Bio12-Q2W8-Quarter Revision

Modified True/False
Indicate whether the statement is true or false. If false, change the identified word or phrase to make the statement true.

____ 1. Differing hormone levels among sexes can cause a single genotype to express more than one phenotype. _____

____ 2. Polygenic inheritance occurs when there are more than two alleles for a single trait. _____

____ 3. More than two phenotypes result from both multiple allelic inheritance and polygenic inheritance. _____

____ 4. Many flowering plants such as roses, African violets, and orchids have been produced by the process of test crossing. _____

____ 5. You have benefited from selective breeding by having more agricultural produce than would have been possible otherwise. _____

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 6. A useful device for predicting the possible offspring of crosses between different genotypes is the _____.
a. law of dominance
b. law of independent assortment
c. Punnett square
d. testcross

____ 7. Which of the following describes an organism that has the genotype Bb?
a. homozygous
b. heterozygous
c. inbreed
d. all of these

____ 8. Mendel's law of segregation states that during meiosis, the factors that control each trait separate, and only _____ from each pair is/are passed to the offspring.
a. one factor
b. the dominant trait
c. two factors
d. the recessive trait

____ 9. The passing on of traits from parents to offspring is called _____.
a. genetics
b. heredity
c. inbreeding
d. gene splicing

____ 10. The gamete that contains genes contributed only by the mother is _____.
a. the sperm
b. an egg
c. a zygote
d. dominant

____ 11. Pollination can best be described as _____.
a. the fusing of the egg nucleus with the pollen nucleus
b. the transfer of the male pollen grain to the female organ
c. the formation of male and female sex cells
d. the type of cell division that produces diploid gametes

____ 12. Genes located on homologous chromosomes may have alternate forms that control different forms of a trait. These alternate forms of a gene are called _____.
a. alleles
b. centromeres
c. phenotypes
d. gametes

____ 13. A white mouse whose parents are both white produces only brown offspring when mated with a brown mouse. The white mouse is most probably _____.
a. homozygous recessive
c. homozygous dominant

b. heterozygous
d. haploid

____ 14. In mink, brown fur color is dominant to silver-blue fur color. If a homozygous brown mink is mated with a silver-blue mink and 8 offspring are produced, how many would be expected to be silver-blue?
a. 0
c. 6
b. 3
d. 8

____ 15. The diagram in Figure 10-2 shows a diploid cell with two homologous pairs of chromosomes. Due to independent assortment, the possible allelic combinations that could be found in gametes produced by the meiotic division of this cell are _____.

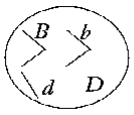


Figure 10-2

a. Bb, Dd, BB, and DD
c. BbDd and BDbd
b. BD, bD, Bd, and bd
d. Bd and bD only

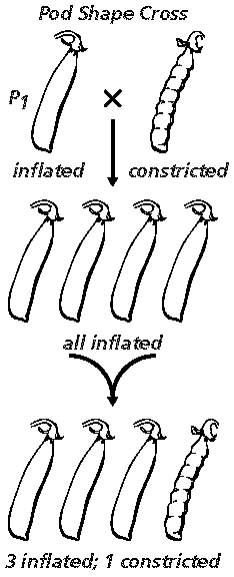


Figure 10-5

____ 16. What is the genotype of generation 1 in Figure 10-5?
a. II
c. ii
b. Ii
d. I

____ 17. What is the phenotype of generation 1 in Figure 10-5?
a. II
c. inflated
b. Ii
d. constricted

____ 18. What is the genotype in the bottom left-hand quadrant in Figure 10-6?

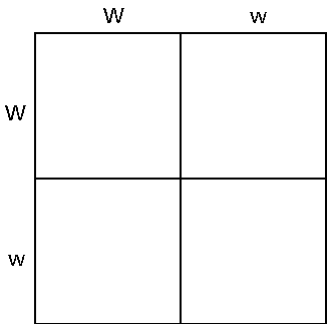


Figure 10-6

a. WW
b. Ww
c. wW
d. ww

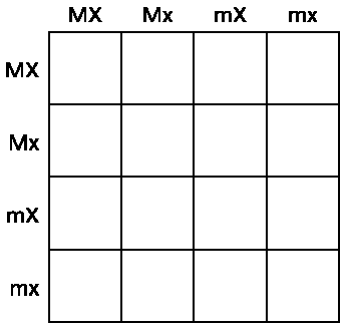
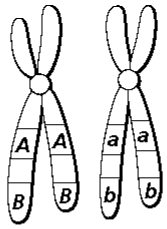


Figure 10-7

____ 19. How should the top row of Figure 10-7 read?

a. MMXX, MMXx, MmXX, MmXx
b. MMxX, MMxx, MmxX, Mmxx
c. mMXX, mMXx, mmXX, mmXx
d. mMxX, mMxx, mmxX, mmxx



Homologous chromosomes

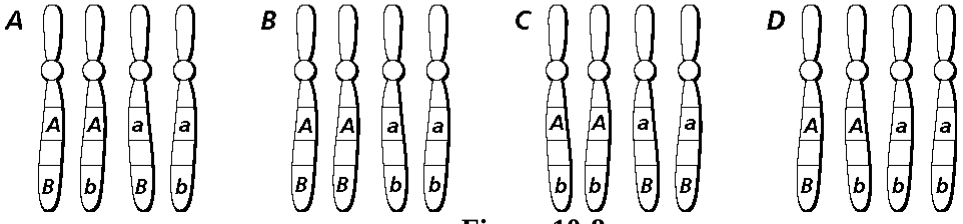


Figure 10-8

____ 20. In Figure 10-8, what gametes will result if there is only a single crossover?

a. A
b. B
c. C
d. D

____ 21. Which one of the following nucleotide pair bonds would be found in a DNA molecule?
a. adenine-guanine
b. guanine-cytosine
c. adenine-cytosine
d. cytosine-uracil

____ 22. The backbone of a DNA molecule is made of which two components?
a. phosphate molecules and ribose sugars
b. deoxyphosphate molecules and ribose sugars
c. phosphate molecules and deoxyribose sugars
d. deoxyphosphate molecules and deoxyribose sugars

____ 23. Ribosomes are made of _____.
a. rRNA and protein
b. tRNA and mRNA
c. rRNA and mRNA
d. protein and tRNA

____ 24. Watson and Crick were the first to suggest that DNA is _____.
a. a short molecule
b. the shape of a double helix
c. a protein molecule
d. the genetic material

____ 25. The chromosome abnormality that occurs when part of one chromosome breaks off and is added to a different chromosome is _____.
a. deletion
b. nondisjunction
c. translocation
d. inversion

