Test Bank for Biochemistry 8th Edition by Berg Tymoczko Gatto and Stryer ISBN 1464126100 9781464126109

Chapter 2 Protein Composition and Structure

1) Which of the following is most often found in proteins?

A) D-amino acids
B) L-amino acids
C) an equal amount of D- and L-amino acids
D) amino acids with the α-carbon exclusively having an R absolute configuration
E) amino acids with the α-carbon exclusively having an S absolute configuration

Answer: B
Section: 2.1

2) A term that describes a molecule that contains both positive and negative charges but overall has a neutral charge is_____.

A) enantiomer
B) amino acid
C) racemate
D) zwitterion
E) amphipath

Answer: D
Section: 2.1

3) Which amino acid forms disulfide bonds?

A) histidine
B) methionine

C) proline
D) serine
E) cysteine

Answer: E
Section: 2.1

4) Which of the following amino acids has an ionizable R-group with a pK_a near neutral pH?

A) histidine
B) serine
C) aspartic acid
D) lysine
E) tyrosine

Answer: A
Section: 2.1

5) Formation of a peptide bond produces_____as a byproduct.

A) ammonia
B) carbon dioxide
C) water
D) H^+
E) OH^-

Answer: C
Section: 2.2

6) What type of plot allows one to investigate the likely phi and psi angles of the peptide backbone?

A) Hill
B) Lineweaver-Burk
C) Hanes-Woolf
D) Ramachandran
E) Michaelis-Menten

Answer: D
Section: 2.2

7) What level of protein structure is composed of α helices, β sheets, and turns?

A) primary
B) secondary
C) tertiary
D) quaternary
E) both secondary and tertiary

Answer: B
Section: 2.3

8) The overall three-dimensional structure of a single polypeptide is referred to as_____.

A) primary structure
B) secondary structure
C) tertiary structure
D) quaternary structure
E) both secondary structure and tertiary structure

Answer: C
Section: 2.4

Fill-in-the-Blank Questions

9) _____is a fibrous protein and is the primary component of wool and hair.
Ans: α-Keratin Section: 2.3

10) Every third residue in the protein collagen is_____.
Ans: glycine Section: 2.3

11) Disulfide bonds in proteins can be reduced to free sulfhydryl groups by reagents such as _____.
Ans: β-mercaptoethanol Section: 2.6

12) A protein is considered to be_____when it is converted into a randomly coiled structure without its normal activity.
Ans: denatured Section: 2.6

13) _____is the major fibrous protein present in skin, bone, tendon, cartilage, and teeth.
Ans: Collagen Section: 2.3

14) Collagen contains_____, a modified amino acid.
Ans: hydroxyproline Section: 2.3

15) Agents such as_____and guanidinium chloride denature proteins by disrupting the noncovalent interactions.
Ans: urea Section: 2.6

16) _____refers to the spatial arrangement of subunits and the nature of their interactions.
Ans: Quaternary structure Section: 2.5

17) The_____β-sheet structure occurs when the two strands are oriented in the same directions (N → C).
Ans: parallel Section: 2.3

Multiple-Choice Questions

18) Which of the following is a function of proteins?

A) energy carrying molecules
B) catalysts
C) storage of genetic information
D) None of the answers is correct.
E) All of the answers are correct.

Ans: B
Section: Introduction

19) Key properties of proteins include

A) a wide range of functional groups.
B) an ability to possess either rigid or flexible structures as dictated by functional requirements.
C) the ability to interact with other proteins.

D) All of the answers are correct.
E) a wide range of functional groups and an ability to possess either rigid or flexible structures as dictated by functional requirements.

Ans: D
Section: Introduction

20) What is the charged group(s) present in glycine at a pH of 7?

A) $-NH_3^+$
B) $-COO^-$
C) $-NH_2^+$
D) $-NH_3^+$ and $-COO^-$
E) All the charged groups are present.

Ans: D
Section: 2.1

21) At a pH of 12, what is the charged group(s) present in glycine?

A) $-NH_3^+$
B) $-COO^-$
C) $-NH_2^+$
D) $-NH_3^+$ and $-COO^-$
E) All the charged groups are present.

Ans: B
Section: 2.1

22) What do the amino acids Tyr, Asn, and Thr have in common?

A) aromatic rings
B) negatively charged at pH 7.0
C) positively charged at pH 7.0
D) double bonds in side chains
E) polar

Ans: E
Section 2.1

23) Which two amino acids contain a sulfur atom?

A) serine and methionine
B) serine and threonine
C) methionine and threonine
D) cysteine and methionine
E) cysteine and threonine

Ans: D
Section: 2.1

24) Which of the following pairs of amino acids is positively charged at a neutral pH?

A) Lys, Arg
B) Tyr, Arg
C) Cys, Met
D) Leu, Pro
E) Asp, Glu

Ans: A
Section: 2.1

25) In the following peptide, which amino acid is the N-terminus?
Phe-Ala-Gly-Arg

A) Phe
B) Ala
C) Gly
D) Arg
E) Phe and Arg

Ans: A
Section: 2.2

26) What is the approximate mass of a protein containing 200 amino acids? (Assume there are no other protein modifications.)

A) 2,000
B) 11,000
C) 22,000
D) 222,000
E) None of the answers is correct.

