

Chapter 1: Nucleic Acids and Proteins

Multiple Choice

1. DNA contains deoxyribonucleotide triphosphates joined together by what type of covalent bond?

- A. Aldehyde
- B. Ester
- C. Phosphodiester
- D. Peptide

ANS: C
OBJ: 1-2

2. Nucleotides in DNA consist of which of the following?

- A. Nitrogen base, deoxyribose, and phosphate
- B. Nitrogen base, ribose, and sulfur
- C. Carbon base, ribose, and phosphate
- D. Carbon base, glucose, and carboxyl

ANS: A
OBJ: 1-1

3. Which of the five ribose carbons of the deoxyribonucleotide are involved in the formation of the DNA chain?

- A. 1' and 5'
- B. 2' and 4'
- C. 3' and 4'
- D. 3' and 5'

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ANS: D
OBJ: 1-23

4. In a DNA molecule, one end has a free hydroxyl group, and one end has a free
- A. phosphate group.
 - B. hydroxyl group.
 - C. amino group.
 - D. carboxyl group.

ANS: A
OBJ: 1-1

5. What type of bonds spontaneously form between two complementary strands of DNA?
- A. Hydrogen bonds
 - B. Covalent bonds
 - C. Phosphodiester bonds
 - D. Polar covalent bonds

ANS: C
OBJ: 1-2

6. In a double-stranded DNA molecule, base pairing between strands occurs between
- A. a purine and a purine.
 - B. a pyrimidine and a pyrimidine.
 - C. a purine and a pyrimidine.
 - D. all types of nucleotide bases.

ANS: C
OBJ: 1-1

7. Which of the following is a purine?
- A. Thymine
 - B. Cytosine
 - C. Adenine
 - D. Alanine

ANS: C

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OBJ: 1-1

8. Which DNA sequence is complementary to 5'GATTCTCAAAGGACT3'?

- A. 5'GATTCTCAAAGGACT3'
- B. 3'GATTCTCAAAGGACT5'
- C. 3'CTAAGAGTTTCCTGA5'
- D. 5'CTAAGAGTTTCCTGA3'

ANS: C
OBJ: 1-7

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9. The term used to describe the arrangement of the individual strands in the double-stranded DNA molecule is

- A. parallel.
- B. antiparallel.
- C. tangential.
- D. divergent.

ANS: B
OBJ: 1-7

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10. The process of separating the two DNA strands into two single strands is called

- A. denaturation.
- B. bidirectional.
- C. depolymerization.
- D. synthesis.

ANS: A
OBJ: 1-2

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11. DNA replication is
- A. conservative.
 - B. semiconservative.
 - C. nonconservative.
 - D. dispersive.

ANS: B
OBJ: 1-3

12. DNA replication requires the presence of
- A. DNA template.
 - B. ribosomes.
 - C. amino acids.
 - D. messenger RNA.

ANS: A
OBJ: 1-3

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13. DNA replication of the leading strand proceeds with the new daughter strand synthesized in which orientation?
- A. 5' to 3'.
 - B. 3' to 5'.
 - C. Discontinuously.
 - D. Either 5' to 3' or 3' to 5'.

ANS: A
OBJ: 1-7

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14. In DNA replication, the leading strand is copied in which direction?
- A. Reading goes 5' to 3'.
 - B. Reading goes 3' to 5'.
 - C. Both strands are leading.
 - D. Reading proceeds from the -OP to the -OH end.

ANS: B
OBJ: 1-7

15. The lagging DNA strand is synthesized discontinuously, producing
- A. Kornberg fragments.
 - B. Southern fragments.
 - C. Okazaki fragments.
 - D. Klenow fragments.

ANS: C
OBJ: 1-3

16. Which of the following accounts for maintenance of DNA sequence information?
- A. RNA primase
 - B. Deoxynucleotide structure
 - C. Semiconservative replication
 - D. DNA polymerase activity

ANS: C
OBJ: 1-3

17. In DNA synthesis, where does replication begin and end?
- A. Origin of replication; end of the molecule
 - B. Promoter; termination site
 - C. Start codon; stop codon
 - D. Start codon; termination site

ANS: A
OBJ: 1-3

18. Which of the following enzymes will untangle DNA?
- A. Polymerase
 - B. Helicase
 - C. Kinase
 - D. Phosphatase

ANS: B
OBJ: 1-8

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19. Restriction endonucleases are enzymes that are produced by bacteria and

- A. degrade viral proteins.
- B. digest DNA.
- C. have no laboratory applications.
- D. degrade lipids.