____ 26. The pairing of _____ in DNA is the key feature that allows DNA to be copied.
a. nucleotides
b. nitrogen bases
c. chromosomes
d. codons

____ 27. A DNA nucleotide may be made up of a phosphate group, along with _____.
a. deoxyribose sugar and uracil
b. ribose sugar and adenine
c. deoxyribose sugar and thymine
d. ribose sugar and cytosine

____ 28. Which series is arranged in order from largest to smallest in size?
a. chromosome, nucleus, cell, DNA, nucleotide
b. cell, nucleus, chromosome, DNA, nucleotide
c. nucleotide, chromosome, cell, DNA, nucleus
d. cell, nucleotide, nucleus, DNA, chromosome

____ 29. Messenger RNA is formed in the process of _____.
a. transcription
b. translation
c. replication
d. mutation

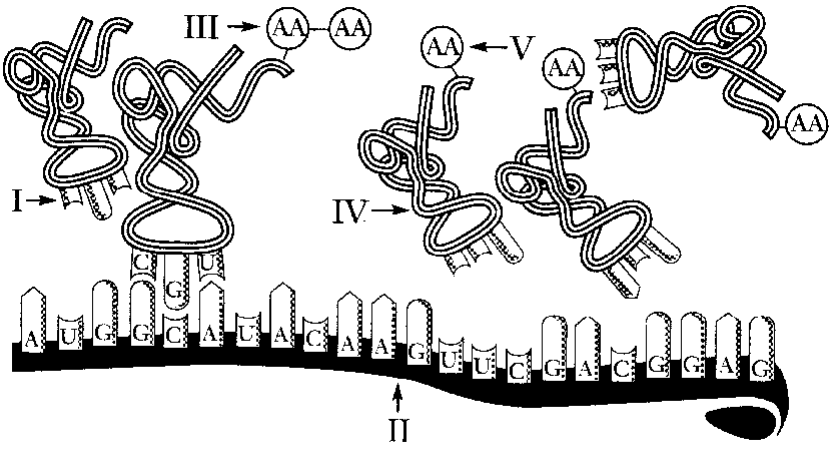


Figure 11-1

____ 30. In which part of the cell does this process shown in Figure 11-1 take place?
a. in the nucleus
b. in food vacuoles
c. at the ribosomes
d. on the chromosome

____ 31. Which of the structures in Figure 11-1 are composed of RNA?
a. II and IV
b. III and IV
c. I and V
d. III and V

____ 32. The process illustrated in Figure 11-1 is called _____.
a. translation
b. replication
c. monoploidy
d. transcription

Help Wanted
Positions Available in the genetics industry. Hundreds of entry-level openings for tireless workers. No previous experience necessary. Must be able to transcribe code in a nuclear environment. The ability to work in close association with ribosomes is a must.
Accuracy and Speed vital for this job in the field of translation. Applicants must demonstrate skills in transporting and positioning amino acids. Salary commensurate with experience.
Executive Position available. Must be able to maintain genetic continuity through replication and control cellular activity by regulation of enzyme production. Limited number of openings. All benefits.
Supervisor of production of proteins—all shifts. Must be able to follow exact directions from double-stranded template. Travel from nucleus to the cytoplasm is additional job benefit.

Table 11-1

____ 33. Applicants for the fourth job of the Help Wanted ad in Table 11-1, "Supervisor," could qualify if they were _____.
a. DNA
b. mRNA
c. tRNA
d. rRNA

____ 34. Applicants for the second job of the Help Wanted ad in Table 11-1, "Accuracy and Speed," could qualify if they were _____.
a. DNA
b. mRNA
c. tRNA
d. rRNA

____ 35. A DNA segment is changed from -AATTAGAAATAG- to -ATTAGAAATAG-. This is a ____.
a. frameshift mutation
b. point mutation
c. inversion
d. translation

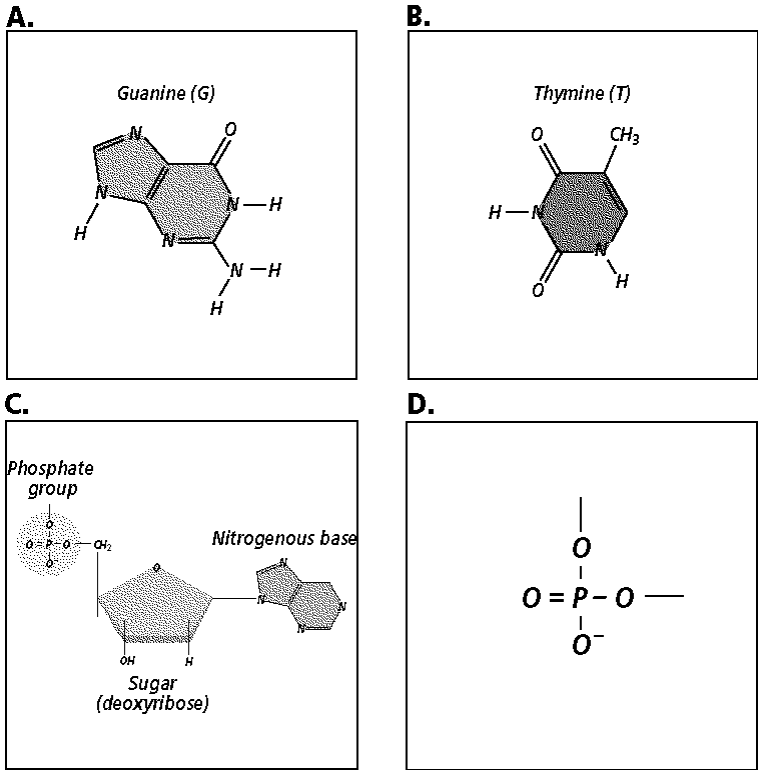


Figure 11-3

____ 36. Which structure shown in Figure 11-3 is a pyrimidine?
a. A
b. B
c. C
d. D

____ 37. Which structure shown in Figure 11-3 does not contain a nitrogenous base?
a. A
b. B
c. C
d. D

____ 38. Which structure shown in Figure 11-3 would attract a free cytosine nucleotide?
a. A
b. B
c. C
d. D

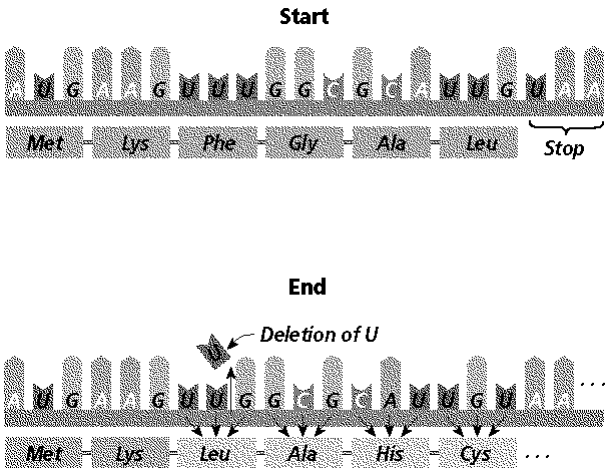


Figure 11-4

____ 39. What will be the result of the mutation in Figure 11-4?
a. it will have no affect on protein function
b. only one amino acid will change
c. nearly every amino acid in the protein will be changed
d. the organism will die

