

Lab 8 Report Sheet
 Mitosis and Meiosis
 Biol 201

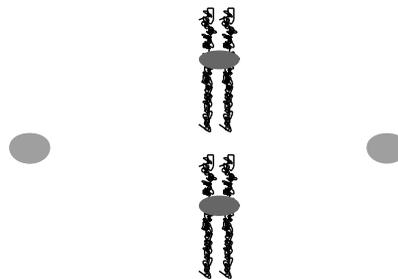
Answers to Selected Questions

Part 1. Modeling the Cell Cycle and Mitosis in Animal Cells

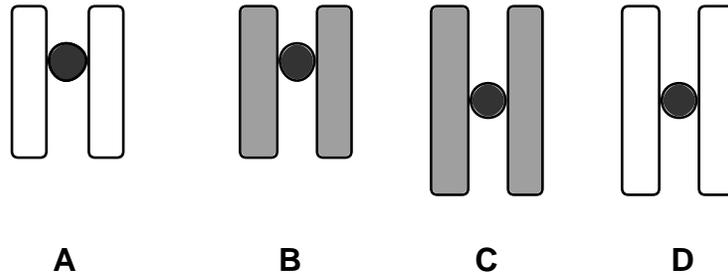
1. Complete the table below as you model the cell cycle with the pop bead models.

Phase of Cell Cycle	Number of Homologous Pairs per Cell	Number of Chromosomes per Cell	No. of Chromatids per Chromosome
G ₁	2	4	one
G ₂	2	4	2
Prophase	2	4	2
Metaphase	2	4	2
Anaphase	4	8	1
Telophase	4	8	1
At End of Cytokinesis	2	4	1

2. Below is a diagram of an animal cell at metaphase of mitosis. Draw the mitotic spindle and centrioles, and then Label each of the following in the figure: Chromosome, *sister chromatids*, *spindle fibers*, *aster*, *centrioles*, and *centromere*.

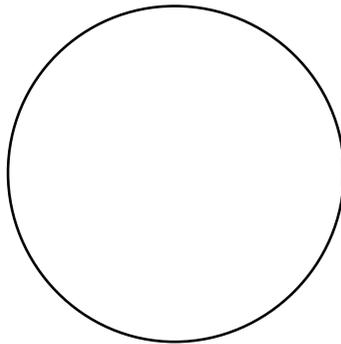


Questions 3 -7 pertain to the following sketches of duplicated chromosomes.

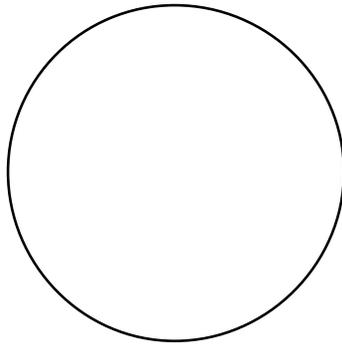


3. Which chromosomes above are homologous pairs? **A and B; C and D**
4. How do the chromatids of chromosome “A” compare genetically?
Genetically identical (assuming no mutations during S-phase): same genes and same alleles
5. How do the chromatids of chromosomes “A” and “B” compare genetically?
Genetically different: Same genes, but different alleles
6. How do the chromatids of chromosomes “A” and “D” compare genetically?
Genetically different: completely different genes that code for completely different traits
7. If no other chromosomes exist in a cell but the ones above, what is the.....
 - a. diploid number (2n) of the cell? **four**
 - b. monoploid number (n) of the cell? **two**

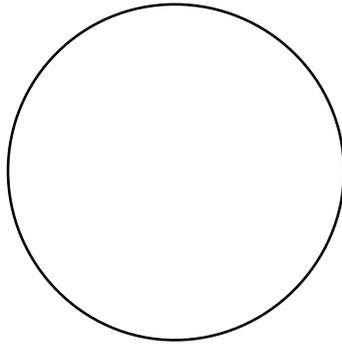
Part 2. Observation of the Cell Cycle in Onion Cells