ANS: B
OBJ: 1-8

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20. Enzymes that recognize palindromic sequences of DNA, that are cut within the recognition sequence, that do not have methylating activity, and that are used frequently in the laboratory are which type of restriction enzymes?

- A. Type I
- B. Type II
- C. Type III
- D. Type IV

ANS: B
OBJ: 1-8

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21. Which of the following is a type II restriction enzyme recognition site?

- A. GAATTC
- B. GAATTG
- C. GAAAAG
- D. GATCAG

ANS: A
OBJ: 1-8

22. An exonuclease will catalyze what type of reaction?

- A. Polymerization of nucleotides into long strands
- B. Separation of complementary DNA strands
- C. Dissociation of phosphodiester bonds at the ends of DNA molecules
- D. Formation of circular DNA molecules from linear ones

ANS: C
OBJ: 1-8

23. What reactions are catalyzed by DNA methyltransferase?

- A. Addition of methyl groups to nitrogen bases
- B. Addition of methyl groups to ribose sugars
- C. Addition of methyl groups to proteins
- D. Removal of methyl groups from DNA

ANS: A

OBJ: 1-8

24. The purpose of ligase is to

- A. synthesize DNA.
- B. cut DNA within the double helix.
- C. chew DNA from the ends.
- D. paste two ends of DNA together.

ANS: D

OBJ: 1-8

25. What is the fertility factor (F) observed by Hayes and Lederberg?

- A. A chemical that encourages bacterial mating
- B. A virus
- C. A plasmid
- D. A polysaccharide on the cell surface

ANS: C

OBJ: 1-10

26. Avery, MacLeod, and McCarty identified the nature of Griffith's transforming factor in an experiment where it was destroyed by what treatment?

- A. Protease
- B. Ribonuclease
- C. Deoxyribonuclease
- D. Heating

ANS: C

OBJ: 1-10

27. The movement of DNA from one bacterium to another through the activity of bacteriophages is called

- A. conjugation.
- B. transformation.
- C. transduction.
- D. crossing over.

ANS: C
OBJ: 1-10

28. In sexual recombination, new combinations of genes are created by which of the following processes?

- A. Transduction
- B. Crossing over
- C. Conjugation
- D. Transformation

ANS: B
OBJ: 1-11

29. Which of the following promote resistance to common antibiotics?

- A. Helicases
- B. R factors
- C. Endonucleases
- D. Methylases

ANS: B
OBJ: 1-10

30. Recombination between a plasmid and the cell chromosome will result in

- A. rapid degradation of the chromosome.
- B. death of the cell.
- C. immediate cellular replication.
- D. integration of plasmid genes.

ANS: D
OBJ: 1-11

31. When an RNA molecule folds, adenine always base pairs with
A. thymine.
B. cytosine.
C. uracil.
D. guanine.

ANS: C
OBJ: 1-5

32. RNA and DNA are structurally similar because they both
A. have ribose as their sugar moiety.
B. consist of a single strand that folds on itself.
C. consist of two complementary strands.
D. are polymers of four different nucleotide bases.

ANS: D
OBJ: 1-4

33. RNA is degraded by
A. helicases.
B. polymerases.
C. ribonucleases.
D. methylases.

ANS: C
OBJ: 1-8

34. The large ribosome subunit in prokaryotes consists of ribosomal proteins and
A. 16S rRNA.
B. 18S rRNA.
C. 23S rRNA and 5S rRNA.
D. 28S rRNA, 5S rRNA, and 5.8S rRNA.

ANS: C
OBJ: 1-5

35. Messenger RNA is different from other types of RNA because messenger RNA has

- A. a 3' polyA tail.
- B. introns and exons.
- C. a 3' methylated cap.
- D. a cruciform structure.

ANS: A
OBJ: 1-5

36. Synthesis of RNA guided by a DNA template is

- A. translation.
- B. DNA replication.
- C. transcription.
- D. reverse transcription.

ANS: C
OBJ: 1-4

37. Synthesis of DNA guided by an RNA template is

- A. translation.
- B. DNA replication.
- C. transcription.
- D. reverse transcription.

ANS: D
OBJ: 1-4

38. In transcription, what is the starting material, what is the ending material, and what is the major enzyme that catalyzes the process?