____ 40. A trait controlled by four alleles is said to have _____.
a. homologous alleles
b. autosomes
c. hybridization
d. multiple alleles

____ 41. A cross between a white rooster and a black hen results in 100% blue Andalusian offspring. When two of these blue offspring are mated, the probable phenotypic ratio seen in their offspring would be _____.
a. 100% blue
b. 75% black, 25% white
c. 75% blue, 25% white
d. 25% black, 50% blue, 25% white

____ 42. Because the gene for red-green color blindness is located on the X chromosome, it is normally <u>not</u> possible for a _____.
a. carrier mother to pass the gene on to her daughter
b. carrier mother to pass the gene on to her son
c. color blind father to pass the gene on to his daughter
d. color blind father to pass the gene on to his son

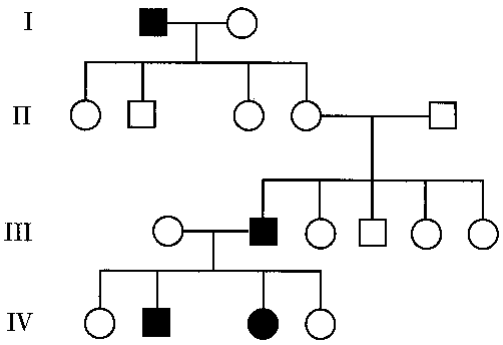


Figure 12-3

____ 43. Based on Figure 12-3, what do you know about individual III-1's mother?
a. She had the trait.
b. She was a carrier.
c. She was homozygous recessive.
d. She was homozygous dominant.

____ 44. According to the pedigree in Figure 12-3, how many of the offspring in the III generation show the normal trait?
a. 1
b. 2
c. 4
d. 5

____ 45. Eye color in humans is the result of _____ inheritance.
a. multiple allelic
b. polygenic
c. sex-linked
d. simple dominant

____ 46. A child is diagnosed with a rare genetic disease. Neither parent has the disease. How might the child have inherited the disorder?
a. The disorder is dominant and was carried by a parent.
b. The disorder is recessive and carried by both parents.
c. The disorder is sex linked and inherited only from the father.
d. The disorder could occur only as a mutation in the child because neither parent had the disease.

____ 47. Cystic fibrosis and Tay-Sachs disease are typical of recessive disorders concentrated in _____.

a. ethnic groups
b. families with a single child
c. countries with hot, wet climates
d. the United States

____ 48. Most human genetic disorders are caused by the expression of _____.
a. recessive alleles
b. two dominant alleles
c. one dominant allele
d. sex-linked heredity

____ 49. Which of the following situations is most usual for a dominant allele that results in severe effects in the offspring?
a. Both parents have the trait.
b. Only a single offspring has the trait.
c. The trait occurs by mutation.
d. none of these

____ 50. A phenotype that results from a dominant allele must have at least _____ dominant allele(s) present in the parent(s).
a. one
b. two
c. three
d. four

____ 51. A phenotypic trait that results from a single dominant allele is _____.
a. attached earlobes
b. more frequent in its appearance
c. cystic fibrosis
d. polydactyly

____ 52. Which of the following genetic disorders can be detected by karyotyping?
a. Down syndrome
b. Tay-Sachs disease and phenylketonuria
c. hemophilia and cystic fibrosis
d. Klinefelter syndrome and sickle-cell anemia

____ 53. A human genetic disorder caused by a dominant gene is _____.
a. Tay-Sachs disease
b. cystic fibrosis
c. phenylketonuria
d. Huntington's disease

____ 54. In humans, red-green color blindness is _____.
a. caused by a recessive allele
b. equally common in both sexes
c. inherited in males from their fathers
d. produced in males by a heterozygous genotype

____ 55. Individuals with Huntington's disease _____.
a. undergo progressive deterioration of the nervous system
b. find breathing difficult and suffer frequent lung infections
c. must have frequent transfusions because their blood lacks a clotting factor
d. suffer from a form of aneuploidy

____ 56. The reason a fetus afflicted with phenylketonuria is <u>not</u> affected until after birth is that _____.
a. the child is not bruised or cut during development and therefore does not require a blood-clotting factor
b. prior to birth, the mother's enzyme level prevents accumulation of the dangerous chemical
c. the missing chromosome is compensated for by the mother prior to delivery
d. because the fetus does not breathe, the accumulation of mucus in the lungs is not dangerous

____ 57. Both hemophilia and red-green color blindness are _____.
a. inherited only from the mother
b. located on the Y chromosome
c. caused by a dominant gene
d. sex-linked conditions

____ 58. Sickle-cell anemia is a genetic disease common to human populations from Africa and the Mediterranean coast. The incidence is greater in these regions than elsewhere because the heterozygous state provides protection against malaria. Individuals afflicted with sickle-cell anemia _____.
a. are two times more likely to be males than to be females
b. will not exhibit the symptoms of the disease until around age 40

c. suffer tissue damage resulting from oxygen deprivation
d. lack an enzyme that breaks down a lipid produced in the central nervous system

____ 59. Which of the following would be an example of gene therapy technology?
a. development of a nasal spray that contains copies of the normal gene that is defective in persons with cystic fibrosis
b. cutting DNA into fragments with restriction enzymes
c. modifying E. coli to produce indigo dye for coloring denim blue jeans
d. separation DNA fragments using gel electrophoresis

____ 60. The process used to separate DNA segments of different lengths is _____.
a. PCR
b. gel electrophoresis
c. gene amplification
d. all of these

____ 61. The effort to completely map and sequence the human genome will likely result in knowing the sequence of the approximately _____ genes on the 46 human chromosomes.
a. 46
b. 10 000
c. 35 000 to 40 000
d. 3 billion

____ 62. A virus isolated from monkeys contains a circular double strand of DNA. The virus, called Simian Virus 40, interests scientists because it causes cancer in laboratory animals. Using a restriction enzyme, the strand is separated into six unequal segments, as shown in Figure 13-2. A scientist hypothesizes that the segment of DNA causing cancer can contain no fewer than 600 base pairs. Using Figure 13-2, decide which segments of the virus have the highest chance of containing the segment of interest. Identify in DESCENDING order, from the HIGHEST chance to the LOWEST.

