Bio12-Q2W4-5- Qs Bank-Molecular Genetics

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

____ 1. DNA is composed of nucleotide subunits, each of which contains a —
a. ribose molecule.
b. phosphate group.
c. uracil base.
d. All of the above

____ 2. The two strands of DNA in the double helix structure are held together by which of the following interactions?
a. Van der Waals forces
b. Covalent bonds
c. Ionic bonds
d. Hydrogen bonds

____ 3. The process of cell division requires the parent cell to synthesize more DNA molecules. These molecules are produced by which of the following mechanisms?
a. Translation
b. Replication
c. Transcription
d. Mitosis

____ 4. Which of the following do DNA and RNA have in common?
a. Both are double-stranded.
b. Both contain ribose molecules.
c. Both contain phosphate groups.
d. Both contain thymine.

____ 5. Translation is the process of synthesizing protein from RNA. Which of the following molecules transports amino acids from the cytoplasm to the ribosome for translation?
a. mRNA
b. rRNA
c. tRNA
d. All of the above

____ 6. There are 64 different mRNA codons in the genetic code. How many possible codons would there be if a codon consisted of only two nucleotides?
a. 64
b. 32
c. 16
d. 8

____ 7. In most organisms, the start of translation is signaled by an AUG codon. What is the first amino acid in most proteins?
a. Proline
b. Leucine
c. Isoleucine
d. Methionine

____ 8. Some mutagens, such as the sun's UV radiation, cause mutations in somatic cells, such as dermal cells. Which of the following is NOT likely to occur as a result of such a mutation?
a. Skin cancer may develop in the exposed individual.
b. Skin cancer may develop in the offspring of the exposed individual.
c. Exposed skin cells may function improperly.
d. All of the above consequences are likely.

____ 9. What is the complementary mRNA sequence to the DNA sequence A-T-T-G-C-A?
a. T-A-A-C-G-T
b. U-A-A-C-G-T
c. U-A-A-C-G-U
d. T-A-A-G-C-U

____ 10. A mutation is any mistake or change in the
a. cell.
b. DNA sequence.
c. ribosomes.
d. nucleus.

____ 11. A point mutation is a change in
a. several bases in mRNA.
b. several bases in tRNA.
c. a single base pair in DNA.
d. several base pairs in DNA.

____ 12. A mutation in which a single base is added to or deleted from DNA is called
a. a frame shift mutation.
c. translocation.

b. a point mutation. d. nondisjunction.

____ 13. Chromosomal mutations are especially common in
a. humans. c. bacteria.
b. animals. d. plants.

____ 14. Few chromosome mutations are passed on to the next generation because
a. the zygote usually dies.
b. the mature organism is sterile.
c. the mature organism is often incapable of producing offspring.
d. all of the above.

____ 15. When part of one chromosome breaks off and is added to a different chromosome, the result is a(n)
a. translocation. c. inversion.
b. insertion. d. deletion.

____ 16. Many chromosome mutations result when chromosomes fail to separate properly during
a. mitosis. c. crossing over.
b. meiosis. d. linkage.

____ 17. The failure of homologous chromosomes to separate properly is called
a. translocation. c. nondisjunction.
b. disjunction. d. deletion.

____ 18. Mutations that occur at random are called
a. spontaneous mutations. c. nonrandom mutations.
b. nonspontaneous mutations. d. environmental mutations.

____ 19. An agent that can cause a change in DNA is called a(n)
a. zygote. c. mutagen.
b. inversion. d. mutation.

____ 20. Mutations in body cells can sometimes result in
a. new species. c. sterile offspring.
b. cancer. d. hybrids.

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

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

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

____ 27. The process by which a DNA molecule is copied is called _____.
a. binary fission
b. mitosis
c. replication
d. translation

____ 28. 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

____ 29. 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

____ 30. An RNA molecule is a polymer composed of subunits known as _____.
a. polysaccharides
b. ribose molecules
c. nucleotides
d. uracil molecules

____ 31. X rays, ultraviolet light, and radioactive substances that can change the chemical nature of DNA are classified as _____.
a. growth regulators
b. metamorphic molecules
c. hydrolytic enzymes
d. mutagens