- A. DNA; RNA; DNA polymerase
- B. RNA; protein; peptidyl transferase
- C. RNA; DNA; reverse transcriptase
- D. DNA; RNA; RNA polymerase

ANS: D
OBJ: 1-4

39. If the following oligonucleotide of double-stranded DNA was transcribed, what would be the sequence of the RNA?

5'TGCTAGCTA3'

3'ACGATCGAT5'

A. 5'UGCUAGCUA3'

B. 5'ACGAUCGAU3'

C. 3'ACGATCGAT5'

D. 3'ACGAUCGAU5'

ANS: A

OBJ: 1-4

40. Which of the following enzymes performs transcription in bacteria?

A. RNA-dependent DNA polymerase

B. DNA-dependent RNA polymerase

C. DNA-dependent DNA polymerase

D. RNA-dependent RNA polymerase

ANS: B

OBJ: 1-4

41. The RNA polymerase holoenzyme consists of which of the following?

A. α 2, β , β'

B. α 2, β , β' , σ

C. α , α' , β , β'

D. α 2, β , β' , ρ

ANS: B

OBJ: 1-4

42. Which component of RNA polymerase is responsible for initiating transcription at the correct site?

A. α

B. β

C. β'

D. ρ

E. σ

ANS: E

OBJ: 1-4

43. Which of the following is required for termination of transcription in bacteria?

- A. DNA polymerase
- B. Sigma
- C. Rho
- D. PolyA signal

ANS: B

OBJ: 1-4

44. Which of the following is required for termination of transcription in eukaryotes?

- A. RNA polymerase
- B. Sigma
- C. Rho
- D. PolyA signal

ANS: B

OBJ: 1-4

45. Which of the following types of RNA is directly involved in removing introns from RNA in eukaryotes?

- A. Micro
- B. Transfer
- C. Small nuclear
- D. Small interfering

ANS: C

OBJ 1-9

46. What is the secondary structure of transfer RNA?

- A. Cruciform or inverted L
- B. Hairpin
- C. Triple helix or triplex
- D. Ring or inverted C

ANS: A

OBJ: 1-5

47. The loop of transfer RNA that interacts with the codon on mRNA in translation is called the
- A. D loop.
 - B. T ψ C loop.
 - C. variable loop.
 - D. anticodon loop.

ANS: D
OBJ: 1-5

48. A mechanism of intron removal results in which by-product?
- A. Dinucleotides
 - B. PolyA tails
 - C. Lariats
 - D. Okazaki fragments

ANS: C
OBJ: 1-9

49. Capping of RNA involves which type of connection?
- A. 3'RNA-5' cap
 - B. 5'RNA-3' cap
 - C. 5'RNA-5' cap
 - D. 3'RNA-3' cap

ANS: C
OBJ: 1-9

50. Thalassemias arise from changes in what part of the beta-globin gene?
- A. 3' untranslated region
 - B. PolyA tail
 - C. Splice-recognition site
 - D. Ribosome-binding site

ANS: C
OBJ: 1-9

51. Which of the following describes the general structure of an amino acid?
- A. Planar carbon-nitrogen ring with deoxyribose sugar
 - B. Pentose sugar bound to phosphate and purine or pyrimidine base
 - C. Central carbon with carboxyl group, amino group, hydrogen, and a side chain
 - D. Polymer of molecules bound together by a peptide bond

ANS: C
OBJ: 1-12

52. The chemical nature of alanine, leucine, phenylalanine, and tryptophan is described as
- A. polar.
 - B. acidic.
 - C. basic.
 - D. nonpolar.

ANS: D
OBJ: 1-12

53. Which of the following amino acids has a nonpolar R group?
- A. Valine
 - B. Cysteine
 - C. Arginine
 - D. Tyrosine

ANS: A
OBJ: 1-12

54. At physiological pH, amino acids are
- A. anions.
 - B. cations.
 - C. neutral.
 - D. zwitterions.

ANS: D
OBJ: 1-12

55. What chemical group is found at the beginning of peptide chains?

- A. Carboxyl
- B. Hydroxyl
- C. Phosphate
- D. Amine

ANS: D

OBJ: 1-13

56. What chemical group is found at the end of peptide chains?

- A. Carboxyl
- B. Hydroxyl
- C. Phosphate
- D. Amine

ANS: A

OBJ: 1-13

57. The sequence of amino acids in a protein constitutes which level of protein structure?

- A. Primary
- B. Secondary
- C. Tertiary
- D. Quaternary

ANS: A

OBJ: 1-13

58. Alpha helices and beta-pleated sheets are what level of protein structure?

- A. Primary
- B. Secondary
- C. Tertiary
- D. Quaternary

ANS: B

OBJ: 1-13

59. A protein that has lost its tertiary structure is called
A. a zwitterion.
B. a zinc finger.
C. denatured.
D. depolymerized.