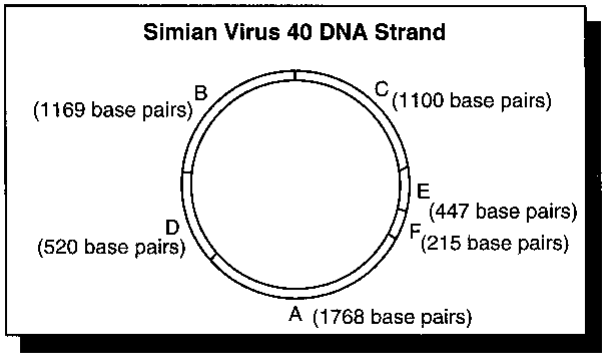


Figure 13-2

a. C, B, A
b. F, E, D
c. A, B, C
d. D, E, F

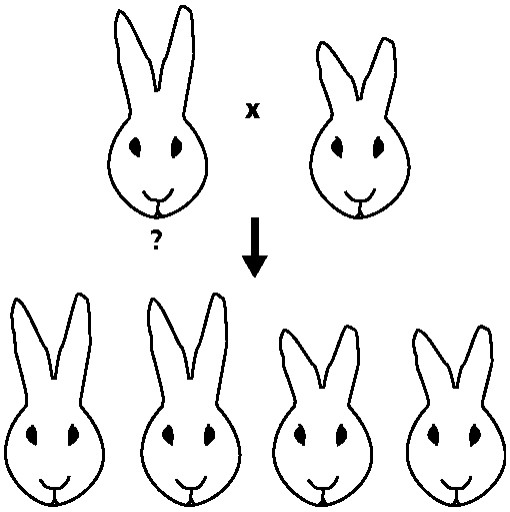


Figure 13-4

____ 63. What would be the result of the test cross in Figure 13-4 if the unknown were homozygous long ears?
a. 1/2 of the offspring would have long ears
b. all of the offspring would have long ears
c. all of the offspring would have short ears
d. 1/4 of the offspring would have short ears

____ 64. What must be on either end of any genetic material that is inserted into the cleaved DNA in Figure 13-5?

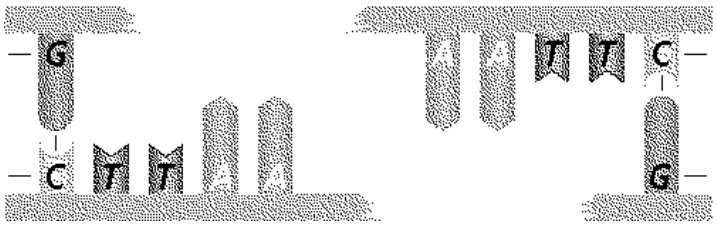
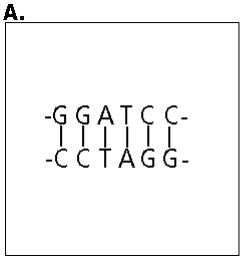


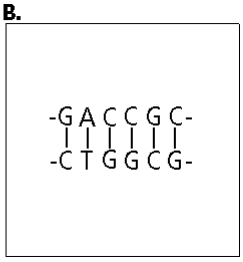
Figure 13-5

a. AATT
b. ATAT
c. CCGG
d. CGCG

A.



B.



C.

D.

Figure 13-6

____ 65. Which segment in Figure 13-6 is not a palidrome?
a. A
b. B
c. C
d. D

____ 66. Which segment in Figure 13-6 will attach to genetic material with the sequence TCGA?
a. A
b. B
c. C
d. D

____ 67. If the segments in Figure 13-6 are mixed with several restriction enzymes, which will not be cleaved?
a. A
b. B
c. C
d. D

____ 68. According to Figure 13-7, which DNA sequence will be cleaved by EcoRI, which cuts AATT/TTAA?

Figure 13-7

a. A
b. B
c. C
d. D

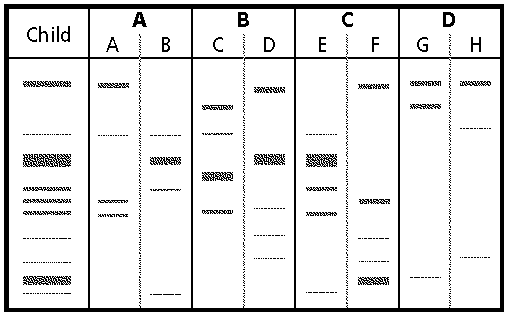


Figure 13-8

____ 69. According to Figure 13-8, which are the parents of the child?
a. A
b. B
c. C
d. D

____ 70. According to Figure 13-8, which parents might give a false positive if only the longer DNA fragments were analyzed?
a. A
c. C

b. B
d. D

Matching

Match each item with the correct statement below.

a. crossing over
b. meiosis
c. dihybrid
d. heredity
e. haploid
f. homozygous
g. zygote
h. fertilization

____ 71. A cross involving two different traits
____ 72. The exchange of genetic material between homologous chromosomes
____ 73. A cell that contains one member of each chromosome pair
____ 74. The alleles present for a trait are the same
____ 75. The passing of characteristics from parents to offspring

Short Answer

76. How does meiosis maintain a constant number of chromosomes in the body cells of organisms that reproduce sexually?

77. How does the knowledge of the events of meiosis explain Mendel's Law of Segregation?

78. Explain how crossing over in meiosis results in genetic variation.

79. How does Mendel's Law of Independent Assortment assure genetic diversity?

80. Analyze the differences between Mendel's Law of Dominance and Law of Segregation.

81. Describe how genetic recombination through segregation and crossing over can lead to variations in the offspring.

82. Approximately one out of every 20 white Americans carries an allele for a hereditary disorder known as cystic fibrosis (CF), but only one in every 2000 Caucasian babies born in the United States is afflicted with the disorder. Individuals with two alleles for cystic fibrosis produce large amounts of mucus that accumulate in the lungs, liver, and pancreas. This mucus clogs important ducts in these organs and causes extensive damage. Why is there such a difference between the number of individuals who carry the allele and the number actually born with the disease?