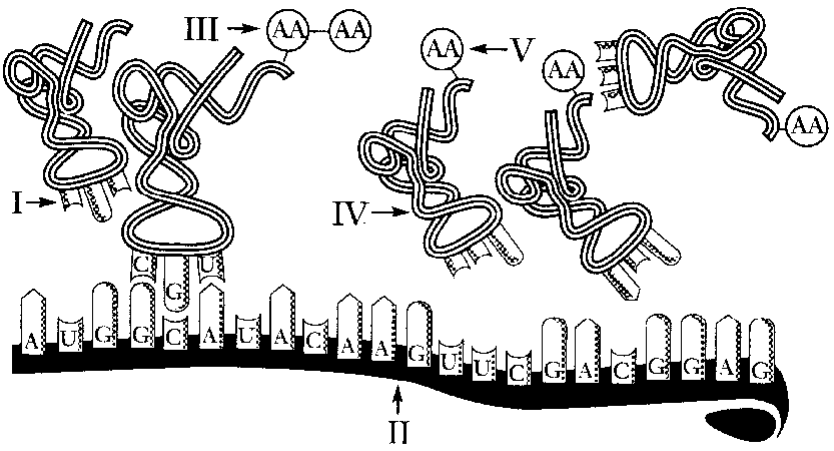


Figure 11-1

____ 32. 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

____ 33. 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

____ 34. Structure III in Figure 11-1 represents a(n) _____.
a. gene
b. amino acid
c. codon
d. DNA molecule

____ 35. 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

____ 36. 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

____ 37. Applicants for the third job of the Help Wanted ad in Table 11-1, "Executive Position," could qualify if they were _____.

a. DNA
b. mRNA
c. tRNA
d. rRNA

____ 38. 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

____ 39. A DNA segment is changed from-AATTAG- to -AAATAG-. This is a ____.

a. frameshift mutation
b. point mutation
c. inversion
d. deletion

____ 40. A DNA segment is changed from -AATTAGAAATAG- to -ATTAGAAATAG-. This is a ____.

a. frameshift mutation
b. point mutation
c. inversion
d. translation

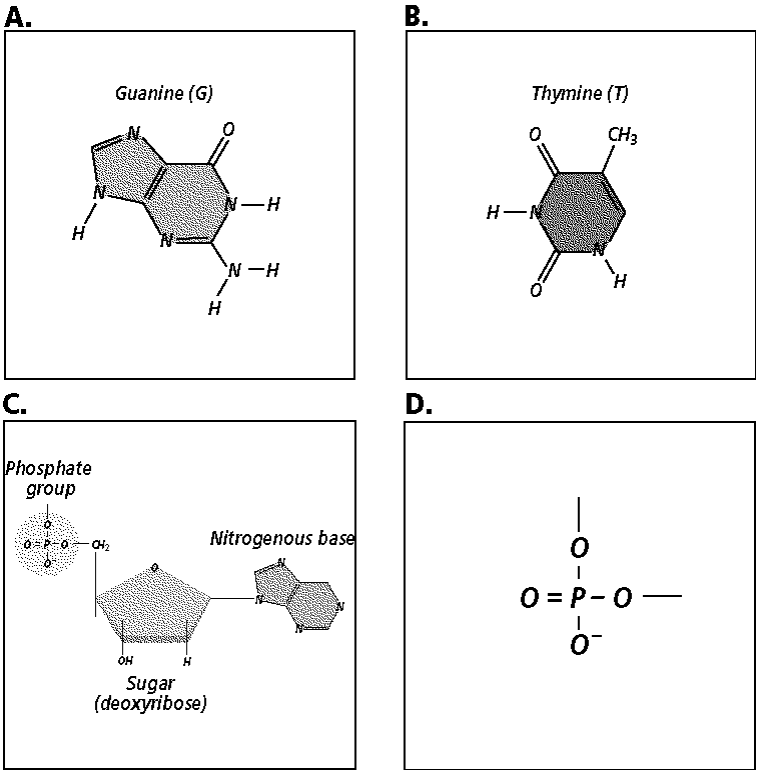


Figure 11-3

____ 41. Which structure shown in Figure 11-3 is a pyrimidine?
a. A
b. B
c. C
d. D

____ 42. Which structure shown in Figure 11-3 does not contain a nitrogenous base?
a. A
b. B
c. C
d. D

____ 43. Which structure shown in Figure 11-3 would attract a free cytosine nucleotide?
a. A
b. B
c. C
d. D

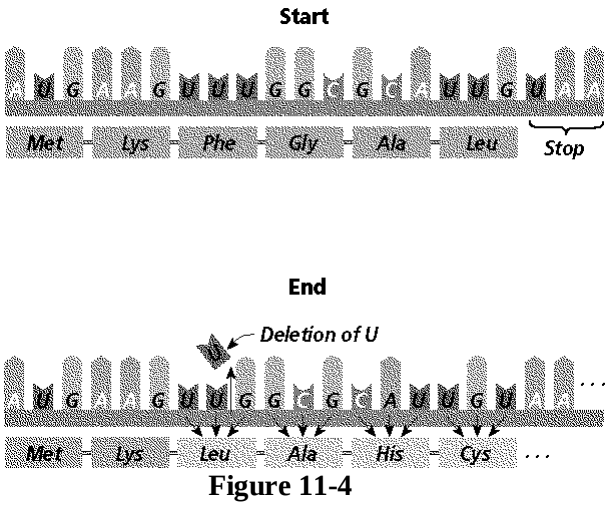


Figure 11-4

____ 44. What type of mutation has occurred in Figure 11-4?
a. point mutation
b. frame shift
c. lethal
d. protein

____ 45. 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

Completion
Complete each statement.

