7

DepED
DEPARTMENT OF EDUCATION

Lesson Exemplar for Science

Quarter 2
Lesson
4

Lesson Exemplar for Science Grade 7
Quarter 2: Lesson 4 (Week 4)
S.Y. 2024-2025

Development Team

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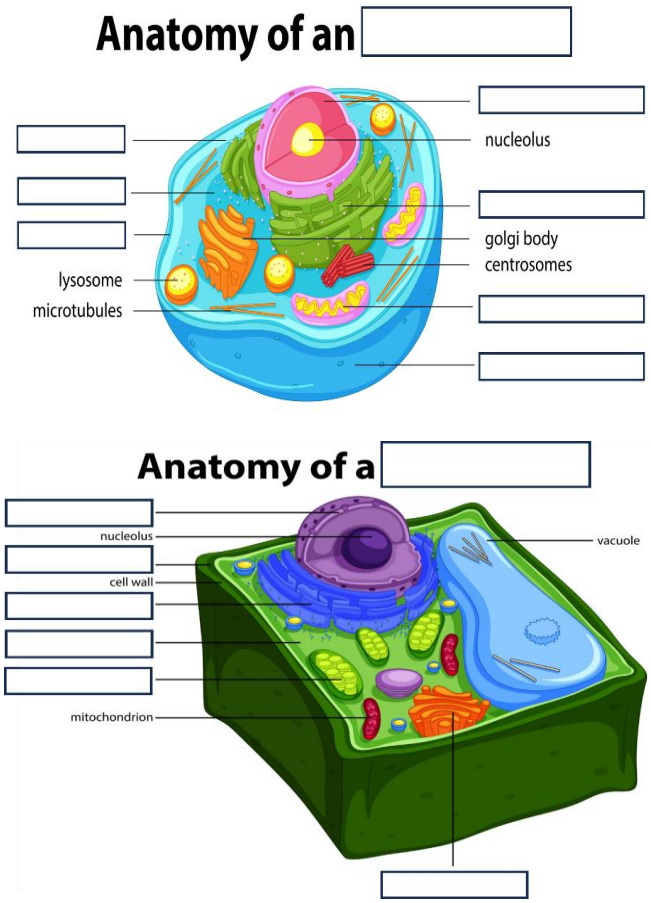
SCIENCE (BIOLOGY) / QUARTER 2 / GRADE 7

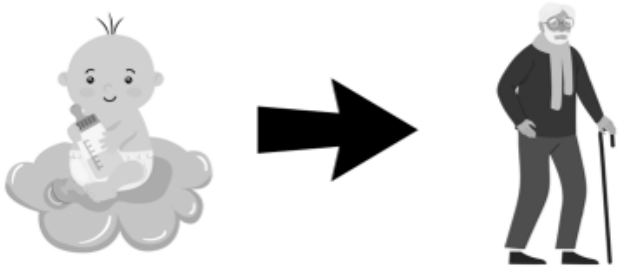
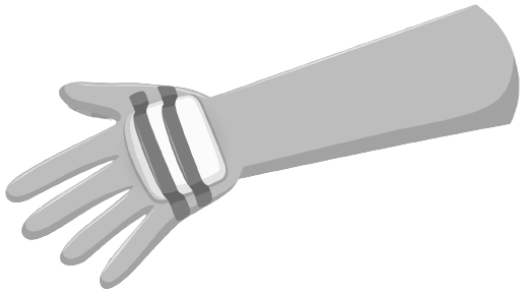
I. CURRICULUM CONTENT, STANDARDS, AND LESSON COMPETENCIES	
A. Content Standards	*Learners learn that:* 1. Familiarity and proper use of a compound microscope are essential to observe cells. 2. The organelles of plant and animal cells can be identified using a compound microscope. 3. Cells are the basic unit of life and mitosis, and meiosis are the basic forms of cell division. 4. Fertilization occurs when a male reproductive cell fuses with a female reproductive cell. 5. Sexual reproduction is the basis of heredity. 6. The level of biological organization provides a simple way of connecting the simplest part of the living world to the most complex. 7. Identifying trophic levels helps understand the transfer of energy from one organism to another as shown in a food pyramid.
B. Performance Standards	By the end of the Quarter, learners demonstrate understanding of the parts and function of a compound microscope and use this to identify cell structure. They recognize that the cell is the basic unit of life and that some organisms are unicellular and some are multicellular. They explain that there are two types of cell division, and that reproduction can occur through sexual or asexual processes. They use diagrams to make connections between organisms and their environment at various levels of organization. They explain the process of energy transfer through trophic levels in food chains.
C. Learning Competencies and Objectives	***Learning Competency*** 1. recognize that cells reproduce through two types of cell division, mitosis and meiosis, and describe mitosis as cell division for growth and repair ***Lesson Objectives*** 1. Identify the types of cell division. 2. Define mitosis and meiosis. 3. Differentiate mitosis and meiosis. 4. Enumerate the significance of mitosis. 5. Describe the different stages of mitosis. 6. Illustrate the stages of mitosis. 7. Summarize the stages that occur during meiosis.

