ANSWER IN ENGLISH

Measuring Up – Workbook - Lesson #17 “Meiosis”

**You will learn about a type of cell division called meiosis. Meiosis produces cells that have only half the number of chromosomes as the parent cell. Sperm and egg cells are produced by meiosis.**

A **homologous chromosome** is one member in a pair of matching chromosomes. One chromosome of the pair comes from the male parent and the corresponding chromosome comes from the female parent.

A **diploid cell** contains both of the chromosomes of a homologous pair.

A **gamete** is an egg cell or a sperm cell.

**Mitosis** is the part of the cell cycle in which the nucleus divides into two nuclei. Both nuclei have the same number and kind of chromosomes.

**Meiosis** is a part of the cell cycle in which the nucleus divides twice to produce four cells. The chromosome number in each cell is reduced by half. The process is used to form gametes than can participate in fertilization.

A **haploid cell** has only one set of chromosomes from a homologous pair.

**Chromatids** are the two exact copies of DNA that make up each chromosome after the chromosome copies itself.

Guided Instruction: Directions – Read the following information and answer the questions

Your body is made mostly of cells called body cells. Human body cells have 46 chromosomes. Of the 46 chromosomes in each human body cell, 23 come from one parent and the other 23 corresponding chromosomes come from the other parent. The two sets of matching chromosomes are called **homologous chromosomes**. A cell such as a body cell that contains both sets of homologous chromosomes is said to be **diploid**. The number of chromosomes in a diploid cell is represented by 2N. For example human body cells would be represented by 2N=46. The body cells of a fruit fly each contain 8 chromosomes, which would be written 2N=8.

GUIDED QUESTION: (1) How is a **diploid cell** related to **homologous chromosomes**?

Many organisms, including all plants and animals, reproduce by joining **gametes** – a sperm cell and an egg cell. This process, called fertilization, begins a complex series of steps that leads to the development of an adult organism. The fertilized egg cell contains the same number of chromosomes that is found in any body cell of the parent. How is it possible for the fertilized egg cell and the parent body cell to have the same number of chromosomes when a fertilized egg is produced when two cells join? Then this happens shouldn’t the chromosome number of the fertilized egg be twice the diploid number?

GUIDED QUESTION: (2) What is a **gamete**?

The answer to this question is in the process that organisms use to produce gametes. When body cells reproduce, they do so using mitosis. **Mitosis** produces cells that contain exact copies of the chromosomes in the parent cell. In mitosis the chromosomes are copied once during DNA replication. The nucleus then divides once. As a result, each new cell produced by mitosis receives the same number of chromosomes as the parent cell. Each new cell is a diploid cell.

However, when an organism produces gametes, it uses a process that is different from mitosis. This process is called meiosis. **Meiosis** results in cells that have half the number of chromosomes of the parent cell. These cells are called **haploid cells**, and they are represented by 1N. A human gamete would be represented by 1N=23. Just as in mitosis, before meiosis begins, each chromosome makes an exact copy of itself. The two resulting chromosomes are actually called chromatids. The chromatids are attached together.

GUIDED QUESTION: (3) How does a **haploid cell** differ from a **diploid cell**?

Notice that the two chromatids of the above (see workbook picture page 119) homologous pair carry an allele labeled *T*. The other two chromatids carry an allele labeled *t*. Assume that these two alleles determine the height of a pea plant so that the dominant allele *T* determines tall height, while the recessive allele *t* determines the short height.

After each chromosome makes a copy of itself, the process of meiosis begins. During meiosis, the cell undergoes two cell divisions called meiosis I and meiosis II. To make it easier to follow what happens during meiosis, only two pairs of homologous chromosomes are shown in the following diagram. (See page 120 in workbook) However, keep in mind that the organism contains many more chromosomes that are undergoing the same processes that are shown for these two homologous pairs.

At the start of meiosis I, the nuclear membrane disappears, and the chromosomes thicken and shorten. Then homologous pairs line up along the equator or middle of the cell. Next, the chromosomes separate from their homologous partners and move to opposite ends of the cell. Finally, the cell divides. Notice that one pair of homologous chromosomes carries the alleles *T* and *t*, while the other homologous chromosome pair carries the alleles *G* and *g*. (See workbook picture on page 120)

GUIDED QUESTION: (4) What happens to **homologous** pairs of chromosomes when **meiosis** begins?

