

**Week 5**  
EOC Review  
***DNA, Mitosis, Meiosis, and Genetics***

**Benchmarks:**

SC.912.L.16.3 Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information

SC.912.L.16.4 Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring.

SC.912.L.16.5 Explain the basic processes of transcription and translation, and how they result in the expression of genes.

SC.912.L.16.9 Explain how and why the genetic code is universal and is common to almost all organisms

SC.912.L.16.17 Compare and contrast mitosis and meiosis and relate to the processes of sexual and asexual reproduction and their consequences for genetic variation

SC.912.L.16.8 Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer

SC.912.L.16.14 Describe the cell cycle, including the processes of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction

SC.912.L.16.16 Describe the processes of meiosis, including independent assortment and crossing over. Explain how reduction division results in the formation of haploid gametes or spores

SC.912.L.16.1 Use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance

SC.912.L.16.2 Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles

**Summary:**

**You need to know the following:**

- The basic process of DNA replication and how it relates to the transmission and conservation of genetic information.
- Mutations in the DNA sequence may or may not result in phenotypic change and how mutations in gametes may result in phenotypic changes in offspring.
- The basic processes of transcription and translation and how they result in gene expression. You will also need to know that the basic processes of DNA are universal in organisms.
  - Similarities in the genetic codes of organisms are due to common ancestry and the process of inheritance.
- The differences and similarities in the processes of mitosis and meiosis and relate these to the processes of sexual and asexual reproduction.
- How mitosis and meiosis lead to genetic variation.
- The relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.
- The cell cycle, including the process of mitosis and be able to explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during sexual reproduction.
- How to use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance.
- How dominant, recessive, codominant, sex-linked, polygenic, and multiple allele modes of inheritance cause observed inheritance patterns.

**Additional Support**

- Holt McDougal Biology Interactive Reader:
  - Chapter 5, Section 5.1, 5.2, 5.3, 5.4
  - Chapter 6, Section 6.1, 6.2, 6.3, 6.4, 6.5, 6.6
  - Chapter 7, Section 7.1, 7.2, 7.4
  - Chapter 8, Section 8.2, 8.3, 8.4, 8.5, 8.7
- Everglades Biology End-Of-Course Review
  - Pages 97-126
- Web Site
  - <http://www.ecsd-fl.schoolloop.com/BiologyEOCReview>
  - <http://fcat.fldoe.org/eoc/>

## Sample Questions

### SC.912.L.16.1 Mendel's Law of Segregation and Independent Assortment

1. In pea plants, the trait for tall stems is dominant over the trait for short stems. If two heterozygous tall plants are crossed, what percentage of the offspring would be expected to have the same phenotype as the parents?

- A. 100%
- B. 75%
- C. 50%
- D. 25%

2. Hemophilia is a sex-linked, recessive trait. Which of the following describes the probability of hemophilia in the offspring of a man who does not have hemophilia and a woman whose father is a hemophiliac?

- A. Each of their sons will have hemophilia.
- B. None of their daughters will have hemophilia.
- C. Their sons have a 25% chance of having hemophilia.
- D. There is a 50% chance that their daughters will have hemophilia.

3. Alleles for the A and B blood cell antigens are codominant. The condition where no antigens are present on the blood cells (type O blood) is a recessive trait. Which set of parents can most likely produce a child with type O blood?

- A. one parent with type AB blood, and the other parent with type A blood
- B. one parent with type AB blood and the other parent with type O blood
- C. one parent with heterozygous type A blood, and the other parent with type O blood
- D. one parent with homozygous type A blood, and the other parent with homozygous type B blood