D. Content	• Two types of cell division • Stages of Mitosis and Meiosis • Mitosis as cell division for growth and repair
E. Integration	SDG 3 (Good Health and Well-Being): Cellular reproduction as fundamental to human health SDG 2 (Zero Hunger): Cellular reproduction in plants for crop growth and production SDG 15 (Life on Land): Mitosis in plants and animals contributes to biodiversity and the conservation of various species and ecosystems SDG 4 (Quality Education): Biology education and scientific research

II. LEARNING RESOURCES

- Hoefnagels, M. (2019). Biology: The Essentials (3rd ed.). McGraw-Hill Education.
- Raven, P. (2017). Biology (11th ed.). McGraw-Hill Education.
- New Mexico AgriScience Lesson Plan Library. (n.d.). Examining Mitosis and Meiosis [Lesson plan]. http://www.nmffa.org/uploads/4/1/0/7/41075673/c3-3_mitosis_and_meiosis.pdf
- McGraw-Hill. (n.d.). A: Chapter 4: Cell Reproduction - McGraw-Hill Higher Education. Yumpu.com. https://www.yumpu.com/en/document/read/33170847/a-chapter-4-cell-reproduction-mcgraw-hill-higher-education

III. TEACHING AND LEARNING PROCEDURE		NOTES TO TEACHERS
A. Activating Prior Knowledge	**DAY 1** **SHORT REVIEW** Recall the important organelles involved in the cell cycle process. Identify the type of cell and its parts, and write your answer in the box provided. *Use the link provided for the picture)*  	Photo Link: https://www.vecteezy.com/vector-art/430301-diagram-showing-anatomy-of-animal-cell Photo Link: https://www.vecteezy.com/vector-art/419163-diagram-showing-anatomy-of-plant-cell

	Review Activity: Cycle of Life Instruction: The teacher will present the pictures and let the students answer the process questions. *Picture #1*  **Process Questions:** **1.** What have you observed in the picture? Can you compare it with yourself during your childhood to your picture now? **2.** Which do you think has the greatest number of cells, the adult, the child or they have the same number? *Picture #2*  **Process Question:** Have you experienced to have a wound in your skin? How is the healing process possible?	Photo Link: https://www.vecteezy.com/vector-art/1868584-injury-arm-with-gauze
B. Establishing Lesson Purpose	**1. Lesson Purpose** **Essential Questions:** 1. What kind of cell divides by mitosis? 2. What kind of cell divides by meiosis? 3. Where does the mitosis and meiosis division take place? 4. Why are both cell divisions necessary for the development of an organism?	

Essential Concept Activity

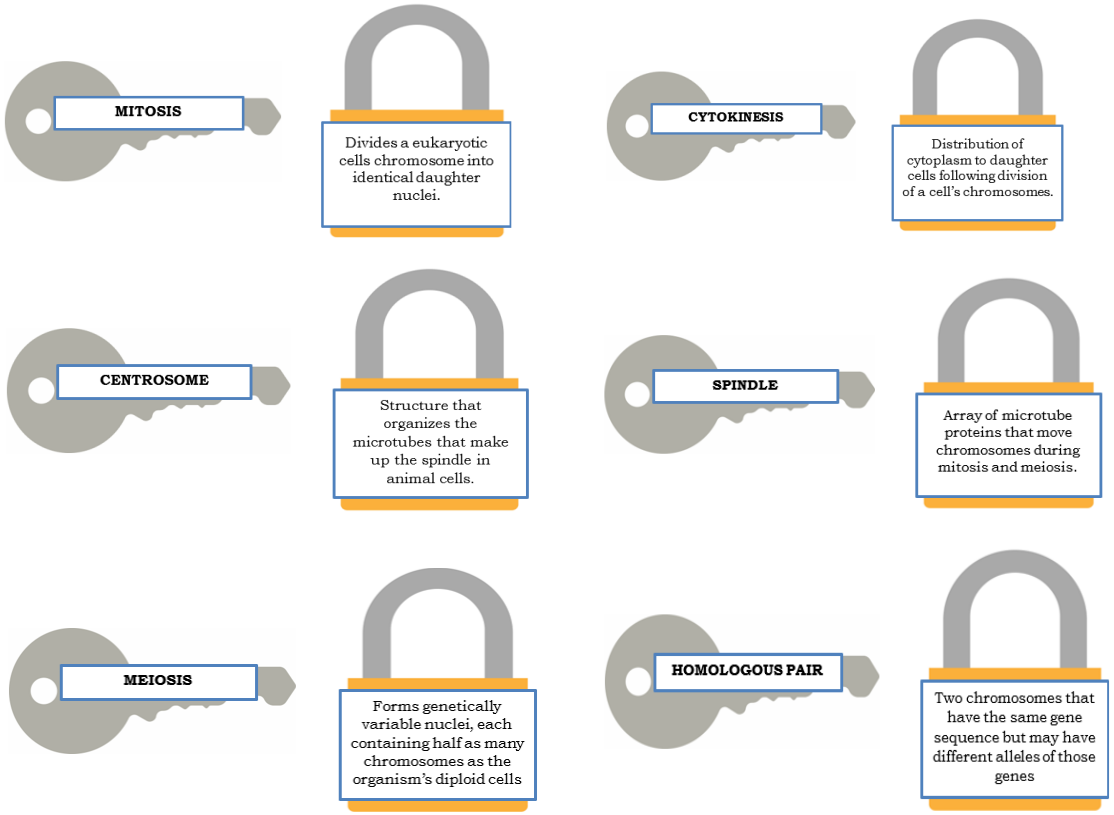
Identify the two types of cell division being described in the following:

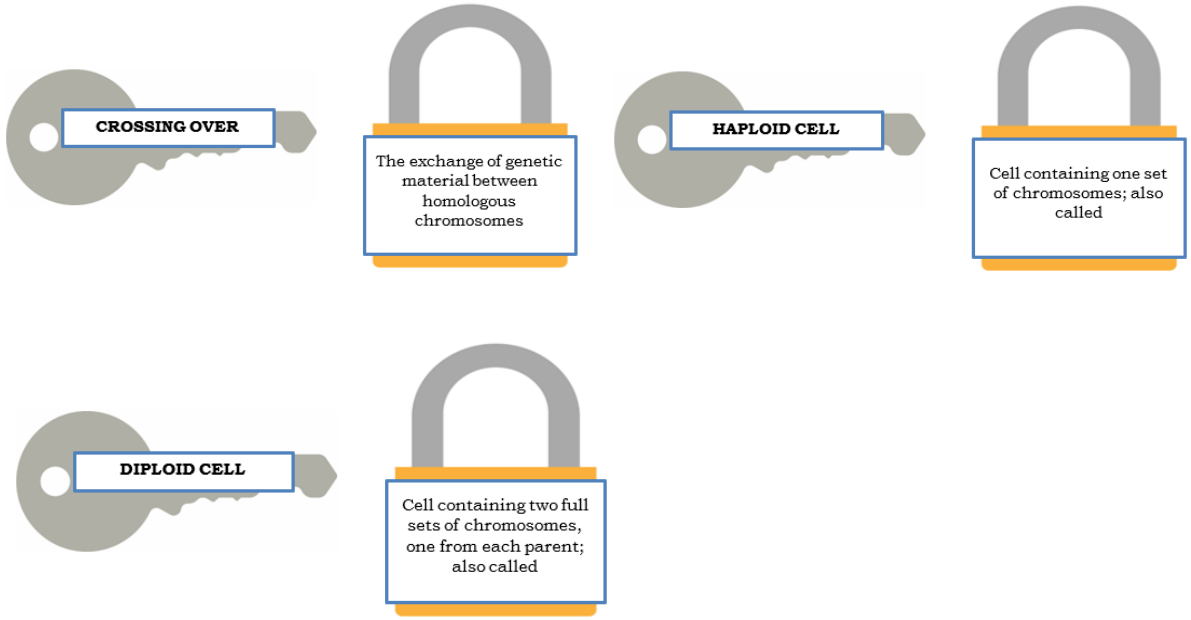
__ __ __ __ __ __ __ 1. It is the division of cells in the reproductive process.

__ __ __ __ __ __ __ 2. It is cell division for growth and repair.

2. Unlocking Content Area Vocabulary

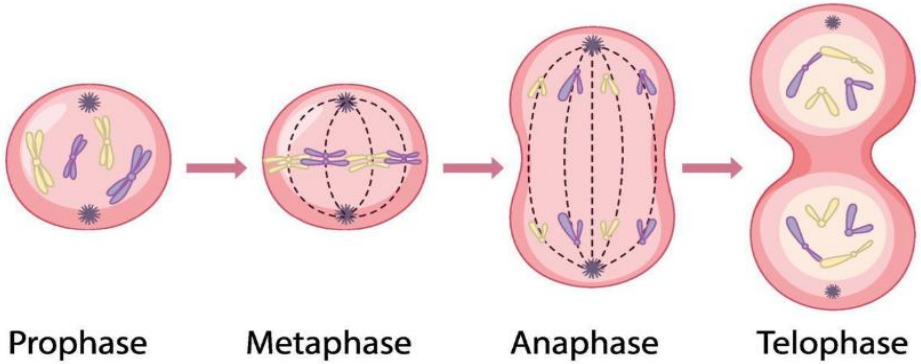
Instruction: The teacher will unlock the content area vocabulary to guide the students about the terms used throughout the lesson.



		
C. Developing and Deepening Understanding	**SUB-TOPIC 1: Stages of Mitosis** **1. Explicitation** **Guided Questions:** 1. What is mitosis, and why is it important? 2. What are the steps of mitosis, and what happens in each? *Learning Activities:* The student will watch the video about mitosis and meiosis using the link provided. Link: https://www.mometrix.com/academy/cellular-division-mitosis-and-meiosis/ **Stages of Mitosis** **Instruction:** From the video provided, draw a cell in each of the following stages of mitosis. Provide the major events in each stage. (See activity sheet)	The teacher may first discuss the lesson about cell cycle and its phases. The cell cycle includes gap phase 1 (G_1), synthesis (S), gap phase 2 (G_2), mitosis, and cytokinesis. G_1, S, and G_2 constitute the interphase, and mitosis and cytokinesis together are called the M phase. Cytokinesis is the phase of the cell when the cytoplasm divides, creating two daughter cells. Link for Lecture: https://vcell.science/project/mitosis

Learner's Guide:

Mitosis divides a eukaryotic cell's chromosomes into two identical daughter cells, wherein mitotic cell division produces the cells needed for growth, development, and tissue repair. Mitosis is divided into four stages.



Prophase - is the stage of chromosome replication. The chromosomes condense and the spindle forms; the nucleus disassembles, the nuclear envelope breaks up, and the spindle fibers attach to the chromosomes.
Metaphase - is the step in which the chromosomes formed in prophase move to the middle of the cell. These chromosomes line up along the equator of the cell.
Anaphase - is where the chromosomes separate and move to opposite sides of the cell. Shortening spindle fibers separate the chromosomes.
Telophase - the nucleus reforms and a membrane appears between each mass of chromosomes. This newly formed membrane divides the cytoplasm. Once this is completed, the two separate cells repeat the process.

Link:
https://www.vecteezy.com/vector-art/7011727-asexual-reproduction-fragmentation-diagram

Video demonstration for Stages of Mitosis:
https://youtu.be/Rc_Mu4lSbf8

DAY 2

2. Worked Example

Mitosis Matching (Individual Activity)
Instruction: Pair the phase of mitosis with the corresponding description given below. Write your answer in the blank provided. Some stages will be used more than once.

Prophase	Metaphase	Anaphase
Telophase	Cytokinesis	

_____ 1. The sister chromatids are moving apart.
_____ 2. The nucleolus begins to fade from view.
_____ 3. The cell plate is completed.
_____ 4. The spindle is formed.
_____ 5. The chromosomes become invisible.
_____ 6. The chromosomes are located at the equator of the cell.
_____ 7. Cell division is completed.
_____ 8. The nuclear membrane begins to fade from view.
_____ 9. The division (cleavage) furrow appears.
_____ 10. The chromosomes are moving towards the poles of the cell.
_____ 11. Chromatids line up along the equator.
_____ 12. The reverse of prophase.
_____ 13. The organization phase.
_____ 14. A new nuclear membrane is forming around chromosomes.
_____ 15. The cytoplasm of the cell is being divided.

