STAGES OF MITOSIS

Learning Competency/ies:
Compare mitosis and meiosis and their role in the cell

LESSON 1: CELL CYCLE: Interphase and cell Division

Living organisms grow. Growth is a permanent increase in size resulting from cell division and cell differentiation to form tissues and organs in multicellular organisms. As the smallest living component of an organism, the cell performs a lot of activities. It grows., prepares to divide, then undergoes division to form two daughter cells. Each daughter cell contains the same genetic materials as the parent cell. Soon, the daughter cell will also undergo the same cycle of growth and division. The series of activities is called Cell Cycle.

The two main stages in the cell cycle are Interphase- Period of Growth and Cell division (Mitosis and Meiosis). In Figure 1 is illustration of the stages of the cell cycle.

New cells are formed through cell division. This is one important breakthrough that was discovered by Rudolf Virchow, a German pathologist in 1885. In this process, one cell divides and becomes two. The two daughter cells formed in the process grow and later divide again into four new cells. This repeated process of cell division is called a cycle through mitosis and meiosis.

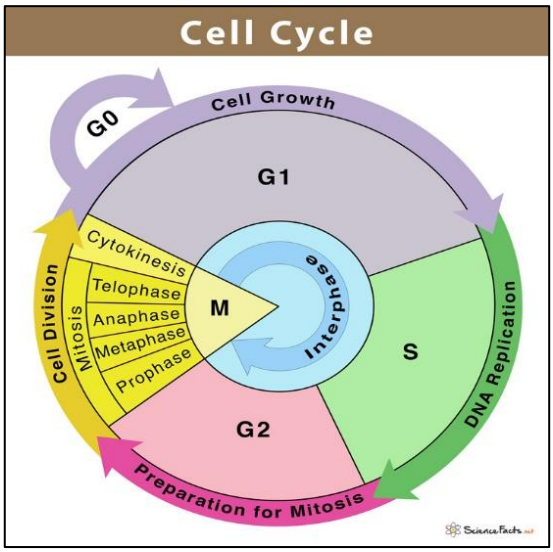


Figure 1. Cell cycle in Eukaryotic cells

A. INTERPHASE

Table 1: Event of Interphase stage

SUMMARY EVENTS DURING THE INTERPHASE STAGE	
GO	• A resting phase where the cell has left the cycle and has stopped dividing
First Gap 1 – G1	• Cell grows initially • Synthesis of protein and ribonucleic acid or RNA occurs • Organelles such as mitochondria increase in number
Synthesis phase or S phase	• DNA is synthesized, thus replicating the chromosomes in preparation for the next cell division
Second Gap or G2	• Cell grows rapidly • Cell prepares for the actual cell division (mitosis)

The interphase refers to the period that follows one cell division and precedes another. During this stage, the cell does not divide; it merely grows. The chromosomes replicate itself because the DNA molecule contained in the chromosomes produces an exact copy of itself. Interphase is the longest phase in the cell cycle and consists of the G1, S, and G2 phase. The First phase is the G1 or gap 1 is the primary growth phase of the cell. The second phase is the synthesis phase or the S phase. The third phase is Gap 2 which is the preparation for the cell division. Table 1 is the summary of the event during the interphase stage

B. Cell Division

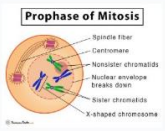
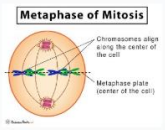
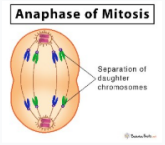
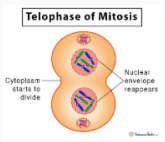
Cell Division may be the nuclear division (karyokinesis), which involves the division of the nucleus, and cytoplasmic division (cytokinesis) is the division of cytoplasm. There are two types: the mitosis (asexual reproduction) division and meiosis (sexual reproduction)

I. MITOSIS - a type of cell division that occurs in the nonreproductive (somatic) cells such as the skin, bones, nails, and hair. It is responsible for the increase in weight and height of the baby as she grows and develops into a teenager. Also responsible for the healing of the wounded when a part of a body is accidentally cut or scratched.