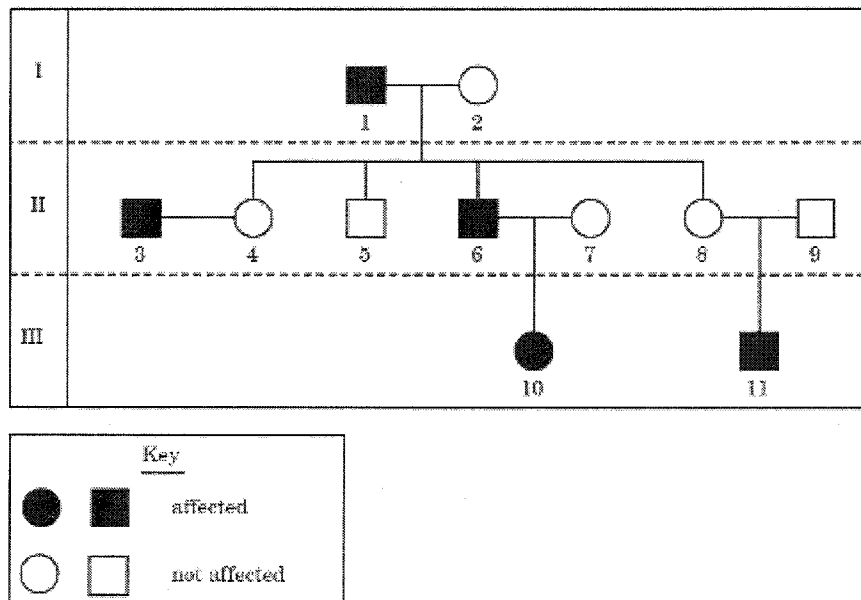
4. One of the parents of a child has phenylketonuria (PKU), which is caused by recessive alleles. The other parent does not have the PKU alleles. What is the chance that the couple will have a child with phenylketonuria?

- A. 0%
- B. 50%
- C. 75%
- D. 100%

5. Hitchhiker's thumb (H) is dominant to no hitchhiker's thumb (h). A woman who does not have hitchhiker's thumb marries a man who is heterozygous for hitchhiker's thumb. What is the probable genotypic ratio of their children?

- A. 0% Hh: 100% hh
- B. 50% Hh: 50% hh
- C. 75% Hh: 25% hh
- D. 100% Hh: 0% hh

6. This diagram shows a pedigree for a recessive genetic disorder.



What is the genotype of individual 6?

- A.  $X^H X^H$
- B.  $X^H X^h$
- C.  $X^H Y$
- D.  $X^h Y$

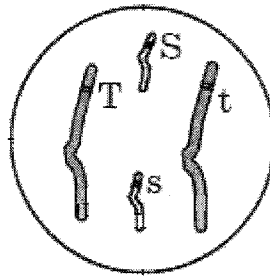
7. A pair of male Holstein (black-and-white) calves that have the same parents display many similarities but also exhibit some variations. Which process best explains these variations?

- A. independent assortment
- B. sex linkage
- C. dominance
- D. gene linkage

8. A human baby boy inherits a recessive allele from his mother. In which circumstance would he most likely show the trait coded for by the recessive allele?

- A. The baby inherits the dominant allele from his father.
- B. The allele is on an autosomal chromosome and the baby is a twin.
- C. The allele is on the X chromosome.
- D. The allele is on the Y chromosome.

9. This diagram shows a diploid cell with two pairs of homologous chromosomes.



Due to independent assortment, what is the possible genetic make-up of gametes produced by this organism?

- A. SsTt
- B. Ss, Tt
- C. S, s, T, t
- D. ST, St, sT, st

10. The table lists the trials for fruit color where allele R exhibits incomplete dominance over allele R'.  
R'.

Genotype	Phenotype
RR	Red
R'R'	Yellow
RR'	Orange

Heterozygous fruit have orange phenotypes. What percent of offspring are expected to have an orange phenotype if the parent plants are orange (RR') and yellow (R'R')?

- A. 25%
- B. 50%
- C. 75%
- D. 100%

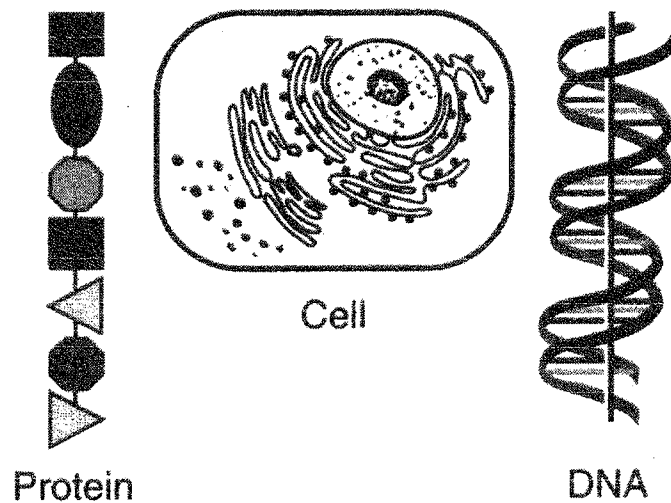
11. In guinea pigs, black coat color (B) is dominant over white coat color (b) and short hair (S) is dominant over long hair (s). Based upon the dihybrid cross shown below, what is the genotype and phenotype for letter X?