Figure It Out (Individual Activity)

Instruction: Answer the following questions based on your understanding of the lesson.

1. A mosquito cell in interphase has six chromosomes. How many sister chromatids does the same cell have during metaphase? Explain.
2. A human cell in early prophase has 46 chromosomes. How many chromosomes does one of the daughter cells have immediately after mitosis and cytokinesis?

Explore (Group Activity): Observing Mitosis in Onion Root Tip Cells (Using Prepared Slides)

Objective: To observe and identify the stages of mitosis in onion root tip cells using prepared microscope slides with guided questions.

ANSWER KEY:

1. Anaphase
2. Prophase
3. Cytokinesis
4. Prophase
5. Telophase
6. Metaphase
7. Cytokinesis
8. Prophase
9. Cytokinesis
10. Anaphase
11. Metaphase
12. Telophase
13. Prophase
14. Telophase
15. Cytokinesis

Materials: Microscope, Prepared slides of onion root tip cells (mitosis)**,** Microscope slides**,** Coverslips

Procedure:

Preparation

a) Obtain a prepared microscope slide with onion root tip cells in different stages of mitosis.
b) Place the slide on the stage of the microscope.

Observation

a) Start with the lowest magnification and locate the onion root tip tissue on the slide.
b) Once you've found the tissue, switch to higher magnifications to observe the stages of mitosis.

Guided Questions:

1. Identify and describe the cells in prophase. What features indicate that they are in this stage?
2. What does a cell in metaphase look like? What specific characteristics define this stage?
3. Describe the cells in anaphase. How can you tell they are in this stage?
4. What are the key features of cells in telophase?

"**Mitosis in Motion**" **Activity (Group Activity)**

For those schools without a microscope, you can use this activity as an alternative.

Objective: To simulate the stages of mitosis using everyday objects to illustrate the process.

Materials Needed:

Play-Doh or modeling clay (different colors if possible)
Popsicle sticks or toothpicks
String or yarn
Clear space (table or floor)
Images or diagrams of mitosis stages for reference

Procedure:

Preparation: Prepare different colors of Play-Doh or clay to represent chromosomes. Roll small balls or elongated shapes to depict chromosomes.

Setting the Stage:

Lay out the clear space and designate specific areas to represent different stages of mitosis (e.g., prophase, metaphase, anaphase, telophase).

Use the string or yarn to divide these areas to mimic cell boundaries.

Representing Mitosis Stages:

Prophase:
Place the chromosomes (Play-Doh balls) randomly within the cell area.
Use popsicle sticks or toothpicks to simulate the spindle fibers by placing them between the chromosomes.

Metaphase:
Arrange the chromosomes in a line along the center of the cell using the string or yarn as a guide.

Anaphase:
Pull the chromosomes apart to opposite sides of the cell. Show the splitting of the chromatids and their movement.

Telophase:
Cluster the separated chromatids at opposite ends of the cell, representing the formation of new nuclei.

Use additional Play-Doh to show the formation of a cleavage furrow or cell plate to divide the cell into two.

Guided Questions:

Prophase
1. What happens to the chromosomes during prophase?
2. Why are the chromosomes condensed and scattered during this phase?

Metaphase
1. How are the chromosomes aligned during metaphase?
2. What is the significance of this alignment in mitosis?

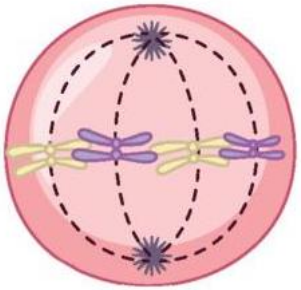
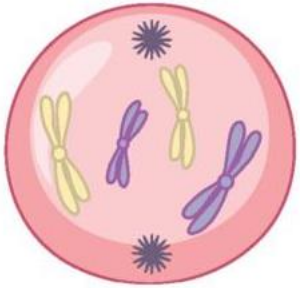
Anaphase
1. What occurs to the chromatids during anaphase?
2. How does this stage contribute to cell division?

Telophase
1. What changes are observed in telophase compared to the earlier stages?
2. Why is the formation of new nuclei crucial for cell division?

3. Lesson Activity

Mix and Match: MITOSIS Version (Individual Activity)

Instruction: Cut out the four diagrams and descriptions of the stages of mitosis and stick them on bond paper in the correct order.

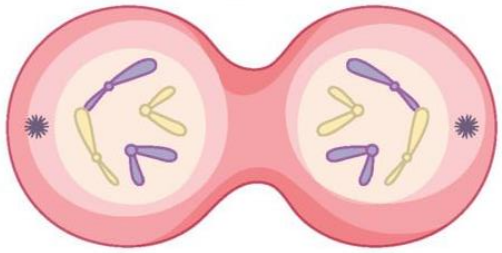
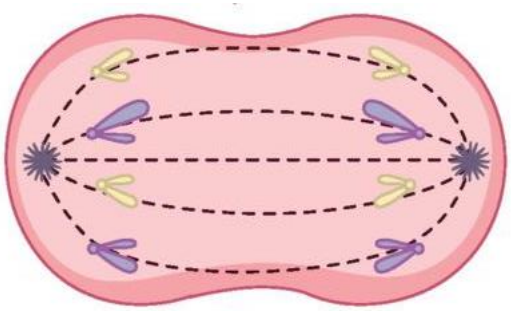
DIAGRAM OF STAGE	DESCRIPTION OF STAGE
	Stage: __ __ __ __ __ __ __ __ __ The chromosomes line up randomly on the e__ __ __ __ __ __ of the cell. They attach to the s__ __ __ __ __ __ f__ __ __ __ __ by their c__ __ __ __ __ __ __ __ __.
	Stage: __ __ __ __ __ __ __ __ The chromosomes in their r__ __ __ __ __ __ __ __ __ form, consist of two sister c__ __ __ __ __ __ __ __ __ joined by a c__ __ __ __ __ __ __ __. In this stage, the chromosomes c__ __ __ __ __ __ __, giving a shorter and thicker appearance. The nuclear e__ __ __ __ __ __ __ also breaks down. The centriole divides and the two centrioles move to opposite p__ __ __ __ of the cell. A s__ __ __ __ __ __ starts to form between the two centrioles. The spindle fibers are made from a protein called t__ __ __ __ __ __.

