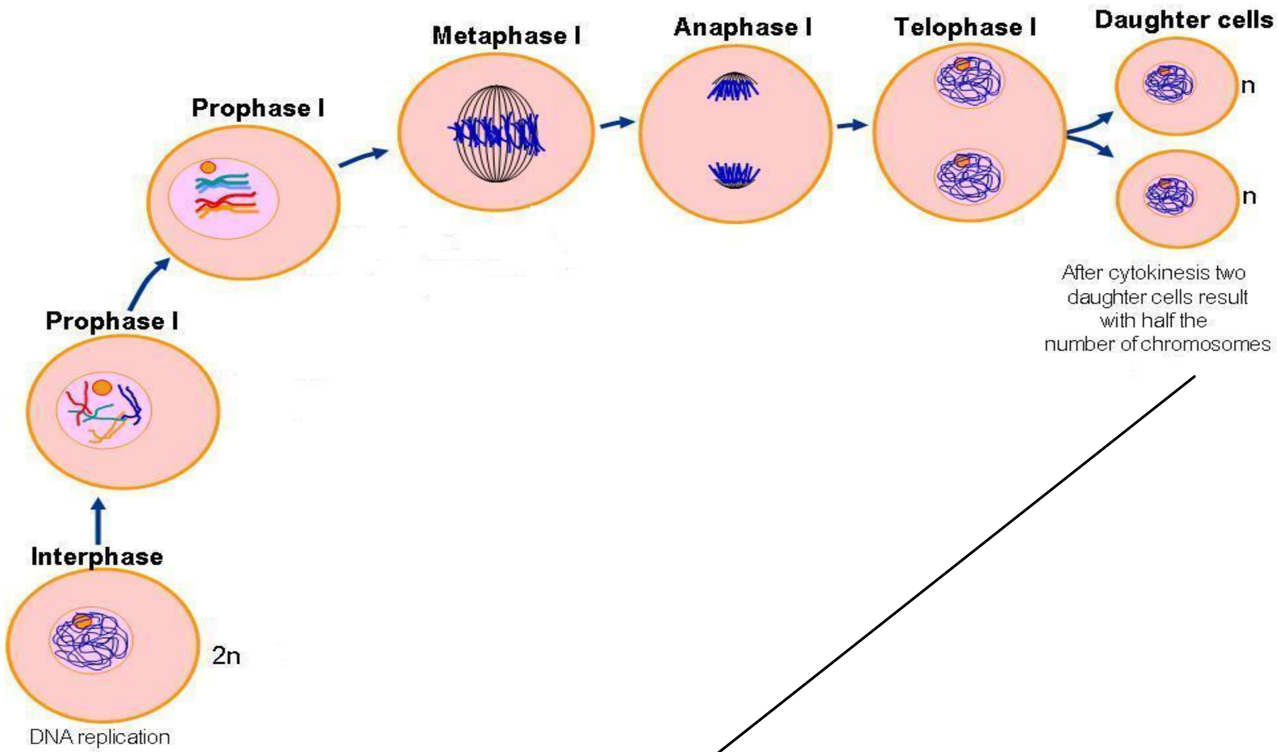
TELOPHASE • There is now an identical set of chromosomes/chromatids at each side of the cell and they are grouped together. New nuclear membrane starts to form around the group of chromosomes. • The DNA in the chromosomes begins to uncoil and loosen. • The cellular membrane and cytoplasm starts to pinch together in the center and the cell starts to divide.	TELOPHASE I • Each side of the cell now contains one set of 46 chromosomes, half of each homologous pair. The chromosomes are NOT identical. • The chromosomes group together, and new nuclear membrane starts to form around the new groups of chromosomes. • The DNA in the chromosomes begins to uncoil and loosen. • The cellular membrane and cytoplasm starts to pinch together in the center and the cell starts to divide.	TELOPHASE I • Each side of the cell now contains one set of 23chromatids. (These chromatids are sometimes also now called chromosomes.) The chromatids/chromosomes are similar but are not identical.. • The chromosomes group together, and new nuclear membrane starts to form around the new groups of chromosomes. • The DNA in the chromosomes begins to uncoil and loosen. • The cellular membrane and cytoplasm starts to pinch together in the center and the cell starts to divide.
CYTOKINESIS • The parent cell has completely divided and now there are two genetically-identical daughter cells. Each daughter cell is about half the size of the original parent cell (like breaking a whole candy bar in half). • Each daughter cell is identical to each other and is an identical (cloned) copy of what the parent cell was. • Each daughter cell has a complete set of 46 chromosomes and is a 2n diploid cell.	CYTOKINESIS • The parent cell has completely divided and now there are two 2n diploid daughter cells, but they are NOT identical. They are "similar," but not identical due to the crossing over that occurred during Prophase I. • Each daughter cell is about half the size of the original parent cell (like breaking a whole candy bar in half). • Each daughter cell has a complete set of 46 chromosomes and is a 2n diploid cell.	CYTOKINESIS • The 2 "parent cells" have completely divided and now there are four 1n haploid daughter cells, but they are NOT identical. They are "similar," but not identical due to the crossing over that occurred during Prophase II. • Each daughter cell is about half the size of the original parent cell (or ¼ the size of the parent cell that started Meiosis I

MITOSIS DIAGRAM: *(from qa.everythingmaths.co.za)*



MEIOSIS DIAGRAMS: *(from geneticssuite.com)*

MEIOSIS I



MEIOSIS II