		Guinea pig female			
		Gametes	<i>BS</i>	<i>Bs</i>	<i>bS</i>
Guinea pig male	<i>BS</i>	<i>BBSS</i>	<i>BBsS</i>	<i>BbSS</i>	<i>BbSs</i>
	<i>Bs</i>	<i>BBsS</i>	<i>BBss</i>	X	<i>Bbss</i>
	<i>bS</i>	<i>BbSS</i>	<i>BbSs</i>	<i>bbSS</i>	<i>bbSs</i>
	<i>bs</i>	<i>BbSs</i>	<i>Bbss</i>	<i>bbSs</i>	<i>bbss</i>

- A. *Bbss*; brown coat, long hair
- B. *BbSs*; black coat, short hair
- C. *BBss*; black coat, long hair
- D. *Bbss*; black coat, long hair

## SC.912.L.16.3 DNA Replication

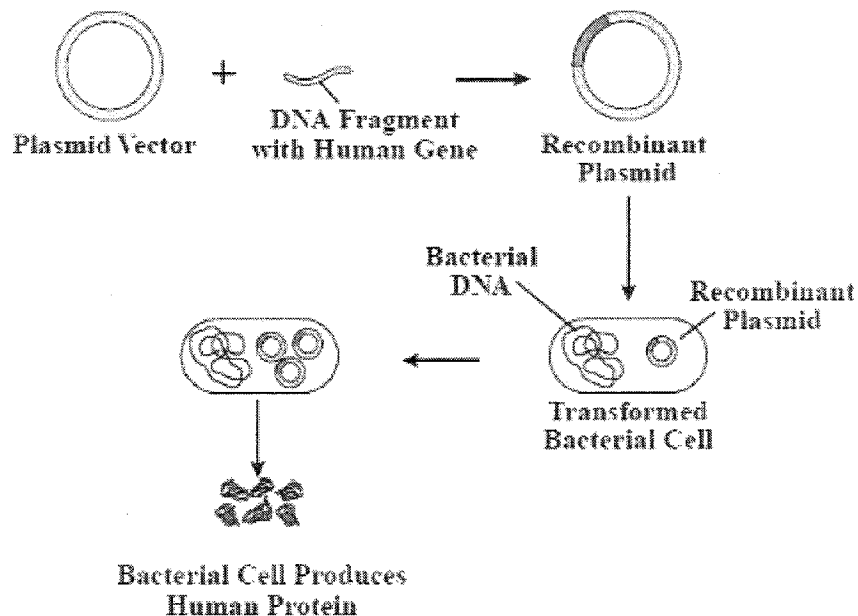
1. Base your answer to the following question on the structures represented in the diagram below.



What is the relationship between these three structures?

- A. DNA is made up of proteins that are synthesized in the cell.  
B. Protein is composed of DNA that is stored in the cell.  
C. DNA controls the production of protein in the cell.  
D. The cell is composed only of DNA and protein.
2. The individuality of an organism is determined by the
- A. sequence of nitrogenous bases in deoxyribonucleic acid  
B. number of amino acids in a cell  
C. position of the ribosomes on the endoplasmic reticulum  
D. number of nitrogenous bases in a codon
3. If 20% of a DNA sample is made up of thymine, T, what percentage of the sample is made up of cytosine, C?
- A. 15%  
B. 30%  
C. 35%  
D. 50%

4. A medical test indicates that a patient has a defective protein. This condition is most likely due to a change in the directions coded in the:
- number of hydrogen atoms in starch molecules
  - sequence of inorganic molecules
  - number of carbon atoms in sugar molecules
  - sequence of subunits in DNA
5. Genes for medically important proteins can be cloned and inserted into bacteria, as shown in the diagram below.



Why can bacteria recognize a human gene and then produce a human protein?