The teacher can use the suggested activity below before presenting the lesson on meiosis.

Mitosis Matching Game
Print out or display cards with the following terms and descriptions related to mitosis and its stages. Have students work individually or in small groups to match each term with its correct description.

Terms:
Mitosis
Interphase
Prophase
Metaphase
Anaphase
Telophase
Cytokinesis

Descriptions:
A. The division of the cytoplasm in a cell
B. The condensation of chromatin into chromosomes and the breakdown of the nuclear envelope
C. The duplicated chromosomes line up at the equator of the cell
D. A series of events that a cell goes through from one cell division to the next
E. The separation of sister chromatids and their movement towards opposite poles
F. The formation of new nuclear envelopes and the decondensation of chromosomes

	Stage: __ __ __ __ __ __ __ __ __ The separated chromosomes reach the opposite p__ __ __ __ of the cell. A n__ __ __ __ __ __ envelope forms round the two sets of duplicated chromosomes. The two n__ __ __ __ __ __ that form are i__ __ __ __ __ __ __ __ to one another. After mitosis, c__ __ __ __ __ __ __ __ __ occurs, where the cell splits into two separate cells.	
	Stage: __ __ __ __ __ __ __ __ The c__ __ __ __ __ __ __ __ __ joining the two sister chromatids splits as proteins called motor proteins walk along the spindle fibers in opposite directions. This causes the chromatids, now called c__ __ __ __ __ __ __ __ __ __, to be pulled a__ __ __ __ to the opposite poles of the cell.	

Recall: Review the stages of mitosis and its connection to meiosis.

DAY 3

SUB-TOPIC 2: MEIOSIS

1. Explicitation (Paired Activity)

Guided Questions:

1. What is meiosis, and why is it important?
2. What are the steps of meiosis, and what occurs in each?

Learning Activities:
The student will watch the video or listen to the audio file about meiosis in the link provided.

G. The process of nuclear division in somatic cells, resulting in two genetically identical daughter cells

Once students have matched the terms and descriptions, go through each pair together as a class, clarifying any misconceptions and reinforcing the key events and sequence of mitosis.

You can follow up this activity with questions like:

- What is the primary purpose of mitosis?
- How does mitosis differ from meiosis, which you'll learn about next?
- Can you give an example of a type of cell or organism that undergoes mitosis? Why is mitosis important for that cell or organism?

This review activity allows students to recall their prior knowledge of mitosis before diving into the new concept of meiosis, helping to solidify their understanding and make connections between the two processes.

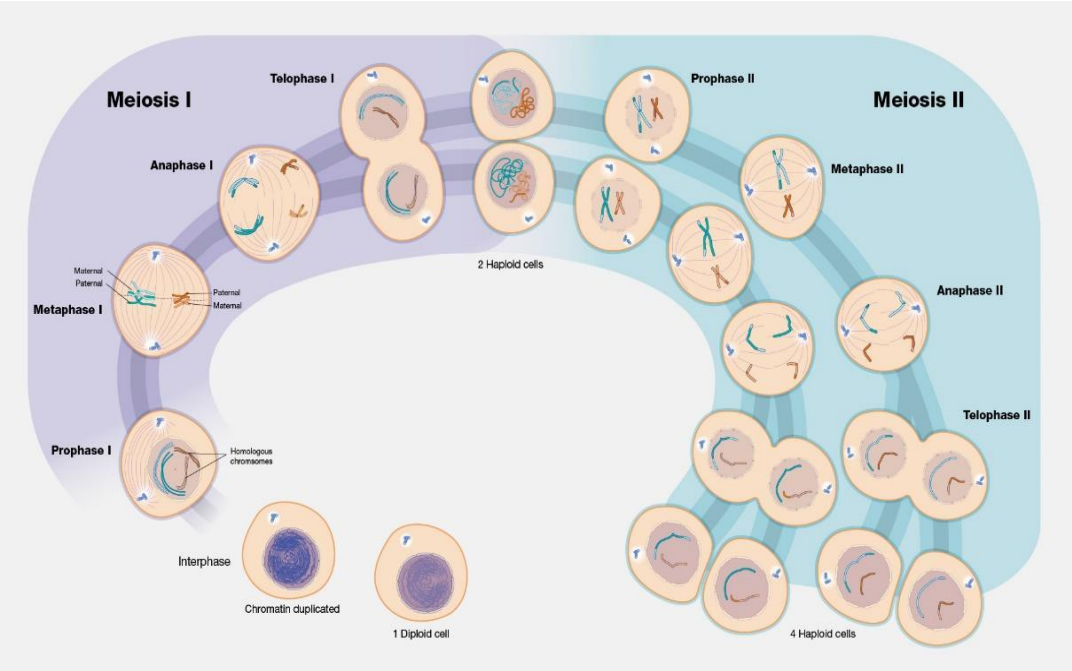
Link:
https://www.genome.gov/genetics-glossary/Meiosis

Guided Questions:

1. What is the purpose of meiosis in organisms?
2. Why is it essential for sexually reproducing organisms to undergo meiosis rather than mitosis?
3. What are the key takeaways from understanding meiosis?

