Cell Reproduction Worksheet

Name_____

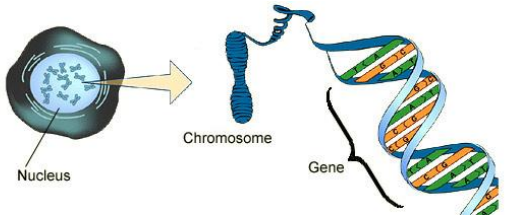
Section A: Why must a cell divide?

Cells are limited in size because the membrane must transport materials to the inside of the cell. As a cell gets bigger, the outside is unable to keep up with the inside, because the inside grows at a faster rate than the outside. As cells get larger, the surface to volume ratio gets smaller, meaning the cell membrane cannot supply the inside with what it needs to survive. Cell division occurs so multicellular organisms can grow and repair damaged tissue. In multicellular organisms, division occurs to produce egg and sperm for reproduction. In unicellular organisms, division is needed to reproduce the organism.

1. In multicellular organisms, why do cells need to divide? _____
   _____

Section B: Vocabulary

1. Explain the relationship between chromosomes, genes and DNA. _____
   _____
   _____
2. Define diploid. _____
3. Define haploid. _____
4. Check the correct box that matches the description of the two types of Eukaryotic cells.
5. Why is the chromosome number in each animal cell an even number?
   _____
   _____
6. Why is it important that gamete cells have only one set of chromosomes?
   _____
   _____
7. What are the two types of gametes?
   _____

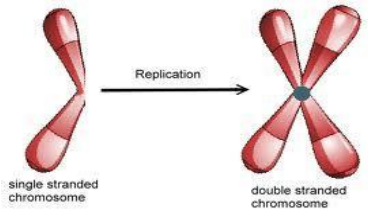


	Body Cells	Sex Cells
a. 46 chromosomes in humans		
b. haploid		
c. somatic cells		
d. diploid		
e. 23 chromosomes in humans		
f. gametes		
g. muscle cells		
h. sperm		

8. What process is the fusion of gametes that create a zygote? _____ Is a zygote a diploid or haploid cell? _____
9. The data table shows the number of chromosomes for somatic cells.
   a. Chromosome # for diploid human cell? _____
   b. Chromosome # for haploid pea plant? _____
   c. Chromosome # for dog gamete? _____
   d. Chromosome # for diploid frog cell? _____
   e. If a frog cell had 26 chromosomes, then the cell is *diploid or haploid*. _____
   f. If a mosquito cell had 3 chromosomes, then it would be a *gamete or somatic cell*. _____
   g. If an orangutan cell had 24 chromosomes, then the cell is *diploid or haploid*. _____
   h. If a corn cell had 20 chromosomes, then the cell is *diploid or haploid*. _____

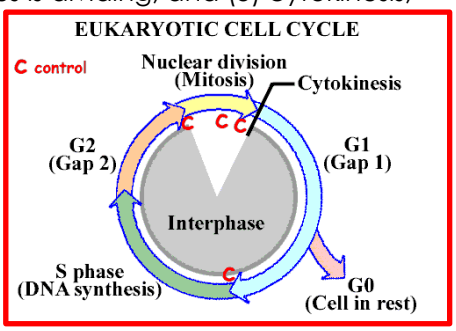
Organism	2n
Mosquito	6
Frog	26
Orangutan	48
Corn	20
Dog	78
Human	46
Pea Plant	14

10. In the karyotyping activity, identify the diploid number, gender and chromosomal abnormality in each patient.
    a. Patient A - _____
    b. Patient B - _____
    c. Patient C - _____
    d. Patient D - _____
11. Label the sister chromatids and the centromere on the duplicated chromosome. Label the chromatid and centromere on the single chromosome.
12. _____ is a segment of DNA that codes for a protein.
13. What are homologous chromosomes? _____
    _____



Section C: Cell Cycle

The cell cycle is the series of events that take place in a eukaryotic cell between its formation and the moment it replicates itself. These events can be divided in three main parts: (1) interphase (includes G_1 phase, S phase, G_2 phase), during which the cell is forming and carries on with its normal metabolic functions; (2) the M phase (mitosis or meiosis), during which the nucleus is dividing, and (3) cytokinesis, during which the cytoplasm divides and new daughter cells are formed. Thus, cell-division cycle is an essential process for repair and growth in eukaryotic organisms. It is also the process where unicellular or multicellular organisms reproduce asexually. Sometimes the cells exit the cell cycle and enter the G_0 phase. In the G_0 phase, cells are alive and metabolically active, but do not divide. In this phase cells do not copy their DNA and do not prepare for cell division. Many cells in the human body, including those in heart muscle, eyes, and brain are in the G_0 phase. If these cells are damaged they cannot be replaced.



