# AP Biology Unit 4 Study Guide: Mitosis and Meiosis

**Key Terms**

* 1. **Cell cycle**
  2. **Mitosis**
  3. **Interpahse**
  4. **Sister chromatids**
  5. **Centromere**
  6. **Prophase**
  7. **Metaphase**
  8. **Anaphase**
  9. **Teleophase**
  10. **Spindle fibers**
  11. **Cleavage furrow**
  12. **Cell plate**
  13. **Diploid cell**
  14. **Haploid cell**
  15. **Homologous chromosomes**
  16. **Gametes**
  17. **Meiosis**
  18. **Germ lines**
  19. **Crossing over**
  20. **Alleles**
  21. **Chiasmata**
  22. **Gametogenesis**
  23. **Spermatogenesis**
  24. **Oogenesis**
  25. **Polar bodies**
  26. **Nondisjunction**

# AP Biology Unit 4 --Cell Reproduction--Mitosis & Meiosis

**Cell Division:** *Define-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

Every second, thousands of cells are dying throughout our bodies. Fortunately, the body replaces them at an amazing rate. In fact, epidermal, or skin, cells die off and are replaced so quickly that the average 18-year-old grows an entirely new skin every few weeks. The body keeps up this unbelievable rate thanks to the mechanisms of cell division.

## The Cell Cycle: *Define:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

Every cell has a life cycle, the period from the beginning of one division to the beginning of the next. The cell cycle is divided into two periods: **interphase and mitosis.**

*Define interphase:*

Interphase can be divided into three stages: **G1, G2, and S phase.**

*Draw a diagram of the cell cycle, include interphase with it’s three phases; mitosis with it’s four phases; and cytokinesis. Also, describe the events in G1, G2, and S phase.*

The most important phase is the **S phase**. That’s when the cell replicates its genetic material. The first thing a cell has to do before undergoing mitosis is to duplicate all of its chromosomes, which contains the organism’s DNA “blueprint”. During interphase, every single chromosome in the nucleus is duplicated.

*What is a chromatid?*

*What are sister chromatids?*

*Draw a diagram of a chromatid that is replicated to form sister chromatids. Show the location of the centromere(s) on each structure.*

You’ll notice that the original chromosome and its duplicate are still linked, like Siamese twins. These identical chromosomes are now called **sister chromatids**. (each individual structure is called a chromatid.) The chromatids are held together by a structure called the **centromere or a kinetochore.** \***Although the chromosomes have been duplicated, they are still considered a single unit.** Once duplicated has been done, we’re ready for mitosis.

**Mitosis**: *Define-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*For each of the following stages describe the events that in it and draw a diagram to illustrate the phase.*

*Prophase:*

*Metaphase:*

*Anaphase:*

*Telophase:*

*What is cytokinesis and when does it occur?*

Draw a diagram to illustrate cytokinesis and the formation of two new distinct daughter cells in an animal cell. Label the cleavage furrow and the two new nuclei.

One thing to remember: Cytokinesis occurs differently in plant cells. The cell doesn’t form a cleavage furrow. Instead, a partition called a **cell plate** forms down the middle region.

Draw and label a diagram of this event.

## Haploids versus Diploids

*What is a haploid cell? How many chromosomes are present?*

*What is a diploid cell? How many chromosomes are present?*

Human chromosomes come in pairs called **homologues**. So while there are 46 of them altogether, there are actually only 23 distinct chromosomes. The **homologous chromosomes** which make up each pair are similar in size and shape and express similar traits. This is the case in all sexually reproducing organisms. In fact, this is the essence of sexual reproduction: Each parent donates half its chromosomes to its offspring.

**Gametes**

What are gametes and where do they come from?

Are gametes haploid or diploid? (Circle one)

**Meiosis**

Meiosis is very similar to mitosis. The major distinction is that meiosis consists of two groups of divisions, meiosis I and meiosis II.

*Summarize the phases of meiosis I:*

1. *Prophase I, include* ***synapsis, tetrad, chiasmata, and crossing over.***
2. *Metaphase I*
3. *Anaphase I*
4. *Telophase I*

*Summarize meiosis II:*

1. *Prophase II:*
2. *Metaphase II:*
3. *Anaphase II:*
4. *Telophase II:*

**Genetic Variation**

In mitosis, every daughter cell is exactly like the parent cell. Meiosis and sexual reproduction, however, result in a reassortment of the genetic material. This reassortment, called **genetic recombination**, originates from three events during the reproductive cycle:

*Describe the following three sources of variation>*

1. *Crossing over:*
2. *Independent assortment of homologues:*
3. *Random joining of gametes:*

**Why Cells Divide**

*Explain why cell divide. Focus on explaining the* ***surface-to-volume ratio*** *and the* ***genome-to-volume ratio****.*

*What is density-dependent inhibition?*

# Grid-In Questions (numerical responses)

1. A yeast cell in the early portion of interphase of meiotic cell division has 24 fg of DNA (fg = 1 x 10-15 grams). If the yeast cell completes meiotic division to form four haploid cells, how many fg of DNA would be expected in each haploid cell?

Answer:\_\_\_\_\_\_\_\_\_\_\_

Essay #1

Describe the process of cell division in plants and animals giving specific attention to the following:

1. The stages of mitosis, cytokinesis, and other phases of the cell cycle.
2. Factors that induce cells to divide.
3. Factors that might contribute to abnormal cell division such as cancer.

Essay #2

Describe meiosis in animals and plant cells giving special attention to the following:

1. The stages of meiosis.
2. The function of meiotic daughter cells and the organs where meiosis takes place.
3. Contribution to genetic variation.