83. Describe the process of replication.

84. Provide a mathematical reason for why codons cannot be two nucleotides in length.

85. Identify the following types of chromosome changes.
    a. abcdef $\rightarrow$ abcedf
    b. abcdef $\rightarrow$ abcef
    c. abcdef $\rightarrow$ abcd56

86. What is the difference between a codon and an anticodon?

87. Why is tRNA important in translation?

88. How does incomplete dominance differ from multiple alleles?

89. How does polygenic inheritance differ from Mendelian inheritance?

90. Discuss how the external environment of an organism can affect gene function.

91. A male is said to be hemizygous for genes on the X chromosome. Explain why you think this term was chosen.

92. Choose the term that does not belong with the rest and explain your answer: *genotype, phenotype, heterozygous, homozygous.*

93. What is the genetic reason for Down syndrome? Discuss the results.

Name	Mrs. Page	Mr. Page	Mrs. Baker	Mr. Baker	Baby #1	Baby #2
Blood Type	B	AB	B	A	A	O

Table 12-1

94. Two couples, the Pages and the Bakers, had baby boys in the same hospital at the same time. There was a mix-up in the hospital nursery. Use the information given in Table 12-1. Which baby belongs to which family?

95. Based on the Pages' blood types, could either or both babies be theirs? Use Table 12-1 to explain your answer.

96. Based on the Bakers' blood types, could Baby #1 be their child? Could Baby #2 be their child? Use Table 12-1 to explain your answer.

97. Which term does NOT belong with the rest: *red blood cells, phenylalanine, oxygen deprivation, hemoglobin.* Explain your answer.

The pedigree in Figure 12-6 shows the occurrence of Tay-Sachs disease in a family. Children who were born with the homozygous recessive genotype are not able to produce the enzyme, hexosaminidase A. Without hexosaminidase A, lipids accumulate in nerve cells and damage them. The symptoms usually start to appear a few months after birth. The infant suffers seizures and degeneration of motor and mental skills and dies within the first few years. Scientists believe there is an evolutionary explanation for why the Tay-Sachs allele persists in a population. In Eastern Europe during the early 20th century, tuberculosis was a leading cause of death. Yet, among certain ethnic groups, particularly those with a high incidence of Tay-Sachs disease, few people died of tuberculosis. It appeared as if the presence of the Tay-Sachs allele protected an individual against TB. Individuals with the heterozygous genotype were better able to survive tuberculosis and thus lived to pass the recessive allele along to their offspring. Scientists have determined that the blood serum levels of hexosaminidase A differ in measurable amounts among normal people, carriers, and infants with the disease.

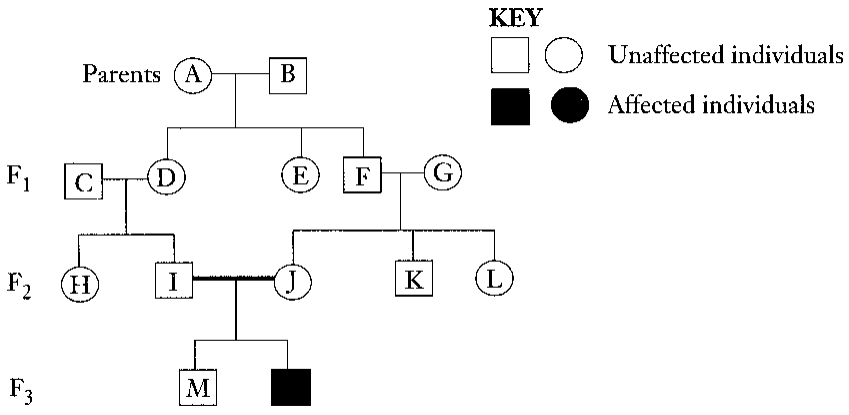


Figure 12-6

98. Individual L in Figure 12-6 is contemplating getting married and starting a family. She sees what has happened in her sister's family and is concerned. She has discussed with her fiancé the possibility of not having children. What are the options available to L and her fiancé that would allow them to determine the odds of their having a child with Tay-Sachs disease?

99. Which individuals in the F_2 generation of Figure 12-6 have at least a 50% chance of being carriers, and which of these have a 100% chance of being carriers? Explain your answer.

100. Examine the F_2 generation of Figure 12-6. What is significant about the relationship indicated by the heavy line connecting individuals I and J?

101. Explain the term *recombinant DNA* in a complete sentence.

102. Explain the term *genetic engineering* in a complete sentence.

103. Discuss how DNA fingerprinting works in crime analysis.

104. Figure 13-3 is a drawing of a hypothetical gel. Included on the gel is the banding pattern of the mother and father of two children. Determine possible banding patterns for each child selecting the letters A to F from the chart.

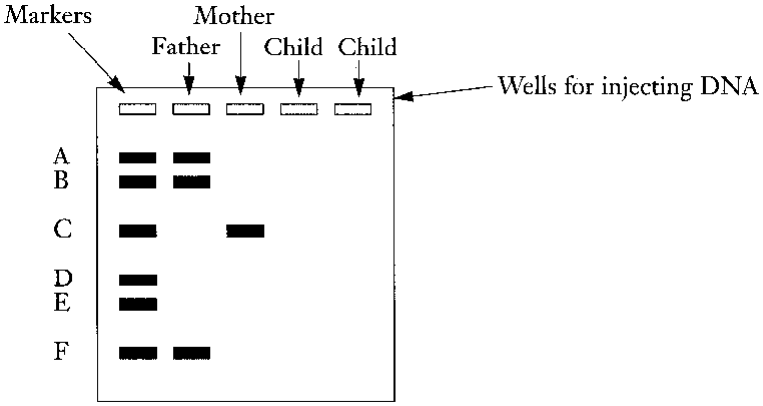


Figure 13-3

105. A breeder wants to find out whether or not a certain golden retriever is a carrier of an undesirable recessive trait. What could the breeder do? Explain.

Problem

Some biology students wanted to determine whether a pair of brown mice purchased at a pet store was homozygous dominant or heterozygous for fur color. They let the mice mate and examined the offspring. Six mice were born. All six had brown fur.

Some of the students felt that this was enough evidence to prove that the mice were homozygous for brown fur color. Other students did not, so another experiment was planned.

106. Describe the next experiment the students could conduct to determine whether the parent mice are homozygous brown or heterozygous. Explain your answer.

107. Do you think the experiment described was adequate to prove that the parent mice were homozygous brown?

108. In Figure 11-2, use the letter P to label all of the phosphate groups. Use an S to label all the sugar molecules. For labeling the nitrogen bases, use a T for thymine and a C for cytosine. Guanine and adenine have been filled in for you. Circle and label a codon. Circle and label a nucleotide.