1. What are the three steps of cell cycle? _____
2. What occurs during interphase? _____
3. What occurs during M phase? _____
4. What occurs during cytokinesis? _____
5. What is the G_0 phase? _____
6. What type of cell enters the G_0 phase? _____

Section D: Interphase

The *G_1 phase* is the major period of cell growth. During this stage new organelles are being synthesized, so the cell requires both structural proteins and enzymes, resulting in great amount of protein synthesis. The *S phase* (synthesis phase) is when DNA synthesis or replication occurs. At the beginning of the S stage, each chromosome is composed of one coiled DNA double helix molecule, which is called a chromatid. At the end of this stage, each chromosome has two identical DNA double helix molecules, and therefore is composed of two sister chromatids. During S phase, the centrosome is also duplicated. *G_2 phase* is the shortest subphase during interphase in which the cell undergoes a period of rapid growth to prepare for the M phase. Although chromosomes have been replicated they cannot yet be distinguished individually because they are still in the form of loosely packed chromatin fibers.

1. When are chromosomes duplicated? _____
2. If the parent cell has 20 chromosomes in G_1, how many chromosomes will it have in the G_2 phase? _____
3. Which phase is the longest in interphase? _____
4. Are chromosomes visible during interphase? _____
5. What are chromatin? _____
6. Which phase is protein synthesis going on? _____
7. Which phase is the cell preparing for division? _____

Section E: Cell Cycle Webquest

On "Websites-Genetics" page, click on 'Cell Cycle'. Use the animation to answer these questions.

1. What are the 3 phases of the cell cycle? _____
2. Interphase includes _____, _____ and _____ phases.
3. How long does it take for DNA replication to occur? _____
4. What occurs in G_1 phase? _____
5. What occurs in G_2 phase? _____
6. What is the purpose of the M phase? _____
7. What is the G_0 phase? _____
8. Give an example of cells that enter the G0 phase? _____
   _____
9. What is apoptosis? _____
   _____
10. Why is apoptosis an important process? _____

Section F: Mitosis Webquest

On "Websites-Genetics" page, click on 'Mitosis'. Use the animation to answer these questions.

1. What is divided in mitosis? _____
2. What is divided in cytokinesis? _____
3. What are the stages of mitosis? _____
4. What happens during prophase? _____
   _____
5. What happens during metaphase? _____
   _____
6. What happens during anaphase? _____
   _____
7. What happens during telophase? _____
   _____
8. In which phase do chromosomes become visible? _____
9. What is the purpose of spindle-fibers (microtubules)? _____
   _____
10. If the spindle fibers malfunction, how would the malfunction affect nuclear division? _____
    _____
11. What is cytokinesis? _____
12. How is cytokinesis in an animal cell different than a plant cell? _____
    _____

Section G: Onion Root Tip Cell Cycle

On "Websites-Genetics" page, click on 'Onion Root Tip'. Click next and assort the cell cycle pics.

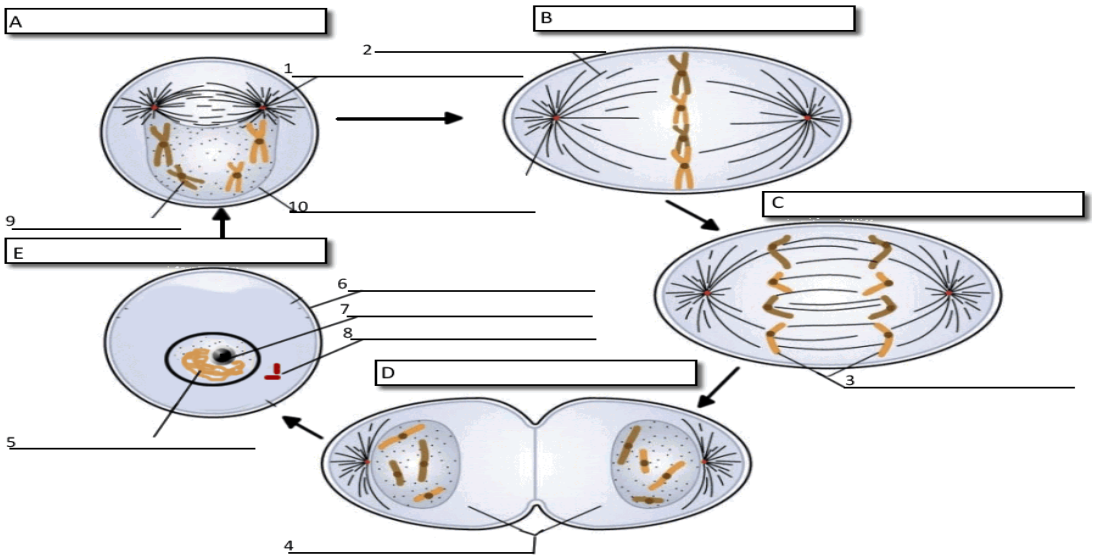
NUMBERS	INTERPHASE	PROPHASE	METAPHASE	ANAPHASE	TELOPHASE	TOTAL
Actual Cell Number						36
Percent of Total Cells						100%

