

Unit 7: MEIOSIS PACKET

This packet is designed to help you understand several concepts about Cell Division.

As you practice the exercises on each handout, you will be able to:

- Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. **(HS-LS3-1)**
- Describe the identifying features of the stages of meiosis I and meiosis II. **(HS10-LS3-1.1)**
- Describe the role of meiosis in producing gametes and its significance to genetic diversity. **(HS10-LS3-1.2)**
- Compare and contrast Meiosis & Cell Division **(HS10-LS3-1.3)**

Record this packet in the Table of Contents for Unit 7.
This will be the next “HANDOUT.”

Contained in this Packet:

1. Video #1: Meiosis – Sexual Reproduction
2. Meiosis Hands-on
3. Meiosis Virtual Lab

UNIT 7: MEIOSIS
Video#1: Meiosis – Sexual Reproduction


In order to be considered alive, certain requirements must be met. One of these requirements is reproduction: the ability to create offspring. Meiosis is one way living things produce offspring. During Meiosis, a series of steps must be followed in a particular sequence. Each step is unique and important in its own way. Understanding each step will increase your understanding of this type of reproduction.

Objectives:

The purpose of this video is to provide information so that students can:

- Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. **(HS-LS3-1)**
- Describe the identifying features of the stages of meiosis I and meiosis II. **(HS10-LS3-1.1)**
- Describe the role of meiosis in producing gametes and its significance to genetic diversity. **(HS10-LS3-1.2)**

Directions:

1. **FUN NOTES:** Use as a resource as you watch the video.
2. Go to the class website: thsclaybio.weebly.com
3. Click Semester #2.
4. Scroll down to Unit 7: Meiosis.
5. Click the button: Video #1: Meiosis – Sexual Reproduction
6. Turn on the closed captioning by clicking: 
7. Watch the video at least 1 time without stopping.
8. As you answer the questions that follow, **PAUSE and REWIND OFTEN!**

The questions below are designed to explain important concepts about the stages of Meiosis. Answer each question. **INCLUDE DETAILS!**

1. What is the purpose of meiosis? What does meiosis generate and for what purpose?
2. Describe the characteristics of the parent cell and the daughter cells produced during meiosis.
3. **PAUSE THE VIDEO:** Using the information from questions #2, answer this question: If a diploid cell containing 20 chromosomes experiences meiosis, how many chromosomes will each daughter cell have?
4. In order for the correct # of chromosomes to make it into the daughter cells at the end of meiosis, how many times must the cell divide (experience cytokinesis)?
5. Even though cell division and meiosis look very similar, there are some very distinct differences between these two processes. Of these differences, what are the 2 major events that occur during meiosis that lead to genetic diversity? (make sure to include the event with details & the stage of meiosis)

6. **PAUSE THE VIDEO:** DRAW a picture of the events occurring in question #5 to clarify your description.

7. What are the identifying characteristics of each stage of meiosis (I and II)?

8. If 2 parents have more than one child, why are the children not identical to one another?

Unit 7: MEIOSIS
Meiosis Hands-on

Objectives:

The purpose of this activity is to provide information so that students can:

- Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. **(HS-LS3-1)**
- Describe the identifying features of the stages of meiosis I and meiosis II. **(HS10-LS3-1.1)**
- Describe the role of meiosis in producing gametes and its significance to genetic diversity. **(HS10-LS3-1.2)**
- Compare and contrast Meiosis & Cell Division **(HS10-LS3-1.3)**

Directions: Use the notes, textbook (pgs. 270-276) and instructor as a guide for this activity.

- **MODEL:** Use the poster & envelope, set up each stage of Cell Division (begin with Interphase).
 - **ANSWER:** On a separate sheet of paper, answer all 9 questions about each stage.
1. What stage of Meiosis is this?
 2. Does this stage have a nuclear membrane?
 3. If this stage has a nuclear membrane, is the nuclear membrane in pieces or one piece?
 4. How many chromosomes are there in this stage?
 5. How is the DNA organized in this stage? (chromatin, chromosomes, chromatid pairs or homologous chromosomes)?
 6. Where is the DNA located in this stage (in the nucleus, middle of the cell, opposite sides of the cell)?
 7. Where are the centrioles located in this stage?
 8. Where are the spindle fibers located in this stage AND what are the spindle fibers doing?
 9. Is this cell diploid or haploid?
 10. What is the purpose of Meiosis?
 11. Write the name of each stage described on the “Stage Identification Cards” on the back of this page.
- **CHECK:** Show answers to Questions #1-10 to the instructor & GET INITIALS in the table below.
 - **GOAL:** PASS OFF ALL THE STAGES OF MEIOSIS (Part 1 & Part 2).