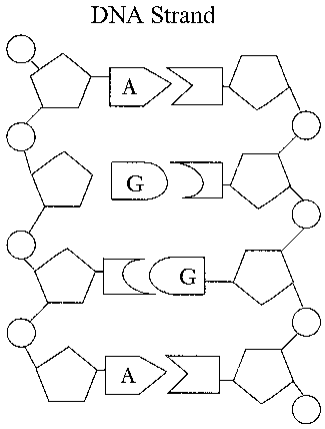


Figure 11-2

Agrobacterium tumefaciens is a bacterium that causes crown gall disease, a tumorous growth on the growing tip of certain plants. The bacterium is able to enter a plant through small cuts in the outer cell layer. When *Agrobacterium* enters a plant cell, a DNA sequence from the bacterium integrates into the plant's DNA. This new section of DNA causes the plant's cell to reproduce quickly to form a tumor and to synthesize a food molecule needed by the bacterium. A critical bit of information that scientists have learned about the process is that the tumor-causing information is carried on a large plasmid that is separate from the bacterium's main chromosome. During the infection process, the DNA on the plasmid that codes for food production and rapid reproduction leaves the plasmid, moves into the plant cell nucleus, and integrates with one of the plant cell's chromosomes. Thus, when the plant cell reproduces, it passes along the bacterium's genetic information, which has been incorporated into the plant genome.

109. Why is the above information about how *Agrobacterium* causes crown gall disease important to scientists hoping to produce transgenic plants?

110. What benefits to agriculture could stem from scientists being able to engineer plants genetically?

Bio12-Q2W8-Quarter Revision
Answer Section

MODIFIED TRUE/FALSE

1. ANS: T PTS: 1 DIF: B
   OBJ: 12-7 NAT: C2 | F4 | G1
2. ANS: F, Multiple allele

   PTS: 1 DIF: B OBJ: 12-5 NAT: C2 | G2 | G3
3. ANS: T PTS: 1 DIF: B
   OBJ: 12-5 NAT: C2 | G2 | G3
4. ANS: F
   selective breeding
   Inbreeding
   hybridization

   PTS: 1 DIF: B OBJ: 13-2 NAT: F1 | G1 | G2
5. ANS: T PTS: 1 DIF: B
   OBJ: 13-2 NAT: F1 | G1 | G2

MULTIPLE CHOICE

6. ANS: C PTS: 1 DIF: B OBJ: 10-2
   NAT: G1 | G2 | G3
7. ANS: B PTS: 1 DIF: B OBJ: 10-1
   NAT: G1 | G2 | G3
8. ANS: A PTS: 1 DIF: B OBJ: 10-5
   NAT: F6 | G1 | G2
9. ANS: B PTS: 1 DIF: B OBJ: 10-1
   NAT: G1 | G2 | G3
10. ANS: B PTS: 1 DIF: B OBJ: 10-3
    NAT: G1 | G2 | G3
11. ANS: B PTS: 1 DIF: B OBJ: 10-3
    NAT: G1 | G2 | G3
12. ANS: A PTS: 1 DIF: B OBJ: 10-1
    NAT: G1 | G2 | G3
13. ANS: A PTS: 1 DIF: B OBJ: 10-2
    NAT: G1 | G2 | G3
14. ANS: A PTS: 1 DIF: B OBJ: 10-2
    NAT: G1 | G2 | G3
15. ANS: B PTS: 1 DIF: B OBJ: 10-5
    NAT: F6 | G1 | G2
16. ANS: B PTS: 1 DIF: A OBJ: 10-2
    NAT: G1 | G2 | G3
17. ANS: C PTS: 1 DIF: B OBJ: 10-2
    NAT: G1 | G2 | G3

18. ANS: B PTS: 1 DIF: A OBJ: 10-2
NAT: G1 | G2 | G3
19. ANS: A PTS: 1 DIF: A OBJ: 10-2
NAT: G1 | G2 | G3
20. ANS: A PTS: 1 DIF: A OBJ: 10-4
NAT: G1 | G2 | G3
21. ANS: B PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
22. ANS: C PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
23. ANS: A PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
24. ANS: B PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
25. ANS: C PTS: 1 DIF: B OBJ: 11-5
NAT: C1 | C2 | F1
26. ANS: B PTS: 1 DIF: B OBJ: 11-2
NAT: C2 | C5 | G1
27. ANS: C PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
28. ANS: B PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
29. ANS: A PTS: 1 DIF: B OBJ: 11-4
NAT: C1 | C2
30. ANS: C PTS: 1 DIF: B OBJ: 11-4
NAT: C1 | C2
31. ANS: A PTS: 1 DIF: B OBJ: 11-4
NAT: C1 | C2
32. ANS: A PTS: 1 DIF: B OBJ: 11-4
NAT: C1 | C2
33. ANS: B PTS: 1 DIF: A OBJ: 11-4
NAT: C1 | C2
34. ANS: C PTS: 1 DIF: A OBJ: 11-4
NAT: C1 | C2
35. ANS: A PTS: 1 DIF: A OBJ: 11-5
NAT: C1 | C2 | F1
36. ANS: B PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
37. ANS: D PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
38. ANS: A PTS: 1 DIF: A OBJ: 11-1
NAT: C2 | C5 | G1
39. ANS: C PTS: 1 DIF: A OBJ: 11-7
40. ANS: D PTS: 1 DIF: B OBJ: 12-5
NAT: C2 | G2 | G3
41. ANS: D PTS: 1 DIF: A OBJ: 12-4
NAT: C2 | G2 | G3
42. ANS: D PTS: 1 DIF: A OBJ: 12-6
NAT: C2 | G2 | G3

43. ANS: B PTS: 1 DIF: A OBJ: 12-3
NAT: C2 | F1 | G1
44. ANS: C PTS: 1 DIF: A OBJ: 12-1
NAT: C2 | G1 | G2
45. ANS: B PTS: 1 DIF: B OBJ: 12-8
NAT: F1 | G1 | G2
46. ANS: B PTS: 1 DIF: B OBJ: 12-2
NAT: C2 | G1 | G2
47. ANS: A PTS: 1 DIF: B OBJ: 12-2
NAT: C2 | G1 | G2
48. ANS: A PTS: 1 DIF: B OBJ: 12-2
NAT: C2 | G1 | G2
49. ANS: C PTS: 1 DIF: B OBJ: 12-3
NAT: C2 | F1 | G1
50. ANS: A PTS: 1 DIF: B OBJ: 12-3
NAT: C2 | F1 | G1
51. ANS: D PTS: 1 DIF: B OBJ: 12-3
NAT: C2 | F1 | G1
52. ANS: A PTS: 1 DIF: B OBJ: 12-9
NAT: F1 | G1 | G2
53. ANS: D PTS: 1 DIF: B OBJ: 12-3
NAT: C2 | F1 | G1
54. ANS: A PTS: 1 DIF: B OBJ: 12-8
NAT: F1 | G1 | G2
55. ANS: A PTS: 1 DIF: B OBJ: 12-3
NAT: C2 | F1 | G1
56. ANS: B PTS: 1 DIF: B OBJ: 12-2
NAT: C2 | G1 | G2
57. ANS: D PTS: 1 DIF: B OBJ: 12-8
NAT: F1 | G1 | G2
58. ANS: C PTS: 1 DIF: B OBJ: 12-8
NAT: F1 | G1 | G2
59. ANS: A PTS: 1 DIF: A OBJ: 13-4
NAT: F1 | F5 | F6
60. ANS: B PTS: 1 DIF: B OBJ: 13-3
NAT: F4 | F5 | F6
61. ANS: C PTS: 1 DIF: B OBJ: 13-5
NAT: F4 | F5 | F6
62. ANS: C PTS: 1 DIF: A OBJ: 13-4
NAT: F1 | F5 | F6
63. ANS: B PTS: 1 DIF: A OBJ: 13-1
NAT: C2 | F1 | G1
64. ANS: A PTS: 1 DIF: A OBJ: 13-2
NAT: F1 | G1 | G2
65. ANS: B PTS: 1 DIF: B OBJ: 13-3
NAT: F4 | F5 | F6
66. ANS: C PTS: 1 DIF: A OBJ: 13-3
NAT: F4 | F5 | F6