- DNA replication in bacteria and humans is the same.
  - Bacterial cells contain the same organelles as human cells.
  - The basic components of DNA are the same in humans and bacteria.
  - Bacterial cells and human cells contain the same kind of chromosomes.
6. Which choice describes DNA after replication has taken place?
- one molecule with two original strands and one molecule with two new strands
  - two molecules, each with one original and one new strand
  - two molecules, each with two new strands
  - two molecules, each with two old strands

7. At what point in the cell cycle does DNA replication occur and why?
- A. before a cell divides, to provide each of the two resulting cells with a complete set of DNA instructions
  - B. before a cell divides, to ensure that the DNA will fit into the resulting cells
  - C. during cell division, to ensure that the DNA will fit into the resulting cells
  - D. after a cell divides, to provide each of the two resulting cells with a complete set of DNA instructions

8. Four different segments of a DNA molecule are represented below.

Segment 1	Segment 2	Segment 3	Segment 4
T-A-G-G-C	G-G-T-G-A	G-A-T-T-A	C-A-A-T-G
A-T-C-C-G	C-C-A-C-T	C-C-A-A-T	G-T-T-A-C

There is an error in the DNA in which molecule?

- A. segment 1 only
  - B. segment 3 only
  - C. segment 2 and 3
  - D. segment 2 and 4
9. The sequence of DNA below is part of a gene. How many amino acids are coded for by this segment?

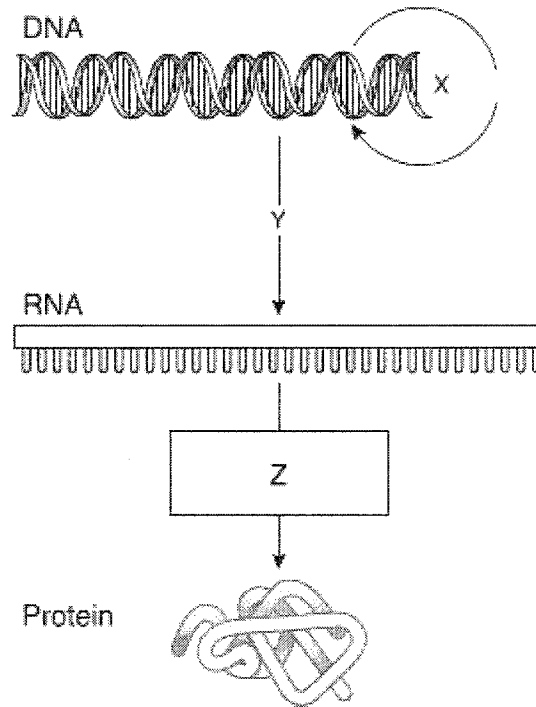
**5' ATCAGCGCTGGC 3'**

- A. 4
  - B. 8
  - C. 12
  - D. 20
10. A scientist puts nucleotide chains of UUUUUU in a test tube under conditions allowing protein synthesis. Soon the test tube is full of polypeptide chains composed only of the amino acid phenylalanine. What does this experiment indicate?
- A. The amino acid phenylalanine is composed of uracil.
  - B. UUU codes for the amino acid phenylalanine.
  - C. Protein synthesis malfunctions in test tubes.
  - D. Most proteins contain only one type of amino acid.



11. Which of the following would most likely cause a mutation?
- A. the placement of ribosomes on the endoplasmic reticulum
  - B. the insertion of a nucleotide into DNA
  - C. the movement of transfer RNA out of the nucleus
  - D. the release of messenger RNA from DNA

12. A diagram of a cellular process is shown below.



Which of the following identifies the process shown at point Z?

- A. Translation
  - B. Translocation
  - C. Replication
  - D. Transcription
13. Which of the following carries amino acids to the site of protein synthesis?
- A. mRNA
  - B. rRNA
  - C. tRNA
  - D. nRNA

14. During transcription the DNA base sequence is transcribed into a complimentary mRNA sequence. A codon table like the one shown below lists the amino acids coded for by particular triads of mRNA bases. A segment of DNA has undergone a mutation in which one nucleotide has been changed. The original sequence was ACG and the new sequence is ACA. Use the codon table to determine whether or not this mutation will cause a change in the phenotype of the organism.