Stage of Meiosis I	Q#1	Q#2	Q#3	Q#4	Q#5	Q#6	Q#7	Q#8	Q#9	Q#10	Q#11 CARD
Interphase											
Prophase I											
Metaphase I											
Anaphase I											
Telophase I											
Cytokinesis I											

Stage of Meiosis II	Q#1	Q#2	Q#3	Q#4	Q#5	Q#6	Q#7	Q#8	Q#9	Q#10	Q#11 CARD
Prophase II											
Metaphase II											
Anaphase II											
Telophase II											
Cytokinesis II											

Look on Back for
Stage Identification Cards

Stage Identification Cards

- Homologous chromatid pairs line up in the middle across from one another.
- Centrioles now on opposite sides of the cell.
- Spindle fibers attach to centromeres.

Stage Name: _____

- Chromatin condenses into homologous chromatid pairs.
- Nuclear membrane dismantles around homologous chromatid pairs.

Stage Name: _____

- Cytoplasm pinches around individual chromosomes.
- Forms 4 new cells have $\frac{1}{2}$ the # of chromosomes as the parent.

Stage Name: _____

- Chromatid pairs separate and move to opposite sides of the cell.

Stage Name: _____

- Nuclear membrane present.
- DNA is the form of chromatin.
- DNA & chromosomes get doubled.
- Cell increases in size.

Stage Name: _____

- Chromatin condenses into chromatid pairs.
- Nuclear membrane dismantles around chromatid pairs.

Stage Name: _____

- Chromatid pairs line up in the middle.
- Centrioles now on opposite sides of the cell.
- Spindle fibers attach to centromeres.

Stage Name: _____

- Nuclear membrane reassembles around individual chromosomes.
- Cytoplasm starts to pinch forming a cleavage furrow.
- Cell plate starts to form (in plant cells).

Stage Name: _____

- Homologous chromatid pairs separate and move to opposite sides of the cell.

Stage Name: _____

- Cytoplasm pinches around chromatid pairs.
- Forms 2 new cells that have $\frac{1}{2}$ the # of chromosomes as the parent.