67. ANS: B PTS: 1 DIF: A OBJ: 13-3
NAT: F4 | F5 | F6
68. ANS: C PTS: 1 DIF: B OBJ: 13-3
NAT: F4 | F5 | F6
69. ANS: C PTS: 1 DIF: A OBJ: 13-5
NAT: F4 | F5 | F6
70. ANS: A PTS: 1 DIF: A OBJ: 13-5
NAT: F4 | F5 | F6

MATCHING

71. ANS: C PTS: 1 DIF: B OBJ: 10-1
NAT: G1 | G2 | G3
72. ANS: A PTS: 1 DIF: B OBJ: 10-4
NAT: G1 | G2 | G3
73. ANS: E PTS: 1 DIF: B OBJ: 10-3
NAT: G1 | G2 | G3
74. ANS: F PTS: 1 DIF: B OBJ: 10-1
NAT: G1 | G2 | G3
75. ANS: D PTS: 1 DIF: B OBJ: 10-1
NAT: G1 | G2 | G3

SHORT ANSWER

76. ANS:
Meiosis reduces the number of chromosomes to *n* or half in the sperm and egg. When fertilization occurs, the 2*n* number of chromosomes is restored.

PTS: 1 DIF: A OBJ: 10-3 NAT: G1 | G2 | G3
77. ANS:
During meiosis, the homologous chromosome pairs line up and split; then in the second division, the chromatids split. This results in only one of the pair of chromosomes (containing the "factors") in a gamete.

PTS: 1 DIF: A OBJ: 10-5 NAT: F6 | G1 | G2
78. ANS:
In crossing over, genetic information is exchanged between homologous chromosomes. This exchange creates new combinations of genes, leading to increased genetic variation in the offspring.

PTS: 1 DIF: A OBJ: 10-4 NAT: G1 | G2 | G3
79. ANS:
Answers may include: During independent assortment, the homologous chromosomes are assorted independently of one another. This increases genetic diversity.

PTS: 1 DIF: A OBJ: 10-4 NAT: G1 | G2 | G3
80. ANS:
Answers may include: The Law of Dominance deals with individual genes and their influence. The Law of Segregation explains how these genes are separated during meiosis.

PTS: 1 DIF: A OBJ: 10-1 NAT: G1 | G2 | G3

81. ANS:
Independent segregation of homologous chromosomes during gamete formation allows for a random assortment of alleles in the sex cells. This allows the members of each pair of alleles to recombine in new ways in the offspring. Crossing over leads to new gene combinations when homologous chromosomes exchange alleles during meiosis. Thus, an allele may be paired with a trait with which it was not previously paired.

PTS: 1 DIF: A OBJ: 10-4 NAT: G1 | G2 | G3

82. ANS:
In order for an individual to inherit cystic fibrosis, two people, each with the recessive gene, must meet and mate. The odds of that are 1/20 x 1/20 or 1/400. Then, using a Punnett square, it can be determined that there is only a 25% chance that a sperm with the recessive allele will fertilize an egg with the recessive allele--hence the relatively low frequency of children with cystic fibrosis.

PTS: 1 DIF: A OBJ: 10-2 NAT: G1 | G2 | G3

83. ANS:
First the double stranded DNA molecule separates like a zipper unzipping. The weak hydrogen bonds between the complimentary nucleotides break and the two DNA strands separate. Then free nucleotides attach to the exposed nucleotides of the DNA strands and bond to form new strands of DNA. From one DNA molecule there are now two DNA molecules. Each one of the DNA molecules has a strand from the original DNA and one new strand.

PTS: 1 DIF: A OBJ: 11-2 NAT: C2 | C5 | G1

84. ANS:
The codons code for amino acids. Living things use 20 amino acids. If the codon was only two nucleotides in length they could not code for all 20 amino acids. Mathematically if two nucleotides made a codon, and there are four possible nucleotides for each codon slot, they would code for only 4^2 or 16 amino acids.

PTS: 1 DIF: A OBJ: 11-3 NAT: C1 | C2

85. ANS:
a-inversion, b-deletion, c-translocation

PTS: 1 DIF: A OBJ: 11-5 NAT: C1 | C2 | F1

86. ANS:
A codon is a three-base code for a specific amino acid. An anticodon is a tRNA triplet of nitrogen bases that bonds to a complementary codon on the messenger RNA.

PTS: 1 DIF: A OBJ: 11-4 NAT: C1 | C2

87. ANS:
Transfer RNA brings an amino acid to the ribosome for translating the DNA code into a protein.

PTS: 1 DIF: A OBJ: 11-4 NAT: C1 | C2

88. ANS:
In incomplete dominance, there are only two alleles, neither of which is dominant to the other. In multiple alleles, there are more than two alleles, any one of which may be dominant to any recessive allele.

PTS: 1 DIF: A OBJ: 12-4 NAT: C2 | G2 | G3

89. ANS:

In Mendelian inheritance, traits are determined by dominant and recessive paired alleles of single genes. In polygenic inheritance, a trait is controlled by two or more genes.

PTS: 1 DIF: A OBJ: 12-5 NAT: C2 | G2 | G3

90. ANS:
Temperature, light, nutrition, chemicals, and infectious agents can all influence genes. Examples resulting from differences in temperature include colors in some bacteria and patterns in the coat color of rabbits. Similar phenotypes are controlled by many other genes in organisms.