Learner's Guide:

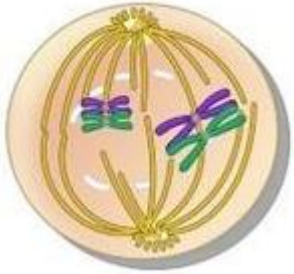
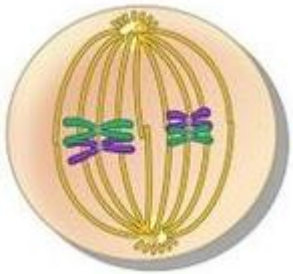
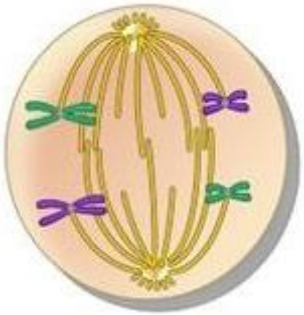
Meiosis is a type of cell division in sexually reproducing organisms that reduces the number of chromosomes in gametes (the sex cells, or egg and sperm).

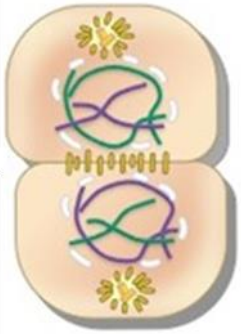
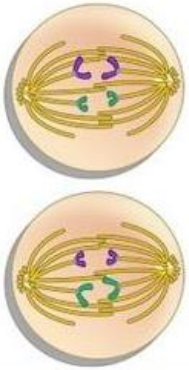
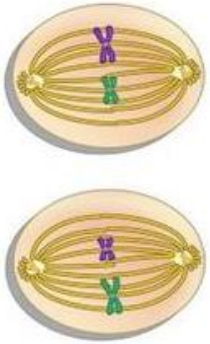


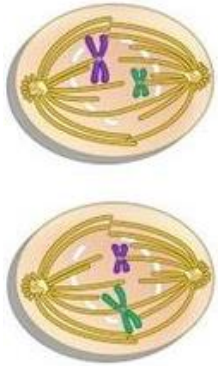
MEIOSIS I

Link: https://www.genome.gov/genetics-glossary/Meiosis

Link: https://youtu.be/84jlwjvrJwY
Link (Pictures): https://ib.bioninja.com.au/standard-level/topic-3-genetics/33-meiosis/stages-of-meiosis.html

Prophase I 	• Chromosomes condense and become visible ($2n = 4$). • Crossing over occurs. • Spindle forms. • Nuclear envelope breaks up.
Metaphase I 	• Paired homologous chromosomes line up along the equator of the cell.
Anaphase I 	• Homologous chromosomes separate to opposite poles of the cell. • Sister chromatids remain joined.

Telophase I & Cytokinesis 	• Nuclear envelopes form around chromosomes, which may temporarily decondense. • Spindle disappears. • Cytokinesis may divide cells into two.
MEIOSIS II	
Prophase II 	• Spindles form. • Nuclear envelopes break up.
Metaphase II 	• Chromosomes line up along the equator of the cell.

Anaphase II 	• Centromeres split as sister chromatids separate to opposite poles of the cell.
Telophase II & Cytokinesis 	• Nuclear envelopes assemble around daughter nuclei. • Chromosomes decondense. • Spindle disappears. • Cytokinesis divides cells.

2. Worked Example

Meiosis Matching (Individual Activity)

Instruction: Pair the following events with their appropriate phase in meiosis and write your answer in the blank provided. Some stages can be used more than once or not at all.

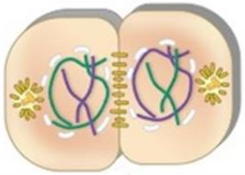
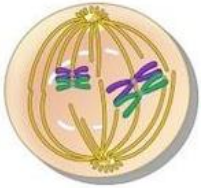
a. Prophase I
b. Metaphase I
c. Anaphase I
d. Telophase I/Cytokinesis
e. Prophase II
f. Metaphase II
g. Anaphase II
h. Telophase II/Cytokinesis

_____ 1. Homologous chromosomes line up at the equator
_____ 2. Daughter cells divide, forming 4 haploid cells
_____ 3. Spindle fibers start to reach out to centromeres of sister chromatids
_____ 4. Sister chromatids separate
_____ 5. Cytoplasm divides amongst daughter cells
_____ 6. Crossing over occurs
_____ 7. Spindle fibers start to reach out to centromeres of homologous chromosomes
_____ 8. Two daughter cells are created
_____ 9. Sister chromatids move to opposite poles
_____ 10. Homologous pairs of chromosomes
_____ 11. Sister chromatids line up along the equator

3. Lesson Activity

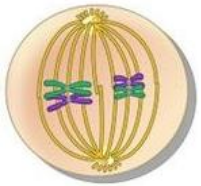
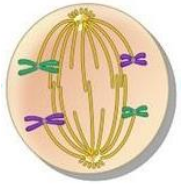
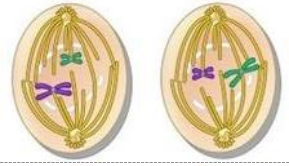
Mix and Match: MEIOSIS Version (Paired Activity)

Instruction: Cut out the stages of meiosis and descriptions, then stick them on a long bond paper in the correct order.

Prophase II	During my phase, the nuclear envelope breaks down, a spindle forms, homologous chromosomes pair up and crossing over occurs.	
Telophase I	During my phase, homologous pairs align at the equatorial plane of the spindle.	
Metaphase II	During my phase, homologous pairs separate and move to the poles.	

ANSWER KEY:

1. B
2. H
3. E
4. G
5. H
6. A
7. A
8. D
9. G
10. C
11. F

Anaphase I	My phase begins when the chromosomes reach the poles. During my phase, the spindle breaks down and cytokinesis begins.	
Telophase II	During my phase, the nuclear envelope breaks down, chromosomes condense and the spindle reforms.	
Metaphase I	During my phase, the duplicated chromosomes align at the equatorial plane of the spindle.	
Anaphase II	During my phase, the chromatids move towards the poles of the spindle.	
Prophase I	My phase begins when the chromosomes reach the poles. During my phase, the spindle breaks down and cytokinesis begins.	