The role of mitosis in the cell cycle is to replicate the genetic material in an existing cell—known as the “parent cell”—and distribute that genetic material to two new cells, known as “daughter cells.” To pass its genetic material to the two new daughter cells, a parent cell must undergo cell division or mitosis. Mitosis results in two new nuclei-which contain DNA that eventually become two identical cells during cytokinesis.

To accomplish this goal, mitosis occurs in four discrete, consistently consecutive **phases: 1) prophase, 2) metaphase, 3) anaphase, and 4) telophase (PMAT).** Figure 2 above and 3 below: show the four Stages of Mitosis (IPMAT)

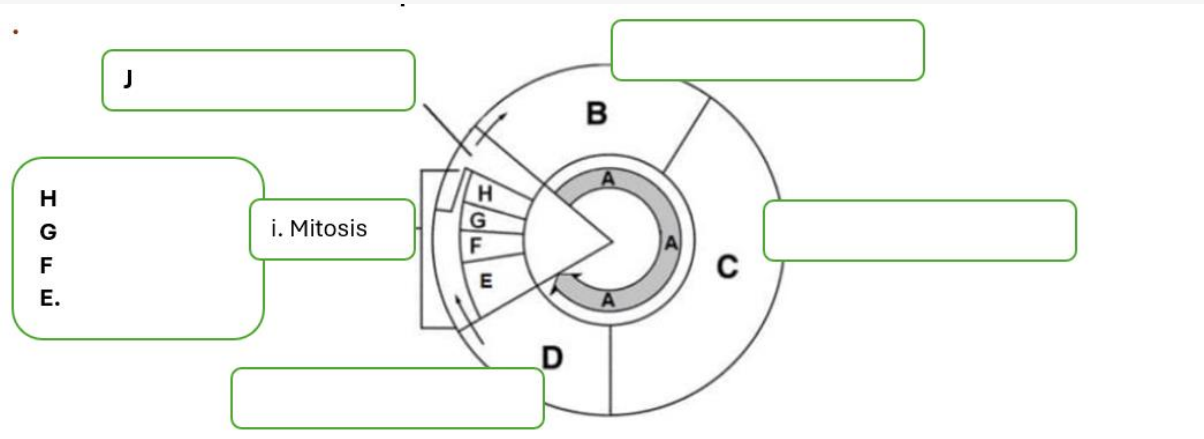
Table 2: Stages of Mitosis with Each Activity

Stages of Mitosis - PMAT	Activities within the Cell
 **Prophase of Mitosis**	• Nucleolus disappears in the nucleus, serving as a starting signal. • The nuclear membrane disintegrates. • Each chromosome appears as two identical sister chromatids joined at the centromere. • In the cytoplasm, spindle fibers begin to form, made of microtubules arranged between the two centrioles. • The centrioles move away from each other, propelled by lengthening bundles of microtubules.
 **Metaphase of Mitosis**	• The centrioles are now at the opposite poles of the cell. • Chromosomes align at the equatorial plane. • Each spindle fiber from both centrosomes connects to each chromosome through its kinetochore.
 **Anaphase of Mitosis**	• Spindle fibers begin to contract and become shorter. Continued contraction causes the separation of the genetically identical sister chromatids. • Centromeres divide. • The single chromatids move towards the opposite poles • Each chromatid is now considered an individual chromosome. • At the end of anaphase, the two poles of the cell have an equal set of chromosomes.
 **Telophase of Mitosis**	• The chromosomes are now at the opposing poles of the spindle. • The microtubules disappear. • Two sets of chromosomes are surrounded by new nuclear membranes, completing the nuclear division process known as **karyokinesis**. • Cytoplasmic division called **cytokinesis** occurs concurrently, splitting the cell into two.

II. PERFORMANCE TASK

Worksheet 1a.: label the Cell Cycle

Label the parts of the cell cycle and briefly describe the event in each stage. Write the name and the letter on the box provided. Look for the answer on the table below.