The chromosome number has been reduced in half because the new cells contain two chromosomes. Each of these chromosomes consists of two sister chromatids that are still joined. The new cells produced in meiosis I now go through a second cell division during meiosis II. However, the two new cells are not copied before the process begins.

GUIDED QUESTION: (5) Compare the number of chromosomes in each cell at the beginning and the end of **meiosis** I.

At the beginning of meiosis II, the chromosomes in each cell line up along each cell’s center. Then the two chromatids split. Once the sister chromatids have separated, each is considered a chromosome. The chromosomes move to opposite ends of the cell, and a membrane forms around each set of chromosomes. The cells separate and four haploid cells are produced. The steps in the second division are shown in the illustration below. (See workbook page 120, bottom picture)

Each of the four gametes produced by meiosis is haploid – it has half the number of chromosomes of the original cell. Notice that two of the four gametes contain the alleles *GT*, while the other two gametes contain the alleles *gt*. The original cell contained the genotype *GgTt*.

GUIDED QUESTION: (6) Compare the number of chromosomes at the end of **meiosis** to the number of chromosomes in the parent cell.

SHORT ANSWER QUESTIONS: Directions – Answer the following questions.

1. The gametes of a pea plant contain seven chromosomes. How many chromosomes does a pea plant cell such as one found in its stem contain?
2. What happens to a parent cell at the end of meiosis I?
3. Why does meiosis result in 1N cells rather than 2N cells?
4. Describe two ways in which meiosis differs from mitosis.

APPLY THE TEKS: Directions – Read the paragraph, study the diagram, and answer the questions.

The illustration below summarizes what happens to the body cell for a particular organism. Look closely at what happens to the chromosomes at each step. (See workbook picture on page 122)

1. What process is shown in the diagram?
2. Suppose all the chromosomes for this organism are shown in the diagram. What is the diploid number of chromosomes for this organism?
3. What kinds of cells are being produced in this process? EXPLAIN your answer.
4. Describe what happened to the chromosome number in this cell as a result of this process.

STAAR PRACTICE: Directions – Read each question and choose the best answer. Then circle the letter for the correct answer.

1. Which of the following occurs in meiosis?
   1. The chromosomes are copied twice.
   2. One cell produces four cells.
   3. One cell produces two cells.
   4. The nucleus divides once.
2. If a parent cell has 18 chromosomes, how many chromosomes would be found in a gamete that this cell produces?
   1. 36 b. 18 c. 9 d. 6
3. What would most likely happen to the alleles for two different traits during meiosis if they were located on the same chromosome?
   1. They would obey Mendel’s law of independent assortment.
   2. They would be distributed into different gametes.
   3. They would segregate from one another.
   4. They would remain together and pass into the same gamete.
4. Which statement correctly describes what happens as a result of the first division that occurs during meiosis?
   1. Sister chromatids separate.
   2. The chromosome number remains unchanged.
   3. Each cell contains half the number of chromosomes of the original cell that started the process.
   4. Four gametes are formed.
5. How are the gametes produced by meiosis alike?
   1. They contain the same number of chromosomes.
   2. They will go through meiosis a second time.
   3. They have the same combinations of alleles.
   4. They contain homologous pairs of chromosomes.

CUMULATIVE REVIEW: Directions – Read each question and choose the best answer. Then choose the letter for the correct answer.

1. Which process occurs in both mitosis and meiosis?
   1. Cell specialization
   2. DNA replication
   3. Pairing of homologous chromosomes
   4. Reduction in chromosome number.
2. Which genotype would illustrate Mendel’s law of independent assortment as explained by meiosis?
   1. *DdEe* b. *DD*  c. *Dd* d. *ee*
3. A student wanted to show her lab partner the process of meiosis. She set up a slide of cells about to undergo meiosis and asked her lab partner to look at them under a microscope. Where should she tell her lab partner to focus?
   1. The cytoplasm
   2. The space between the cells
   3. The nucleus
   4. The cell membrane
4. Which cellular process is part of meiosis?
   1. Homeostasis
   2. Transport
   3. Synthesis of new molecules
   4. Mitosis