46. _____, guanine (G), cytosine (C), and thymine (T) are the four _____ in DNA.
47. In DNA, _____ always forms hydrogen bonds with guanine (G).
48. The sequence of _____ carries the genetic information of an organism.
49. The process of _____ produces a new copy of an organism's genetic information, which is passed on to a new cell.
50. The double-coiled shape of DNA is called a _____.
51. Proteins are made up of _____.
52. There are twenty different types of _____.
53. The message of the DNA code is information for building _____.
54. Each set of three nitrogenous bases that codes for an amino acid is known as a _____.
55. The amino acid _____ is represented by the mRNA codon ACA.
56. _____ and _____ are mRNA codons for phenylalanine.
57. There can be more than one _____ for the same amino acid.
58. For any one codon, there can be only one _____.
59. The genetic code is said to be universal because a codon represents the same _____ in almost all organisms.
60. _____ and _____ are amino acids that are each represented by only one codon.
61. Proteins are made in the cytoplasm of a cell, whereas DNA is found only in the _____.
62. The process of making RNA from DNA is called _____.
63. The process of transcription is similar to the process of DNA _____.
64. _____ carries information from the DNA in the nucleus out into the cytoplasm of the cell.
65. mRNA carries the information for making proteins to the _____.
66. Watson and Crick called the three-dimensional shape of DNA a _____.

67. When parts of chromosomes are broken off and lost during mitosis or meiosis, the result is a(n) _____.

68. The process of converting RNA code into an amino acid sequence is called _____.

69. If a nucleotide is added or removed from a DNA molecule and mRNA is created, the codons after the mutation will not be read correctly. This is a _____.

70. A change in a single base pair of the DNA molecule that affects the synthesis of an entire protein is called a(n) _____.

71. The molecule _____ brings amino acids to the ribosomes for the assembly of proteins.

72. Each set of three nitrogen bases representing an amino acid is referred to as a(n) _____.

73. The process by which DNA makes a copy of itself is called _____.

74. Thymine, adenine, guanine, and cytosine are classified as _____.

75. Watson and Crick, with the help of Rosalind Franklin, developed the _____ model of DNA.

76. A(n) _____ involves the addition or deletion of a single base in a DNA molecule.

77. During the process of transcription, DNA serves as the template for making _____, which leaves the nucleus and travels to the ribosomes.

78. Translation is to protein as transcription is to _____.

79. DNA is to RNA as double stranded is to _____.

80. Adenine is to thymine as guanine is to _____.

Short Answer

81. Describe the process of replication.

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

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

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

85. Why is tRNA important in translation?

Problem

86. 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.

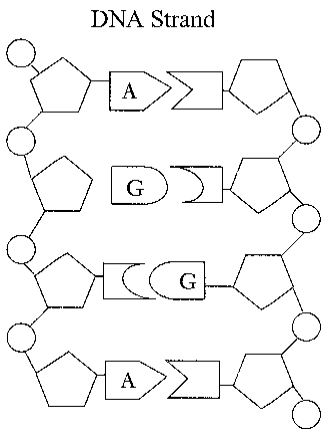


Figure 11-2

Bio12-Q2W4-5- Qs Bank-Molecular Genetics
Answer Section

MULTIPLE CHOICE

1. ANS: B
   A DNA nucleotide is composed of deoxyribose, a nitrogen base, and a phosphate group.

   PTS: 1
2. ANS: D
   The two strands of a DNA double helix are connected by the nitrogen bases extending from the backbone of the chain. Hydrogen bonds form between these bases.

   PTS: 1
3. ANS: B
   To ensure that all new cells have the appropriate amount of DNA, all parental chromosomes must be copied in a process called DNA replication.

   PTS: 1
4. ANS: C
   While RNA and DNA molecules differ in many respects, both contain phosphate groups along with their respective sugar molecules in their backbones.

   PTS: 1
5. ANS: C
   During the process of translation, transfer RNA (tRNA) molecules carry free amino acids in the cytoplasm to the ribosomes for incorporation into a new protein molecule.

   PTS: 1
6. ANS: C
   Since there are four possible bases for each position in a codon, there would be 4 x 4, or 42, possible codons with a length of two nucleotides. Normally, there are 4 x 4 x 4, or 64, possible codons. In general, there are 4n possible codons, where n represents the length of the codon.

   PTS: 1
7. ANS: D
   The genetic code dictates that the AUG codon codes for methionine. Therefore, the first amino acid in most proteins is methionine.

   PTS: 1
8. ANS: B
   Mutations in body, or somatic, cells are not passed on to an individual's offspring. Therefore the damaged skin cells of the parent have no effect on the skin cells of the offspring.