PTS: 1 DIF: A OBJ: 12-7 NAT: C2 | F4 | G1

91. ANS:
The prefix hemi- means "half." Because only one of a male's two sex chromosomes is an X chromosome, only half his sex chromosomes can carry the genes.

PTS: 1 DIF: A OBJ: 12-6 NAT: C2 | G2 | G3

92. ANS:
Phenotype because the other three terms describe the gene combinations an organism would possess and not the expression of those genes

PTS: 1 DIF: A OBJ: 12-1 NAT: C2 | G1 | G2

93. ANS:
Down syndrome is the result of trisomy of chromosome 21. Down syndrome consists of a group of symptoms that include minor to severe mental retardation; a characteristically large, thick tongue; and shortened stature.

PTS: 1 DIF: A OBJ: 12-9 NAT: F1 | G1 | G2

94. ANS:
Baby #2 must belong to the Bakers because only Baby #1 can belong to the Pages.

PTS: 1 DIF: A OBJ: 12-8 NAT: F1 | G1 | G2

95. ANS:
Because Mr. Page is /A/B and Mrs. Page is either /B/B or /B/i, their baby could be either /A/B, /B/B, /Ai, or /Bi; in no case could it be type O (ii). Baby #1 is the only one that could be theirs.

PTS: 1 DIF: A OBJ: 12-8 NAT: F1 | G1 | G2

96. ANS:
Either Baby #1 or Baby #2 could be theirs. If Mrs. Baker is /Bi and Mr. Baker is /Ai or /A/A, then their baby could be /Ai, making it Baby #1. If Mrs. Baker is /Bi and Mr. Baker is /Ai, then their baby could be ii, making it Baby #2.

PTS: 1 DIF: A OBJ: 12-8 NAT: F1 | G1 | G2

97. ANS:
Phenylalanine because the other terms all relate to sickle-cell anemia. Phenylalanine is the amino acid that cannot be metabolized by individuals afflicted with PKU.

PTS: 1 DIF: A OBJ: 12-8 NAT: F1 | G1 | G2

98. ANS:
They could see a genetic counselor who would help them analyze their family histories. The counselor would construct a pedigree and determine the chances of their being carriers. They could also have a blood test done to determine the levels of hexosaminidase A in their blood serum. This would tell them if one or both of them are carriers.

PTS: 1 DIF: A OBJ: 12-2 NAT: C2 | G1 | G2

99. ANS:
H, I, J, K, and L all have at least a 50% chance of being carriers. If C and D are both heterozygous or if one is homozygous dominant and the other heterozygous, there is a 50% chance of their offspring carrying the recessive allele. This would be true of F and G also. In the F_2 generation, I and J have a 100% chance of being carriers because the only way to produce a child with a homozygous recessive genotype is for each parent to contribute a recessive allele.

PTS: 1 DIF: A OBJ: 12-1 NAT: C2 | G1 | G2

100. ANS:
It shows a marriage between first cousins.

PTS: 1 DIF: B OBJ: 12-1 NAT: C2 | G1 | G2

101. ANS:
Recombinant DNA results from cutting and recombining DNA fragments from different organisms.

PTS: 1 DIF: A OBJ: 13-3 NAT: F4 | F5 | F6

102. ANS:
Genetic engineering is the method of cutting DNA from one organism and inserting the DNA fragment into a host organism of the same or a different species.

PTS: 1 DIF: A OBJ: 13-3 NAT: F4 | F5 | F6

103. ANS:
Law enforcement workers use unique DNA fingerprint patterns to determine whether suspects have been at a crime scene. DNA samples can be obtained from hair, blood, skin, or semen. Because no two individuals have the same DNA sequence, samples from the suspects can be matched with samples taken at the crime scene.

PTS: 1 DIF: A OBJ: 13-6 NAT: F5 | F6 | G1

104. ANS:
Any combination of one band from the mother and one band from the father will be correct. Note: The 2 child lanes should not match unless it is indicated that the children are identical twins.

PTS: 1 DIF: A OBJ: 13-6 NAT: F5 | F6 | G1

105. ANS:
The breeder could perform a test cross by mating the questionable retriever with another retriever that has the recessive phenotype (is homozygous recessive). If any offspring show the recessive trait, the breeder knows the first dog is a carrier of the trait and should not be used for breeding.

PTS: 1 DIF: A OBJ: 13-2 NAT: F1 | G1 | G2

PROBLEM

106. ANS:
There are a number of ways students could respond correctly to this problem.
a) The parent mice could be permitted to mate several more times and produce large numbers of offspring. The larger F_1 population would increase the likelihood of the recessive phenotype being expressed.

b) The students could allow several of the F_1 mice to interbreed. If the parents are heterozygous, about 50% of their offspring should be heterozygous and with the larger numbers, there would be a greater chance of the recessive phenotype showing in the F_3 population.
c) The parent mice each could be mated with a homozygous recessive mouse. In that way, if a parent were heterozygous, there would be a 50% chance of the offspring showing the recessive trait. There are other possible correct responses. All of the responses should in some way indicate the need for more offspring because heredity operates according to the laws of probability.

Both mice could be homozygous brown, and that is why the recessive allele does not segregate out and appear in the offspring. BUT, only one mating and six offspring are not enough to prove this mathematically. One of the pair of mice could be heterozygous and the other homozygous brown and again, the recessive trait would not be seen in the offspring. Another possibility is that both mice are heterozygous. There would be only a 25% chance that the recessive alleles would segregate out and combine during fertilization. Six offspring may not be a large enough sample mathematically to reasonably expect the 25% chance of white mice to be expressed.

PTS: 1 DIF: A OBJ: 10-2 NAT: G1 | G2 | G3

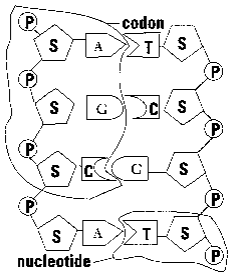
107. ANS:

Either "Yes" or "No" is adequate. The better answer is "No."

PTS: 1 DIF: B OBJ: 10-2 NAT: G1 | G2 | G3

108. ANS:

See Solution 11-1.



PTS: 1 DIF: B OBJ: 11-1 NAT: C2 | C5 | G1

109. ANS:

Answers may vary. This knowledge is important because plant cells are surrounded by a thick cell wall that makes the introduction of foreign DNA difficult. *Agrobacterium* offers a way of successfully placing foreign DNA in a plant cell.

PTS: 1 DIF: A OBJ: 13-3 NAT: F4 | F5 | F6

110. ANS:

Answers may vary. They might be able to engineer plants that require less fertilizer, produce more protein, are resistant to disease, grow in less favorable environments, and are a more nutritious food source.

PTS: 1 DIF: A OBJ: 13-4 NAT: F1 | F5 | F6