Section H: Mitosis - How many chromosomes?

1. At the beginning of interphase, how many chromosomes are in the parent cell? _____
2. At the end of interphase, how many chromosomes are in the parent cell? _____
3. How many chromosomes are in each daughter cell? _____
4. Are the daughter cells genetically identical or different than the parent cell? _____
5. How many daughter cells are created when a cell undergoes mitosis and cytokinesis? _____
6. A parent cell has 24 chromosomes. When it undergoes mitosis, how many chromosomes will be in each daughter cell? _____ How many daughter cells will be created? _____

Section I: Mitosis

1. Fill in the phases and label the diagrams.



Matching: Match the term to the description. Some will be used more than once.

a. G1	d. anaphase	g. mitosis	j. prophase	m. centromere
b. S	e. telophase	h. spindle fiber	k. metaphase	n. interphase
c. G2	f. cytokinesis	i. cell plate	l. chromatid	

2. Sister chromatids are moving apart. _____
3. New nuclear membrane forms. _____
4. Cytoplasm is being divided. _____
5. Chromosomes become invisible. _____
6. Chromosomes are in the middle. _____
7. Nuclear membrane begins to fade. _____
8. Fibers pull chromatids towards poles. _____
9. Spindles are formed. _____
10. Chromosomes are visible. _____
11. Cell plate divides the cytoplasm. _____
12. Chromosomes replicate. _____
13. Reverse of prophase. _____
14. Cell prepares for division. _____
15. Normal metabolic activities occur. _____
16. Structure that connects chromatids. _____
17. The ½ of the chromosome. _____
18. Connects to centromeres. _____
19. Cells spend the majority of time in. _____
20. Structures centrioles produce. _____
21. Forms in plant cells for cytokinesis. _____
22. Constriction region on chromosome. _____
23. Period of cell growth before division. _____
24. Nuclear division. _____
25. Sister chromatids are together in. _____

Section J: Meiosis

1. At the beginning of interphase, how many chromosomes are in the parent cell? _____
2. At the end of interphase, how many chromosomes are in the parent cell? _____
3. How many divisions occur in meiosis? _____
4. In prophase I, what do the homologous chromosomes do? _____
5. What is crossing over? _____
6. In metaphase I, explain independent assortment. _____
   _____
7. How many chromosomes are in each daughter cell at the end of telophase I? _____
8. How many daughter cells are created at the end of cytokinesis I? _____
9. How many chromosomes are in each daughter cell at the end of telophase 2? _____
10. At the end of cytokinesis 2, how many daughter cells are created? _____
11. Are the daughter cells at the end of meiosis and cytokinesis genetically identical or different?
    _____
12. Why is meiosis and sexual reproduction important? _____
13. Why types of cells are produced after meiosis? _____
14. Why is independent assortment important? _____
    _____
15. Why is shuffling of the chromosomes (crossing-over) important? _____
    _____
16. A parent cell has 24 chromosomes. When it undergoes meiosis, how many chromosomes will be in each daughter cell? _____ How many daughter cells will be created? _____

Additional Animations/Tutorials:
http://www.biology.arizona.edu/cell_bio/tutorials/cell_cycle/cells2.html
http://www.biology.arizona.edu/cell_bio/tutorials/meiosis/main.html
http://www.hartnell.edu/tutorials/biology/mitosis.html
http://www.hartnell.edu/tutorials/biology/meiosis.html
http://www.pbs.org/wgbh/nova/miracle/divi_flash.html

Quizzes:
http://www.sciencegeek.net/Biology/review/U3CellReproduction.htm
http://www.sciencegeek.net/Biology/review/U3Meiosis.htm
http://www.sciencegeek.net/Biology/review/U3Review.htm
http://www.neok12.com/quiz/CELDIV05
http://www.neok12.com/quiz/CELDIV03