ANS: C
OBJ: 1-13

60. Protein structure characterized by the combination of different proteins that are required all together for protein function is which level of protein structure?
A. Primary
B. Secondary
C. Tertiary
D. Quaternary

ANS: D
OBJ: 1-13

61. Denaturation of a protein results in what effect?
A. Activation of protein activity
B. Loss of tertiary structure and protein function
C. None
D. Alteration of the amino acid sequence

ANS: B
OBJ: 1-13

62. The fundamental physical and functional unit of inheritance that encodes a functional product is a
A. gene.
B. protein.
C. nucleotide.
D. nucleic acid.

ANS: A
OBJ: 1-14

63. A codon consists of a sequence of how many nucleotides?

- A. One
- B. Two
- C. Three
- D. Four

ANS: C

OBJ: 1-16

64. In translation, what is the starting material, what is the ending material, and what is the major enzyme that catalyzes the process?

- A. DNA; RNA; DNA polymerase
- B. RNA; protein; peptidyl transferase
- C. RNA; DNA; reverse transcriptase
- D. DNA; RNA; RNA polymerase

ANS: B

OBJ: 1-16

65. In early experiments, a polymer of uracil, UUUUUUUU..., translated into a peptide composed of only phenylalanine amino acids. What did this observation demonstrate?

- A. That uracil is not a functional nucleotide
- B. UUU codes of phenylalanine
- C. That RNA cannot be faithfully translated in vitro
- D. That no other amino acid codon contains uracil

ANS: B

OBJ: 1-15

66. The process of protein synthesis is also called

- A. translation.
- B. transcription.
- C. transduction.
- D. transformation.

ANS: A

OBJ: 1-16

67. The set of nucleotides in mRNA that encodes for an amino acid is called a(n)
A. codon.
B. gene.
C. anticodon.
D. chromosome.

ANS: B
OBJ: 1-16

68. All but two amino acids are encoded by more than one codon, thus making the genetic code
A. flexible.
B. adaptable.
C. redundant.
D. denatured.

ANS: C
OBJ: 1-15

69. The codons that do not code for an amino acid and terminate protein synthesis are what kind of codons?
A. Wobble
B. Initiation
C. Nonsense
D. Anticodon

ANS: C
OBJ: 1-15

70. What enzyme is important for faithful translation of genetic information from RNA to protein?
A. DNA polymerase
B. Amino-acyl tRNA synthetase
C. DNA ligase
D. Exonuclease

ANS: B
OBJ: 1-16

71. Given the following sequence of mRNA, what is the corresponding amino acid sequence?

5'AUGCAUAACUCUGCU3'

- A. MCITL
- B. MHASA
- C. MQRRV
- D. MHNSA

ANS: D

OBJ: 1-15

72. The start codon for the synthesis of most proteins is

- A. ACC.
- B. UGA.
- C. AUG.
- D. UAA.

ANS: C

OBJ: 1-15

73. The enzyme that bonds two amino acids together in protein synthesis is

- A. peptidyl transferase.
- B. protein synthetase.
- C. amino acid polymerase.
- D. aminoacyl tRNA synthetase.

ANS: A

OBJ: 1-16

74. What amino acid is used to initiate most proteins in eukaryotes?

- A. Methionine
- B. Alanine
- C. Proline
- D. Aminoacyl tRNA synthetase

ANS: A

OBJ: 1-16

75. A glycoprotein contains _____ attached after translation.

- A. extra amino acids
- B. sugar moieties
- C. lipids
- D. metal ions

ANS: B

OBJ: 1-17

76. Specialized proteins that bind to the large ribosomal subunit and protect the hydrophobic regions of growing polypeptides are called

- A. aminoacyl tRNA synthetases.
- B. molecular chaperones.
- C. metalloproteins.
- D. peptidyl transferases.

ANS: B

OBJ: 1-17

77. In the ribosome, the growing peptide moves from site to site in what direction?

- A. A to E to P
- B. P to A to E
- C. E to P to A
- D. A to P to E

ANS: D

OBJ: 1-16

78. Hydrolysis of the finished polypeptide from the final tRNA by release factors would occur at which of the following codons?

- A. AUG
- B. GUG
- C. ACC
- D. UGA

ANS: D

OBJ: 1-16

79. Endoplasmic reticulum (ER) stress stops protein synthesis in response to what?
- A. Unfolded proteins
 - B. Cell division
 - C. Amino acids
 - D. Degraded RNA

ANS: A
OBJ: 1-16

80. An amino acid sequence containing several L residues separated by six other residues has what type of domain?
- A. Zinc finger
 - B. Leucine zipper
 - C. Branching
 - D. Beta sheet

ANS: B
OBJ: 1-17