Name: _____ Date: _____ Period: _____

Must-Know: Unit 6 (Cell Division)

AP Biology, Mrs. Krouse

Topic #1: The Cell Cycle and Mitosis

1. What events take place in the cell during interphase?

2. How does the amount of DNA in the cell change during the S stage of interphase?

3. How does the length of interphase change when the rate of cell division increases? How does the length of interphase change when the rate of cell division decreases?

4. What is the G0 stage? Why might a cell enter the G0 stage?

5. Describe the organization of DNA in a prokaryotic cell.

6. Describe the organization of DNA in a eukaryotic cell. Why do chromosomes in cells preparing for mitosis have two identical chromatids?

7. How is prokaryotic binary fission different from eukaryotic mitosis?

8. In what stage of mitosis does the mitotic spindle form? In what stage does it break down?

9. Why is cytokinesis necessary after mitosis? If mitosis but not cytokinesis occurred in onion root tip cells, what would you expect to see on a slide of these root cells?

10. Why do scientists believe that centrosomes and not centrioles are responsible for mitotic spindle formation?

11. How is cytokinesis different in animal vs. plant cells?

12. What are the purposes of mitosis in multicellular organisms?

13. What is the difference between diploid (2n) and haploid (n) cells? Does mitosis create diploid or haploid daughter cells from a parent diploid cell?

14. What happens during anaphase? (you should know what happens in EACH of the stages of mitosis)

Topic #2: Meiosis

15. How many daughter cells are created in meiosis? What types of cells (diploid or haploid) are these daughter cells?

16. When do synapsis and crossing over occur during meiosis? What is the purpose of this process?

17. Describe the differences between metaphase I and metaphase II of meiosis. See the images posted to the Wiki page for a visual.

18. Describe the differences between anaphase I and anaphase II of meiosis. See the images posted to the Wiki page for a visual.

19. How does the amount of DNA in a diploid cell that has just copied its DNA in preparation for meiosis compare to the amount of DNA in a haploid daughter cell at the end of meiosis II?

20. Why must gametes (eggs and sperm) be haploid cells?

21. How does meiosis increase genetic variation in a population? (Hint: there are three ways!!!)

22. Why do populations of organisms that use meiosis and sexual reproduction have an evolutionary advantage over populations of organisms that use asexual reproduction?

Topic #3: Cell Cycle Regulation

23. How are cancer cells different from normal cells?

24. What is the difference between a benign and a malignant tumor?

25. What occurs at the M phase checkpoint?

26. Why do most cancer treatments target rapidly dividing cells?

Calculations Practice: Chi Square Test

Remember that we always use the following steps to complete a Chi square test. You will need to have these steps memorized for this test!

1. State your null hypothesis
   This is always a negative statement that begins with "There is no statistically significant difference between…"

2. Determine your expected values
   Typically, you will need to find your expected decimal frequencies and multiply by the total population size to get whole numbers for your expected values.

3. Calculate your Chi square value
   To calculate this value, you will need to know your observed and expected values and the following equation… $X^2 = \sum \frac{(o-e)^2}{e}$

4. Find your critical value using a critical values chart
   To do this, you will need to know the number of degrees of freedom for your data (n-1) and use a p value of 0.05.

5. Compare your Chi square value to your critical value and draw a conclusion
   Remember, if your Chi square value is HIGHER than your critical value, you reject your null hypothesis. If your Chi square value is LOWER than your critical value, you support (fail to reject) your null hypothesis.

Suppose you are conducting an experiment to determine if cancer affects the frequency of cell division. You have collected the following data from intestinal cells in a healthy mouse and intestinal cells in a mouse with cancer. For each sample, you have counted the number of cells in interphase vs. mitosis

	Number of Cells in this Stage in a Healthy Mouse	Number of Cells in this Stage in a Mouse with Cancer
Interphase	85	56
Cell Division	18	38
Total Cells counted in mouse	103	94

1. State your Null Hypothesis.

   Also, state your Alternate Hypothesis (the exact opposite statement).

   State your Alternate Hypothesis as an actual prediction (i.e. the frequency of cell division will increase or decrease) in "If, then" format.

2. Determine your **expected values.**
   *Note: This example is a little different from Chi square tests we have done in the past, but it is **exactly** like the Chi square test we did with the onion root tip photo cards. In this case, if our null hypothesis is true, we would expect the cancer cell data to match the healthy cell frequencies. Use the healthy cell data to determine expected decimal frequencies (percentages) for each stage (interphase vs. cell division). Then, multiply the decimal frequencies by the total number of cancer cells (to determine the number of cancer cells you would expect to find in each stage if the null hypothesis is true).*

3. Calculate your Chi square value. Make your own observed/expected chart to help calculate the final X^2 value.
   You will need to know the expected values that you calculated in #2 and the observed values for the cancer cells from the chart.

4. Find your critical value using a critical values chart (see below)

	Degrees of Freedom							
p	1	2	3	4	5	6	7	8
0.05	3.84	5.99	7.82	9.49	11.07	12.59	14.07	15.51
0.01	6.64	9.32	11.34	13.28	15.09	16.81	18.48	20.09

5. Compare your Chi square value to your critical value **and draw a conclusion**.
   Note: Make sure you discuss your alternate hypothesis as well.