### Codons Found in Messenger RNA

		<i>Second Base</i>				
		U	C	A	G	
First Base	U	Phe	Ser	Tyr	Cys	U
		Phe	Ser	Tyr	Cys	C
		Leu	Ser	Stop	Stop	A
		Leu	Ser	Stop	Trp	G
	C	Leu	Pro	His	Arg	U
		Leu	Pro	His	Arg	C
		Leu	Pro	Gln	Arg	A
		Leu	Pro	Gln	Arg	G
	A	Ile	Thr	Asn	Ser	U
		Ile	Thr	Asn	Ser	C
		Ile	Thr	Lys	Arg	A
		Met	Thr	Lys	Arg	G
	G	Val	Ala	Asp	Gly	U
		Val	Ala	Asp	Gly	C
		Val	Ala	Glu	Gly	A
		Val	Ala	Glu	Gly	G

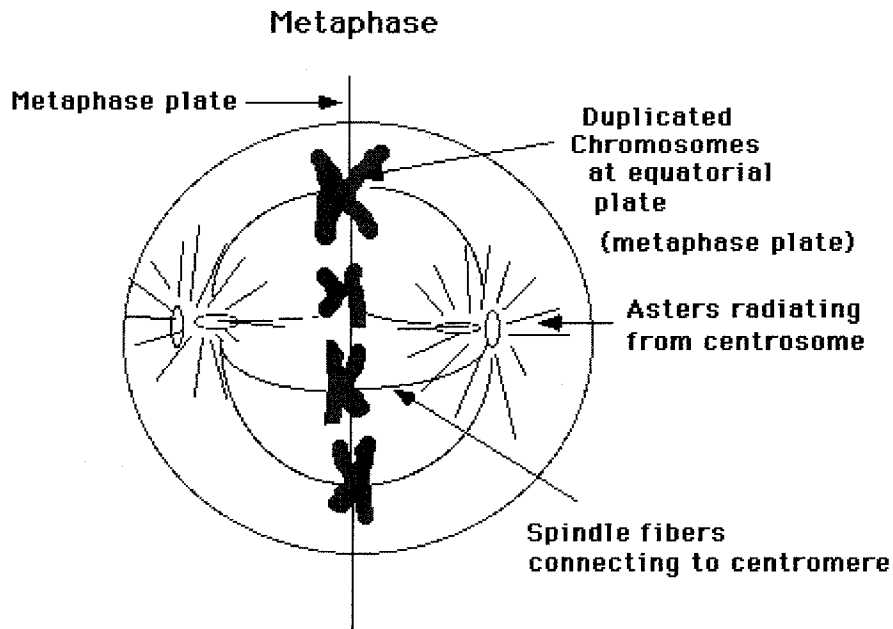
- A. yes, the phenotype of the organism would change because a new amino acid will be coded for.
- B. yes, the phenotype of the organism would change because any change in the DNA sequence will cause a change in phenotype.
- C. Even though the DNA sequence changed, the sequence still codes for the same amino acid, so no change in phenotype will occur.
- D. It is impossible to determine if a change in phenotype will occur using only the DNA sequence.

**SC.912.L.16.17: Mitosis vs. Meiosis**

1. Mitosis and meiosis are processes involved in cellular reproduction. Which of the following describes an event that results from mitosis but NOT meiosis?
  - A. two stages of cell division
  - B. replication of cellular genetic material
  - C. daughter cells that are identical to the parent cell
  - D. four daughter cells that are produced from each parent cell
  
2. How are sexual reproduction and asexual reproduction different from each other?
  - A. sexual reproduction requires two parents and asexual reproduction requires only one parent
  - B. asexual reproduction requires two parents and sexual reproduction requires only one parent
  - C. mutation rates are lower in sexual reproduction than in asexual reproduction
  - D. asexual reproduction occurs only in multicellular organisms
  
3. Which type of reproduction leads to increased genetic variation on a population?
  - A. Parthenogenesis
  - B. Asexual reproduction
  - C. Sexual reproduction
  - D. Vegetative reproduction
  
4. Which of the following phrases best describes cancer?
  - A. absence of cyclins in the DNA
  - B. multiple gene mutations on a chromosome of DNA
  - C. uncontrolled cell growth caused by mutations in genes that control the cell cycle
  - D. presence of genetic defects caused by hereditary disorders

5. Which of the following best describes meiosis?
- A. It is carried out in all tissues that require cell replacement.
  - B. It occurs only in cells in the reproductive structures of organisms.
  - C. It happens in all tissues except the brain and spinal cord.
  - D. It is the first stage of mitosis.