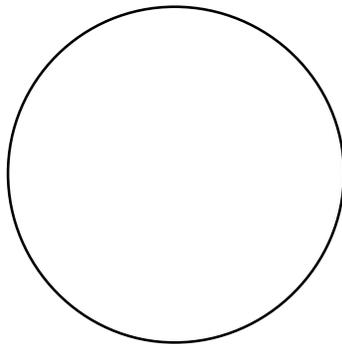
Interphase: *Allium* as viewed at _____ x



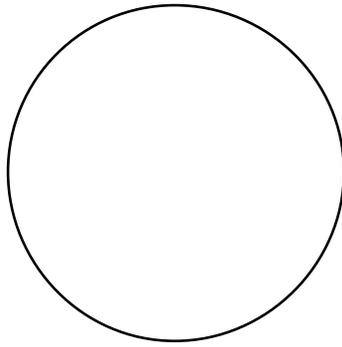
Prophase: *Allium* as viewed at _____ x



Metaphase: *Allium* as viewed at _____ x

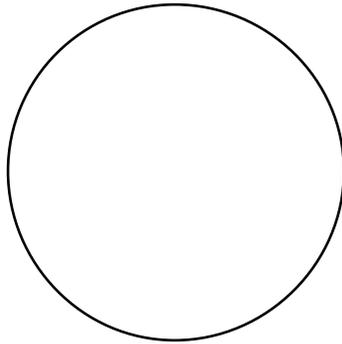


Anaphase: *Allium* as viewed at _____ x

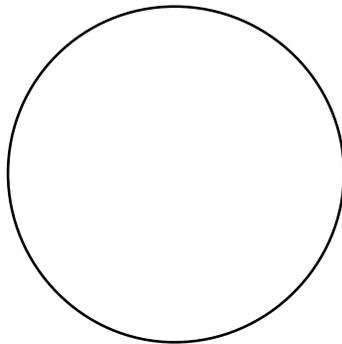


Telophase and Cytokinesis:
Allium as viewed at _____ x

Part 3. Observation of the Cell Cycle in Whitefish Blastula



Metaphase: Whitefish Blastula
as viewed at _____ x



Telophase and Cytokinesis:
Whitefish Blastula as viewed at _____ x

8. List some of the major differences that you observed between plants and animal mitosis.

	Plant Mitosis	Animal Mitosis
Cytokinesis	Divides using a cell plate	Divides by pinching
Centrioles	None present	Present
Asters	None present	Present

Part 4 Modeling Meiosis

9. Complete the table below as you model meiosis with pop bead models of *two pair* of homologous chromosomes.

Phase of Cell Cycle	Number of Chromosomes per Cell	No. of Chromatids per Chromosome	Number of Homologous Pairs per Cell	Diploid, 2n, or Haploid, n ?
G ₁	4	one	2	2n
G ₂	4	2	2	2n
Prophase I	4	2	2	2n
Metaphase I	4	2	2	2n
Anaphase I	4	2	2	2n
Telophase I (after nuclear envelopes reform)	4	2	2	2n
At End of Cytokinesis I	2	2	0	n
Prophase II	2	2	0	n
Metaphase II	2	2	0	n
Anaphase II	4	1	2	2n
Telophase II (after nuclear envelopes reform)	2	1	0	n
At End of Cytokinesis II	2	1	0	n

10. What are the combinations of alleles present on chromatids formed as the result of a crossover between homologues “RN” and “rn” during prophase I?