Ans: C
Section: 2.2

27) Which individual won a Nobel Prize for his (her) landmark work in sequencing the protein insulin?

A) Pauling
B) McClintock
C) Gilbert
D) Maxam
E) Sanger

Ans: E
Section: 2.2

28) Why is the peptide bond planar?

A) Bulky side chains prevent free rotation around the bond.
B) It contains partial double-bond character, preventing rotation.
C) Hydrogen bonding between the NH and C=O groups limits movement.
D) All of the answers are correct.
E) None of the answers is correct.

Ans: B
Section: 2.2

29) The configuration of most peptide bonds in a protein is_____.

A) cis
B) circular
C) parallel
D) trans
E) perpendicular

Ans: D
Section: 2.2

30) What structure(s) did Pauling and Corey predict in 1951?

A) α helix
B) β sheet
C) β turns
D) Pauling and Corey predicted all three of these structures.
E) α helix and β sheet

Ans: E
Section: 2.4

31) The term "quaternary" with respect to protein structure means

A) a repeating structure stabilized by intrachain hydrogen bonds.
B) the ability to form all four kinds of noncovalent bonds.
C) a multisubunit structure.
D) a linear sequence of four amino acids.
E) None of the answers is correct.

Ans: C
Section: 2.5

32) Where are Ω and β turns and loops often found?

A) in a hydrophobic pocket
B) on the interior cleft
C) at the protein interface with ligand
D) on the surface of proteins

E) None of the answers is correct.

Ans: D
Section: 2.3

33) What are some of the modifications that proteins acquire?

A) cleavage and trimming of the protein
B) addition of carbohydrate groups
C) phosphorylation of certain groups
D) All of these are modifications proteins acquire.
E) addition of carbohydrate groups and phosphorylation of certain groups

Ans: D
Section: 2.6

34) Which of the following amino acid residues would most likely be buried in the interior of a water-soluble, globular protein?

A) Asp
B) Ser
C) Phe
D) Lys
E) Gln

Ans: C
Section 2.5

Short-Answer Questions

35) How does a protein's amino acid sequence influence the tertiary structure?
Ans: A protein will spontaneously fold into a three-dimensional structure determined by the amino acid sequence.
Section: Introduction

36) What is the advantage of having 20 different amino acids available to form proteins?

Ans: The amino acids provide a rich diversity of functional groups, which can independently contribute to protein structure and function. In addition, many can be modified, increasing the diversity of functional groups.
Section: Introduction

37) What is the advantage of protein interaction and assembly with other proteins?
Ans: When proteins interact or assemble, new functions and specificity become available. Protein interactions allow new binding sites at the assembly interface, as well as providing multifunctional activity and specificity, such as found in polymerases and signal transduction.
Section: Introduction

38) What are the three aromatic amino acids?
Ans: phenylalanine, tyrosine, and tryptophan
Section: 2.1

39) Which amino acid side chains are capable of ionization?
Ans: The amino acids are Asp, Glu, His, Cys, Tyr, Lys, and Arg.
Section: 2.1

40) How does the protein backbone add to structural stability?
Ans: The protein backbone contains the peptide bond, which is an amide containing an NH group and a C=O (carbonyl) group. Peptide bonds are kinetically stable once formed, having very low rates of hydrolysis. Hydrogen-bond formation between the hydrogen on the nitrogen and the oxygen from other carbonyls in either alpha helices or in beta sheets support the protein conformation.
Section: 2.2

41) Why are all the theoretical combinations of phi and psi not possible?
Ans: Steric hindrances of the side chains make certain combinations and angles impossible.
Section: 2.2

42) Describe some of the features of an α helix.
Ans: The α helix is a coil stabilized by intrachain hydrogen bonds between the carbonyl oxygen of a residue and the amide hydrogen of the fourth residue away. There are 3.6 amino acids per turn. The hydrogen bonds are between amino acid residues that have three intervening residues. Thus, these amino acid residues are found on the same side of the coil. The helix is almost always right-handed, although left-handed helices are, in theory, possible.
Section: 2.3

43) What is the “hydrophobic effect” as it relates to protein structure?

Ans: The three-dimensional structure of a water-soluble protein is stabilized by the tendency of hydrophobic groups to assemble in the interior of the molecule.
Section: 2.1

44) α-Keratin is referred to as a coiled-coil protein. Describe the protein structure of α-keratin.
Ans: Two α helices entwined to form a very stable double helix of approximately 100 nm in length.
Section: 2.3

45) What are prions?
Ans: Prions are proteins that can assume (after infection or by other causes) a new protein structure, which is self-propagating. Mammalian prion diseases are fatal.
Section: 2.6

46) What does the modification involving the attachment of acetyl groups to the amino termini of proteins do?
Ans: The acetylation of the amino termini of proteins makes these proteins more resistant to degradation.
Section: 2.6

47) In the ribonuclease experiments performed by Anfinsen, what was the significance of the presence of the reducing agent β-mercaptoethanol?
Ans: The reducing agent reduced incorrectly paired disulfide bonds, allowing them to reform with the correct pairing until the most stable conformation of the protein had been obtained.
Section: 2.6

48) What is the advantage of having certain areas of partially correct folded regions?
Ans: If some regions interact preferentially, lending stability to certain conformations as the protein folds, they can impact the overall structure of the protein.
Section: 2.6