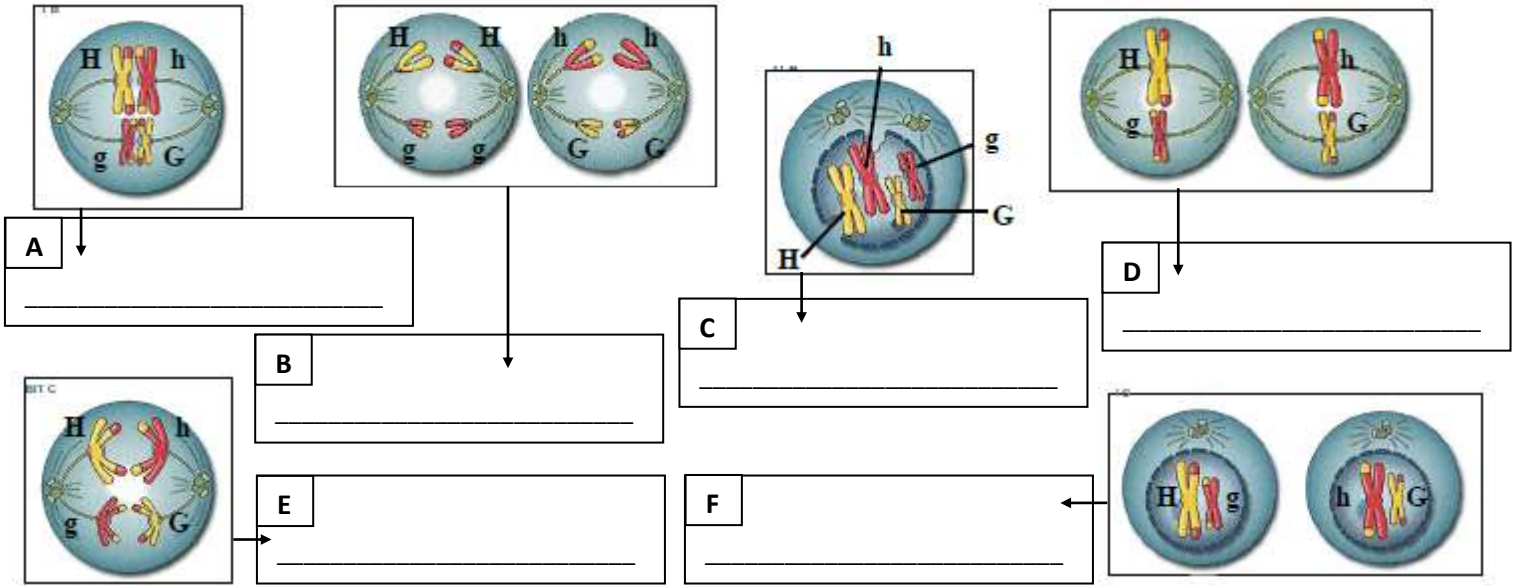
Stage Name: _____

- Nuclear membrane reassembles around chromatid pairs.
- Cytoplasm starts to pinch forming a cleavage furrow.
- Cell plate starts to form (in plant cells).

Stage Name: _____

DIRECTIONS: Answer the questions below.

1. Identify each stage of Meiosis represented in the pictures below.



- During meiosis, a parent cell with 20 chromosomes will produce _____ daughter cells each with _____ chromosomes. Therefore, the purpose of Meiosis is to produce _____ daughter cells each with _____ the number of chromosomes as the parent cell.
- The cells produced during Meiosis are called _____ (sex cells) and are involved in _____ reproduction.

Meiosis Virtual Lab

Introduction:

Meiosis is the second important kind of nuclear division. It resembles cell division in many ways but the products of meiosis are different from the products of cell division. While cell division may occur in almost any living cell of an organism, meiosis occurs only in specialized cells involved with sexual reproduction. In animals, meiosis is restricted to cells that form **gametes** (eggs and sperm).

Each species has a characteristic number of chromosomes per somatic cell. Fruit flies have 8; normal humans have 46. These chromosomes exist as homologous chromatid pairs that are similar in size and shape and carry the same kinds of genes. Thus humans have 23 homologous pairs. The full complement of 46 chromosomes is referred to as the **diploid number** (2 copies of each chromosome).

In sexually reproducing organisms, when an egg is fertilized, the egg and sperm fuse to form a single cell called a **zygote**. The zygote then develops into a new organism. If the egg and sperm were both diploid (46 chromosomes each in the case of humans), then the resulting zygote would be tetraploid (4 copies of each chromosome). This would result in the organism receiving too much DNA, so a mechanism has evolved to insure that each gamete (egg or sperm) contains only one copy of each homologous pair (or half the diploid number). This is referred to as the **haploid number**.

Haploid Egg + Haploid Sperm = Diploid Zygote

The process that makes haploid gametes is called meiosis. Meiosis consists of two divisions, **Meiosis I** and **Meiosis II**, and produces four daughter cells each with $\frac{1}{2}$ the # of chromosomes as the original parent cell (see diagram). The DNA is copied once during Interphase. The stages of meiosis that follow are named like the stages of cell division (prophase, metaphase, anaphase, telophase) but as we shall see the events are somewhat different.

Objectives:

1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. (HS-LS3-1)
2. Describe the identifying features of the stages of meiosis I and meiosis II. (HS10-LS3-1.1)
3. Describe the role of meiosis in producing gametes and its significance to genetic diversity. (HS10-LS3-1.2)
4. Compare and contrast Meiosis & Cell Division (HS10-LS3-1.3)

Materials:

- Computer
- Lab Sheet

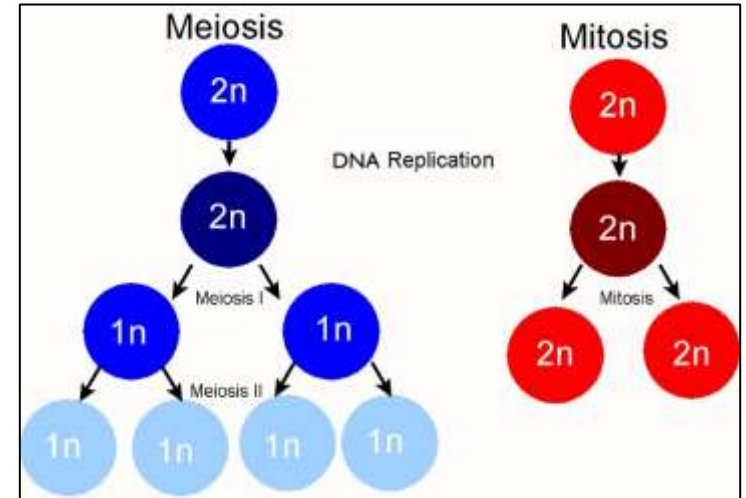


Table 1: Stages of Meiosis I

Interphase	Prophase I	Metaphase I	Anaphase I	Telophase I	Cytokinesis I

**** Interkinesis: In this module, interkinesis is a stage where the nuclear membrane reassembles and the cell plate forms. Include this stage as part of telophase. ****

9. Click “here.”

10. Repeat the process with the Meiosis II cells. Draw and label what the plant sex cells look like at each stage of Meiosis II.