Allele present in the gametes that are the result of x-over: Rn and rN

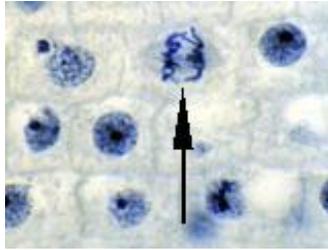
Application Questions

11. Use your knowledge of mitosis and a bit of common sense/logic to explain how each of the following help to facilitate the process of mitosis:
- Condensation of the chromatin:
 - Disappearance of the nucleoli and nuclear envelope:
 - Attachment of the spindle fibers to the centromeres:
12. Crossover occurs between *nonsister* chromatids of homologous pairs. But suppose crossover occurred between sister chromatids. Would the occurrence of crossover between the sister chromatids of a duplicated chromosome during prophase I of meiosis result in increased genetic variation? Explain why or why not.
13. Earthworms, *Lumbricus terrestris*, have 18 pairs of chromosomes in each somatic cell.
- What is the $2n$ (diploid) number for earthworms? **36**
 - What is the n (monoploid) number for this species? **18**
14. If one sister chromatid of a chromosome has the allele D , what allele will the other sister chromatid have? **D**
15. a. If two alleles on one sister homologous chromosome are A and B , and the alleles on the other homologue are a and b , how many different genetic types of gametes would be produced *without* the occurrence of crossover?
Two
- List the genotypes for all possible gametes if crossover does *not* occur.
AB, ab
 - If crossover were to occur, how many different genetic types of gametes could be produced? List them.
**Four genetically different gametes: AB, ab, Ab, aB
(the last two are due to x-over)**

16. **Colchicine** is an alkaloid from the autumn crocus that prevents microtubule proteins from assembling into spindle fibers. If colchicine were added to a culture of rapidly dividing cells and then viewed with a microscope several hours later, what phase(s) of mitosis would you expect the cells to be in? Explain.
17. **Taxol**, an anti-cancer drug from the bark of the Pacific yew tree, has the opposite action of colchicine. Taxol stabilizes microtubules and thus prevents the breakdown of spindle fibers. Explain how taxol acts to kill rapidly dividing cells such as cancerous tissue.
18. Compare the processes of mitosis and meiosis by completing the table below.

	Mitosis	Meiosis
Synapsis and crossover	Does not occur	Happens during Prophase 1
Prophase	No x-over	x-over occurs during prophase 1 (no x-over during prophase 2)
Metaphase	Duplicated chromosomes line up single file at the equator of the cell	Tetrads (homologous pairs) line up at the equator of the cell
Anaphase	Chromatids separate	<u>Anaphase 1</u>: homologous pairs separate <u>Anaphase 2</u>: sister chromatids separate
When chromatids separate	Anaphase	Anaphase 2
Number of divisions	1	2
Number of daughter cells	2	4
Number of chromosomes in daughter cells	Same as parent cell: 2n	Half as many as parent cell: n
Genetic similarity of daughter cells	identical	Different (due to x-over and independent assortment of homologous pairs during) anaphase 1

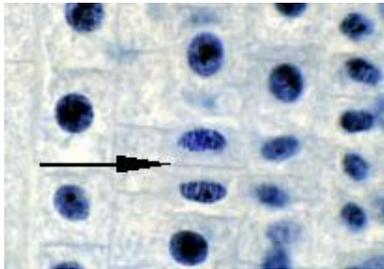
19. Identify each stage in the high-power photomicrographs of onion root tip mitosis.



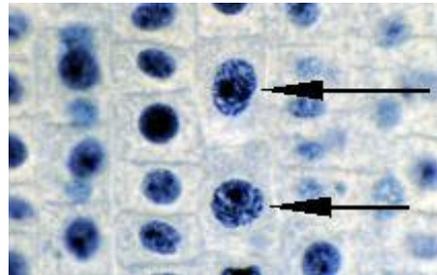
a. _____



b. _____

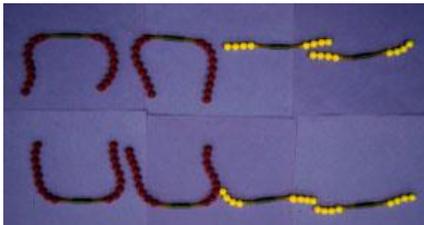


c. _____

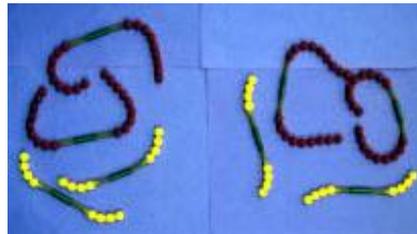


d. _____

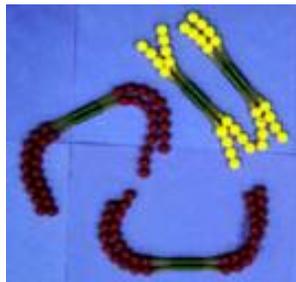
20. Identify each stage of mitosis that is modeled by beads in the images below.