   PTS: 1
9. ANS: C
   Since mRNA uses uracil instead of thymine, the complementary sequence of mRNA is U-A-A-C-G-U.

PTS: 1

10. ANS: B PTS: 1
11. ANS: C PTS: 1
12. ANS: A PTS: 1
13. ANS: D PTS: 1
14. ANS: D PTS: 1
15. ANS: A PTS: 1
16. ANS: B PTS: 1
17. ANS: C PTS: 1
18. ANS: A PTS: 1
19. ANS: C PTS: 1
20. ANS: B PTS: 1
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: 11-2
NAT: C2 | C5 | G1
28. ANS: C PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
29. ANS: B PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
30. ANS: C PTS: 1 DIF: B OBJ: 11-4
NAT: C1 | C2
31. ANS: D PTS: 1 DIF: B OBJ: 11-6
NAT: C1 | C2 | F1
32. ANS: C PTS: 1 DIF: B OBJ: 11-4
NAT: C1 | C2
33. ANS: A PTS: 1 DIF: B OBJ: 11-4
NAT: C1 | C2
34. ANS: B PTS: 1 DIF: B OBJ: 11-4
NAT: C1 | C2
35. ANS: A PTS: 1 DIF: B OBJ: 11-4
NAT: C1 | C2
36. ANS: B PTS: 1 DIF: A OBJ: 11-4
NAT: C1 | C2
37. ANS: A PTS: 1 DIF: A OBJ: 11-3
NAT: C1 | C2
38. ANS: C PTS: 1 DIF: A OBJ: 11-4
NAT: C1 | C2

39. ANS: B PTS: 1 DIF: B OBJ: 11-5
NAT: C1 | C2 | F1
40. ANS: A PTS: 1 DIF: A OBJ: 11-5
NAT: C1 | C2 | F1
41. ANS: B PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
42. ANS: D PTS: 1 DIF: B OBJ: 11-1
NAT: C2 | C5 | G1
43. ANS: A PTS: 1 DIF: A OBJ: 11-1
NAT: C2 | C5 | G1
44. ANS: B PTS: 1 DIF: B OBJ: 11-6
NAT: C1 | C2 | F1
45. ANS: C PTS: 1 DIF: A OBJ: 11-7

COMPLETION

46. ANS: Adenine (A), nitrogen bases

PTS: 1
47. ANS: cytosine (C)

PTS: 1
48. ANS: nucleotides

PTS: 1
49. ANS: replication

PTS: 1
50. ANS: double helix

PTS: 1
51. ANS: amino acids

PTS: 1
52. ANS: amino acids

PTS: 1
53. ANS: proteins

PTS: 1
54. ANS: codon

PTS: 1
55. ANS: threonine

PTS: 1
56. ANS: UUU, UUC

PTS: 1

57. ANS: codon

PTS: 1
58. ANS: amino acid

PTS: 1
59. ANS: amino acid

PTS: 1
60. ANS: Tryptophan, methionine

PTS: 1
61. ANS: nucleus

PTS: 1
62. ANS: transcription

PTS: 1
63. ANS: replication

PTS: 1
64. ANS: Messenger RNA

PTS: 1
65. ANS: ribosomes

PTS: 1
66. ANS: double helix

PTS: 1 DIF: B OBJ: 11-1 NAT: C2 | C5 | G1
67. ANS: chromosomal mutation

PTS: 1 DIF: B OBJ: 11-5 NAT: C1 | C2 | F1
68. ANS: translation

PTS: 1 DIF: B OBJ: 11-4 NAT: C1 | C2
69. ANS: frameshift mutation

PTS: 1 DIF: B OBJ: 11-5 NAT: C1 | C2 | F1
70. ANS: point mutation

PTS: 1 DIF: B OBJ: 11-5 NAT: C1 | C2 | F1
71. ANS: tRNA

PTS: 1 DIF: B OBJ: 11-4 NAT: C1 | C2
72. ANS: codon

PTS: 1 DIF: B OBJ: 11-3 NAT: C1 | C2
73. ANS: replication

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

74. ANS: nitrogen bases

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

75. ANS: double helix

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

76. ANS: frameshift mutation

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

77. ANS: mRNA

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

78. ANS: messenger RNA

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

79. ANS: single stranded

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

80. ANS: cytosine

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

SHORT ANSWER

81. 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

82. 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

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

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

84. 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.

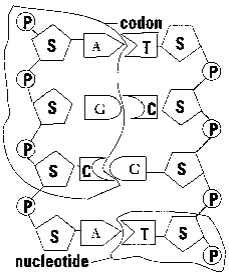
PTS: 1 DIF: A OBJ: 11-4 NAT: C1 | C2

85. 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

PROBLEM

86. ANS:
See Solution 11-1.



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