Checking your Understanding

A. On numbers 1-4, encircle the best answer for the given statement. For items 5-7, write your answer in the blank provided.

1. A cell with two pairs of each set of chromosomes is called a [**diploid** | **haploid**] cell.
2. A cell with only one set of chromosomes is called [**diploid** | **haploid**] cell.
3. A type of cell division that results in diploid cells: [**meiosis** | **mitosis**]
4. A type of cell division that results in haploid cells: [**meiosis** | **mitosis**]
5. What is the diploid number for humans? _____ What is the haploid number? _____

ANSWER KEY:

1. diploid
2. haploid
3. mitosis
4. meiosis
5. Diploid number for humans: 46; Haploid number: 23

	6. When homologous chromosomes exchange genes, it is called: _____. 7. How many daughter cells are created at the end of meiosis I? _____ meiosis II? _____ B. Describe similarities and differences between meiosis I and meiosis II. **Meiosis I** | **Meiosis II** _____ | _____	6. When homologous chromosomes exchange genes, it is called: crossing over 7. Number of daughter cells created at the end of meiosis I: 2; meiosis II: 4
D. Making Generalizations	**DAY 4** **1. Learners' Takeaways** **Checking my Learnings** A. Summarize the major differences between mitosis and meiosis in the table below: **Mitosis** | **Meiosis** Crossing over | | When chromosomes split | | Number of divisions | | Number of cells resulting | | Number of chromosomes in daughter cells | | B. Summarize the major differences between meiosis I and meiosis II in the table below: **Meiosis I** | **Meiosis II** Number of cells | | Number of chromosomes | | Number of pairs of homologous chromosomes | | Number of sister chromatids | | Haploid or diploid? | |	

C. Read each statement and write down on the line the stage of mitosis or meiosis (I/II) in which the action occurs. If the action occurs in both, write **Both**. The first one is done for you.

metaphase I meiosis 1. Homologous chromosomes line up in the center of the cell.
_____ 2. The duplicated chromosomes are split apart.
_____ 3. Spindle fibers separate homologous pairs.
_____ 4. 4 haploid (n) daughter cells form.
_____ 5. Individual chromosomes line up across the middle of the cell.
_____ 6. Chromosomes become visible.
_____ 7. Sister chromatids separate from each other.
_____ 8. 2 haploid (n) daughter cells form.
_____ 9. Sister chromatids separate into individual chromosomes.
_____ 10. Nuclear envelope reforms.
_____ 11. Spindle fibers attach to the homologous chromosome pairs.
_____ 12. Individual chromatids move to each end of the cell.
_____ 13. The nuclear membrane disappears.
_____ 14. Each chromosome is connected to a spindle fiber. On both sides of the centromere.
_____ 15. Crossing over (if any) occurs.

2. Reflection on Learning

My Reflection Entry

Guided Questions	Your Opinion ...
1. What key concepts did you learn about mitosis and meiosis in this lesson?	
2. How do you think mitosis and meiosis are relevant to your everyday life? Can you provide specific examples?	
3. What do you think are the most important things to remember about mitosis and meiosis?	

ANSWER KEY:

1. Anaphase (Mitosis) / Anaphase II (Meiosis II) (Both)
2. Anaphase I (Meiosis I)
3. Telophase II / Cytokinesis (Meiosis II)
4. Metaphase (Mitosis) / Metaphase II (Meiosis II) (Both)
5. Prophase (Mitosis) / Prophase I (Meiosis I) / Prophase II (Meiosis II) (Both)
6. Anaphase (Mitosis) / Anaphase II (Meiosis II) (Both)
7. Telophase I / Cytokinesis (Meiosis I)
8. Anaphase (Mitosis) / Anaphase II (Meiosis II) (Both)
9. Telophase (Mitosis) / Telophase I (Meiosis I) / Telophase II (Meiosis II) (Both)
10. Metaphase I (Meiosis I)
11. Anaphase (Mitosis) / Anaphase II (Meiosis II) (Both)
12. Prophase (Mitosis) / Prophase I (Meiosis I) / Prophase II (Meiosis II) (Both)
13. Metaphase (Mitosis) / Metaphase II (Meiosis II) (Both)
14. Prophase I (Meiosis I)

IV. EVALUATING LEARNING: FORMATIVE ASSESSMENT AND TEACHER'S REFLECTION		NOTES TO TEACHERS
A. Evaluating Learning	**DAY 5** **1. Formative Assessment** **Instruction:** Encircle the letter of the word, words, or phrases that best completes each sentence. (1 point each) 1. During which phase do chromosomes first become visible? a. anaphase b. telophase c. metaphase d. prophase 2. A cell with 10 chromosomes undergoes mitosis. How many daughter cells are created? ___ Each daughter cell has ___ chromosomes. a. 2, 10 b. 10, 2 c. 1, 10 d. 2, 20 3. Cytokinesis begins in which phase? a. metaphase b. telophase c. prophase d. anaphase 4. Each chromosome consists of 2 _____. a. centrofibers b. chromatids c. daughter cells d. centrioles 5. In the first part of prophase, _____. a. the chromosomes uncoil, becoming faint b. the chromosomes are copied for the last time c. the chromosomes condense, becoming visible d. the cell pinches in half	**ANSWER KEY:** 1. D 2. A 3. B 4. B 5. C 6. C 7. B 8. A 9. D 10. B 11. B 12. A 13. D 14. D 15. A 16. B 17. A 18. B 19. C 20. B 21. D 22. C 23. A 24. B 25. D 26. B 27. B 28. D 29. A 30. C