6. Which of the following phases of mitosis is represented by the diagram below?



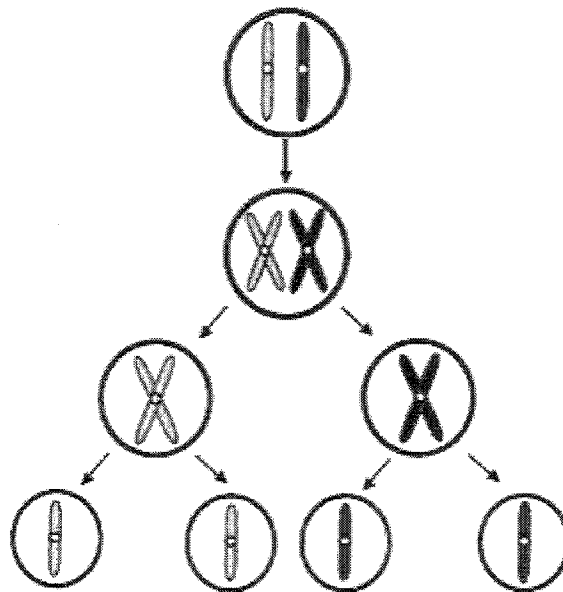
- A. prophase
  - B. metaphase
  - C. anaphase
  - D. telophase
7. A scientist wants to change the DNA of a sexually reproducing organism and have the new DNA present in every cell of the organism. In order to do this after fertilization, she would change the DNA in which of the following?
- A. zygote
  - B. placenta
  - C. testes of the father
  - D. ovaries of the mother

8. Which row in the chart below indicates the correct process for each event indicated?

Row	Formation of Egg	Formation of Sperm	Growth of Embryo
(1)	mitosis	mitosis	meiosis
(2)	mitosis	meiosis	mitosis
(3)	meiosis	mitosis	meiosis
(4)	meiosis	meiosis	mitosis

- A. row 1
- B. row 2
- C. row 3
- D. row 4

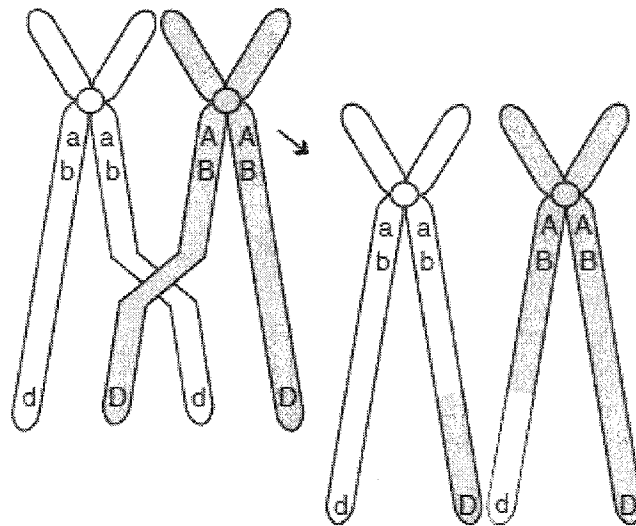
9. The diagram below shows a cellular process that occurs in organisms.



What is the name of this process?

- A. meiosis
- B. mitosis
- C. endocytosis
- D. phagocytosis

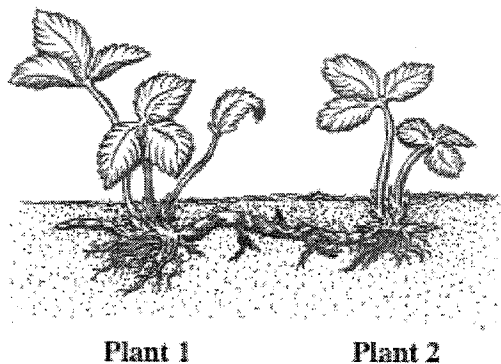
10. The diagram below shows homologous chromosomes during prophase I of meiosis.



Which of the following correctly describes the process being illustrated?

- A. mutation in which the DNA content of the gene is altered
- B. segregation of sister chromatid
- C. condensation and segregation of alleles
- D. crossing-over in which alleles are exchanged

11. The diagram below shows two strawberry plants.



Plant 2 is produced asexually from Plant 1. If the leaf cells of Plant 1 have 56 chromosomes, how many chromosomes will be found in the leaf cells of Plant 2?

- A. 14
- B. 28
- C. 56
- D. 112