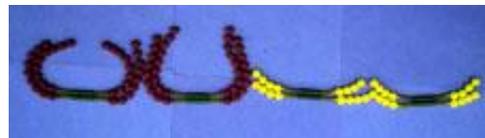
a. _____



b. _____



c. _____



d. _____

Lab 8. Prelab Questions
Mitosis and Meiosis
Biol 201

Answers to Selected Questions

Note: Do the prelab reading at the beginning of this lab handout *before* attempting to answer the questions that follow! Hand in this assignment just *before* the start of your scheduled lab period.

1. Use your knowledge of the cell cycle and mitosis to determine during which phase or of the cell cycle each of the following events take place. Select your responses from the following: *G₁ phase*, *S phase*, *G₂ phase*, *interphase*, *prophase*, *metaphase*, *anaphase*, *telophase* and *cytokinesis*.
 - a. Chromosomes replicate: **S-phase**
 - b. Chromosomes uncoil and become less visible under a compound microscope: **Telophase**
 - c. Microtubules are synthesized: **G2**
(microtubules assemble into spindle fibers in prophase)
 - d. Cells grow: **G1**
 - e. Cells carryout their ordinary day to day activities: **G1**
 - f. Cytoplasm divides into two cells: **Cytokinesis**
 - g. Sister Chromatids separate: **Anaphase (anaphase 2 of meiosis)**
 - h. Duplicated chromosomes line up in the middle of the cell: **Metaphase**
 - i. Chromatin condenses: **Prophase**
 - j. Nuclear membrane disappears: **Prophase**
 - k. Nucleoli disappear: **Prophase**
 - l. Spindle fibers first become visible under a compound microscope: **Prophase (late prophase or prometaphase)**
 - m. Chromosomes begin to be visible under a compound microscope: **Prophase (late prophase or prometaphase)**
 - n. Centromeres split: **Anaphase**
 - o. Microtubules (spindle fibers) attach to centromeres: **Prophase (late prophase)**
 - p. Microtubules assemble into spindle fibers: **Prophase**
 - q. Spindle disorganizes as chromosomes reach the poles of the cell: **Telophase**
 - r. Nuclear envelope re-forms: **Telophase**
 - s. Sister chromatids are produced: **S-phase**

2. Suppose you are trying to help a fellow budding biologist find with a microscope representative cells going through the various stages of the life cycle of a cell. What should they look for when trying to find cells going through the following phases?

Interphase:

Prophase:

Metaphase:

Anaphase:

Telophase:

Cytokinesis in plants:

Cytokinesis in animals:

3. Is it possible to differentiate under a *compound light microscope* cells passing through the following stages of interphase: G₁, S, and G₂? Explain.

4. Why is *interphase* not considered one of the stages of mitosis?

5. What would be the consequence(s) in future generations if *mitosis* produced the gametes instead of *meiosis*?

6. If both homologous chromosomes of each pair are present in the nucleus of the cell, the nucleus is _____ **Diploid** _____ (complete the sentence)

7. The somatic cells of chimpanzees have 48 chromosomes.

Answers

- | | |
|---|----------|
| a. The “2n” number of chromosomes in chimps is | a. _____ |
| b. The monoploid number of chromosomes in chimps is | b. _____ |
| c. The haploid number of chromosomes in chimps is | c. _____ |
| d. The “n” number of chromosomes in chimps is | d. _____ |
| e. The diploid number of chromosomes in chimps is | e. _____ |