A	Interphase- growth and replication of DNA
B	G1 growth (G1 checkpoint cell size, growth, and environment show cell is ready to start reflecting the DNA
C	S- DNA is replicated (synthesis)
D	G2 cells get ready to divide. G2 checkpoint. If the DNA replicated is complete and correct MPF allows the cell to pass G2 and go to M phase.
E	Prophase- chromatin winds up and becomes chromosomes, the nuclear membrane breaks down, and centrioles migrate to the opposite poles of the cell. Nucleolus disappear. Aster forms.
F	Metaphase- sister chromatids line up along the equator. Spindles are attached (Mcheckpoint- check spindle fiber (microtubules) attachment to chromosomes at the kinetochore (anchor sites)
G	Anaphase- sister chromatids separate and move to opposite sides of the cell
H	Telophase- cell wall (cell plates in plates) begins to form. Two cells are beginning to divide, two nuclear membranes are reforms, and two nucleoli are reforming.
I	Mitosis- division of a cell nucleus
J	Cytokinesis – division of cytoplasm.

WORKSHEET # 1.b: Name Me

Direction: The diagram shows the stages of mitosis in an animal cell. Label each stage/phase by writing the name and number. Write your answer in the box provided. **(Ex. Prophase- 1)**

Guide Questions:

1. What stage of mitosis when chromosomes move to the middle of the cell? _____
2. When are chromosomes separate? _____
3. How many daughter cells are produced during mitosis division? _____

Worksheet 2:

Complete the table by checking the correct column for each description of the cell cycle.

Activities in the cell	Interphase	Mitosis
1. Cytokinesis and karyokinesis occurs		
2. Cells grow, and organelles increase in number		
3. Chromosomes align at the equatorial plane		
4. DNA is replicated		
5. Two daughter cells are produced		
6. The period of growth		
7. The period of division		
8. The chromosomes are separated to the opposite pole		
9. The chromatin becomes double-stranded known as sister chromatids		
10. Consists of G1, S and G2		

III. WRITTEN WORKS: (ASSESSMENT)

Direction: Read and understand each question, then choose the correct answer. Write the letter of your choice on a box before each number.

☐ 1. How many daughter cells are produced after mitosis?

A. 2 B.4 C. 23 D.46

☐ 2. Which of the following cells undergo mitosis?

A. Cardiac muscle B. sperm and egg cell C. skin cells D. Both A and C

☐ 3. Which checkpoint in the cell ensures that the cell is ready to enter the M phase?

A. G1 phase B. G2 phase C. M checkpoint D. S checkpoint

☐ 4. Which sequence of the cell cycle is common to eukaryotes?

A. G1 to G2 to S to M to cytokinesis C. G1 to M to G2 to S to cytokinesis

C. G1 to S to M to G2 to cytokinesis D. G1 to S to G2 to M to cytokinesis

☐ 5. Where does the duplication of genetic materials happen?

A. G1 phase B. G2 phase C. M checkpoint D. S checkpoint

☐ 6. What is not a function of mitosis?

A. growth C. wound repair

C. production of reproductive cell D. replacement of old worn-out cell

[ ] 7. Which is the correct sequence of steps in the cell cycle?

A. Anaphase, prophase, interphase, metaphase, telophase

B. Interphase, anaphase, metaphase, prophase, telophase

C. Interphase, prophase, metaphase, anaphase, telophase

D. Prophase, metaphase, interphase, anaphase, telophase

[ ] 8. Which of the following statements of miosis is correct?

A. The centromere of the chromosome separates during metaphase.

B. The chromatid number in a daughter cell is the same as in the parent cell.

B. The chromosome number in a daughter cell is the same as that in the parent cell.

D. The chromosome number in a daughter cell is the same as the chromatid number in the parent cell.

[ ] 9. Which of the following is true about plant cell division that differentiates it from animal cell division?

A. Formation of cell plate

C. Formation of cleavage furrow

B. Inability to undergo cytokinesis after mitosis

D. Production of four new cells

[ ] 10. Your teacher asked you to identify a specimen's mitosis stage under the microscope. You observe that instead of a typical round cell shape, the cell has a narrow middle part that almost separates into two bulging ends, which looks like the number 8. The cell is undergoing _____.

A. Anaphase B. Metaphase C. Cytokinesis D. Prophase

IV. REFLECTION

What Happens When Mitosis Goes Wrong And In Which Phase Will It Go Wrong? | Sciencing