6. At the beginning of metaphase, all chromosomes are _____.
    a. at different locations in the cell
    b. still in the nucleus
    c. aligned at the equator
    d. at one of two poles in the cell
7. At the end of metaphase, _____.
    a. the spindles disappear
    b. each centromere splits in half
    c. each chromosome becomes a pair of chromatids unattached to one another
    d. B and C only
8. As anaphase begins, each matching chromatid is _____.
    a. pulled towards a different centriole
    b. pulled towards the same centriole
    c. pulled towards a different centromere
    d. pulled towards the same centromere
9. At the end of anaphase, _____.
    a. one side of the cell has received all of the chromatids
    b. the matching chromatids become attached at their centromeres once more
    c. a second equator is formed
    d. each side of the cell has received a complete set of chromosomes
10. During telophase, a nuclear membrane _____.
    a. forms around one of the two sets of chromosomes
    b. forms around each set of chromosomes
    c. forms in the center of the cell
    d. forms near each set of chromosomes
11. Meiosis results in _____.
    a. 2 haploid daughter cells
    b. 4 haploid daughter cells
    c. 2 diploid daughter cells
    d. 4 diploid daughter cells

12. Which of the following cells undergo meiosis?
    a. sperm cells
    b. liver cells
    c. unicellular organisms
    d. all of these
13. Human body cells contain _____ chromosomes.
    a. 23
    b. 30
    c. 36
    d. 46
14. A cell containing the full complement of chromosomes is said to be a _____ cell.
    a. haploid (or 1n)
    b. haploid (or 2n)
    c. diploid (or 1n)
    d. diploid (or 2n)
15. A cell containing one-half of the normal complement of chromosomes is said to be a _____ cell.
    a. haploid (or 1n)
    b. haploid (or 2n)
    c. diploid (or 1n)
    d. diploid (or 2n)
16. Crossing over _____.
    a. allows chromosomes to move across the cell
    b. increases genetic diversity
    c. decreases genetic diversity
    d. does not occur in human cells
17. Which of the following distinguishes prophase 1 of meiosis from prophase of mitosis?
    a. homologous chromosomes pair up
    b. spindle forms
    c. nuclear membrane breaks down
    d. chromosomes become visible

18. A cell with a diploid number of 24 undergoes meiosis; how many chromosomes are in each daughter cell?
    a. 6
    b. 12
    c. 24
    d. 48
19. In anaphase I, chromosomes in the homologous pair _____.
    a. move toward the same centriole
    b. have their centromeres split
    c. move towards different centrioles
    d. all of the above
20. In telophase I, the spindles _____.
    a. move toward the center of the cell
    b. pull chromosomes to opposite poles of the cell
    c. replicate
    d. briefly move to the outside of the cell
21. Cytokinesis _____.
    a. usually occurs simultaneously with telophase I
    b. yields two cells with equal amounts of chromosomes
    c. forms two daughter cells
    d. all of the above
22. What event DOES NOT take place in meiosis II?
    a. The nucleus and nucleolus (if reformed at the end of meiosis I) disappear.
    b. The chromosomes (if uncoiling took place at the end of meiosis I) recondense.
    c. The chromosomes (if they did not do so at the end of meiosis I) are copied.
    d. The centrioles reappear.
23. In metaphase II, each centromere is attached to _____.
    a. two different microtubules
    b. microtubules leading to each chromosome
    c. Both A and B.

d. Neither A nor B.

24. Which of the following DOES NOT occur in anaphase II?
    a. The centromeres split.
    b. The homologous pairs separate.
    c. The sister chromatids are pulled towards opposite poles.
    d. All of the above occurs in anaphase II.
25. Which of the following DOES NOT occur in telophase II?
    a. The spindle fibers and centrioles disappear.
    b. The nuclei and nucleoli begin to reform.
    c. The chromosomes begin to uncoil.
    d. All of the above occurs in telophase II.
26. Meiosis begins with _____ and ends in the formation of _____.
    a. one haploid cell, four diploid cells
    b. one diploid cell, four haploid cells
    c. one haploid cell, two diploid cells
    d. one diploid cell, two haploid cells
27. Thus, in humans, meiosis begins with one cell containing _____ chromosomes and ends with _____ cells containing _____ chromosomes.
    a. 23, four, 46
    b. 46, four, 23
    c. 23, two, 46
    d. 46, two, 23
28. During what phase of meiosis do sister chromatids separate?
    a. prophase I
    b. telophase I
    c. telophase II
    d. anaphase II
29. One of these events does not take place during meiosis
    a. One successive division without any DNA replication
    b. Crossing over
    c. Segregation of homologous chromosomes
    d. Separation of sister chromatids

	30. The meiotic division takes place in a. Somatic cells b. Nerve cells c. Reproductive cells d. Bone cells **2. Unlocking Content Area Vocabulary** A. Demonstrate your understanding of defining the following terms. 1. Mitosis (2 points) 2. Meiosis (2 points) 3. Stages of Mitosis (Prophase, Metaphase, Anaphase, and Telophase) (8 points) 4. Diploid and Haploid Cells (2 points) 5. Homologous Chromosomes (1 point) 6. Crossing Over (2 points) 7. Stages of Meiosis (Prophase I, Metaphase I, Anaphase I, and Telophase I) (8 points) 8. Stages of Meiosis (Prophase II, Metaphase II, Anaphase II, and Telophase II) (8 points)			
B. Teacher's Remarks	*Note observations on any of the following areas:*	**Effective Practices**	**Problems Encountered**	
	strategies explored			
	materials used			
	learner engagement/ interaction			
	others			

C. Teacher's Reflection	*Reflection guide or prompt can be on:* ▪ *principles behind the teaching* *What principles and beliefs informed my lesson?* *Why did I teach the lesson the way I did?* ▪ *students* *What roles did my students play in my lesson?* *What did my students learn? How did they learn?* ▪ *ways forward* *What could I have done differently?* *What can I explore in the next lesson?*	