(If there is a stage that is not represented, use your notes to help you with the drawing of that stage.)

- nuclear membrane
- cell membrane
- cell plate (if applicable)
- DNA (chromatin/chromosomes/homologous chromosomes)

**** Interkinesis: In this module, interkinesis is a stage where the nuclear membrane reassembles and the cell plate forms. Include this stage as part of telophase. ****

Table 2: Stages of Meiosis II

Prophase II	Metaphase II	Anaphase II	Telophase II	Cytokinesis II
<u>REMEMBER:</u> IN MEIOSIS II, THERE ARE 2 CELLS EXPERIENCING EACH STAGE AT THE SAME TIME TO PRODUCE 4 DAUGHTER CELLS AT THE END OF CYTOKINESIS II.				

11. Click “Begin Part 4.” (really it takes you to part 3 – it is a typo in the module)
12. **BEFORE BEGINNING PART 4**, answer this question and GET INSTRUCTOR INITIALS:
 - What is a karyotype and what information can you get from looking at a karyotype (use page 311)?

13. Complete at least case studies #1-4 of the cytogeneticists. Record the gender/ karyotype and the diagnosis for each case studies.

Case #	Gender (Male XY or Female XX)	Karyotype	Diagnosis Description
1			
2			
3			
4			

14. Answer the questions in the Conclusion section below.

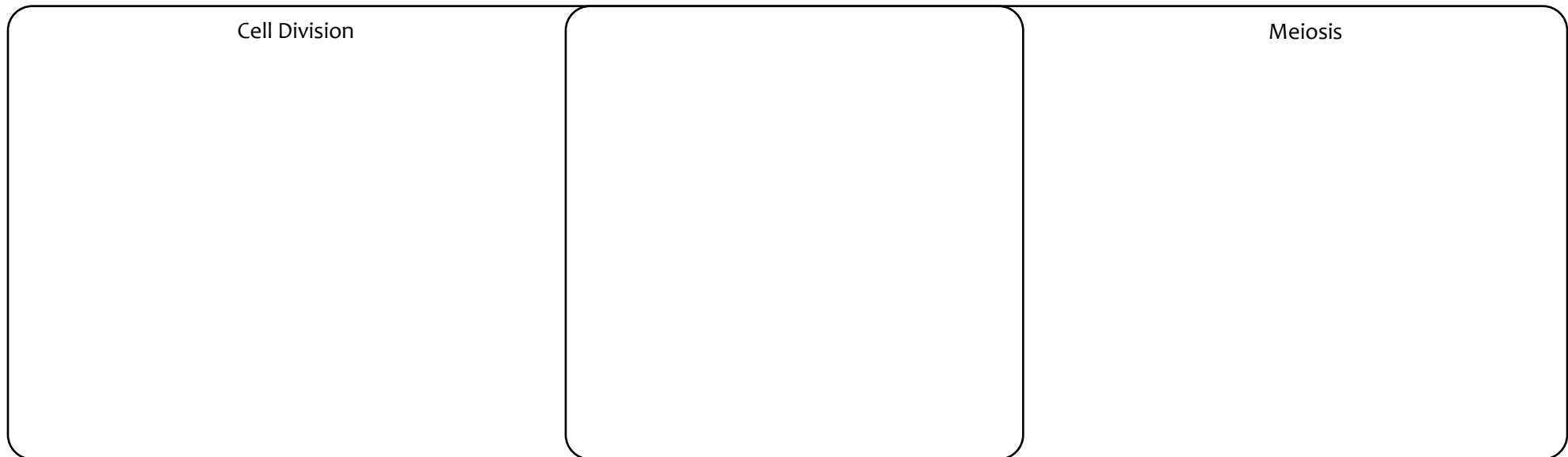
Conclusion:

Answer the following questions using complete sentences. Include details to demonstrate your mastery of the concept of Meiosis.

1. What is the purpose of meiosis? (be specific) Use these “sciency” words:

- haploid
- diploid
- daughter cells
- parent cell
- gametes

2. Create a Venn Diagram to describe the similarities and differences between cell division and meiosis?



3. In which stages of meiosis are the cells considered haploid?

4. In which stages of meiosis are the cells considered diploid?

5. Considering humans are diploid organisms $2n=46$, how many chromosomes would you expect to find in human gametes?