Name:_____ Class:_____ Date:_____

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Multiple Choice

1. What is NOT a key property that enable proteins to participate in a wide range of functions?
   a. Proteins have a high molecular weight.
   b. Proteins contain different functional groups.
   c. Some proteins are quite rigid, whereas others display considerable flexibility.
   d. Proteins are linear polymers built of different amino acids.
   e. Proteins can interact with one another and with other biological macromolecules to form complex assemblies.

ANSWER: a

2. What does an α-amino acid consist of?
   a. carbonyl group, α carbon, amino group, oxygen atom, distinctive R group
   b. carboxylic acid group, α carbon, amino group, hydrogen atom, distinctive R group
   c. carboxylic acid group, ε carbon, nitro group, hydrogen atom
   d. alcohol group, α carbon, amino group, nitrogen atom, distinctive R group, hydrogen atom
   e. carboxylic acid group, δ carbon, imine radical, hydrogen atom, distinctive R group

ANSWER: b

3. What isomers of amino acids are found in proteins and what absolute configuration do they have?
   a. L isomer; R absolute configuration
   b. D and L isomers; R absolute configuration
   c. L isomer; S absolute configuration
   d. D isomer; S absolute configuration
   e. L and D isomers; S absolute configuration

ANSWER: c

4. In an acidic solution (pH = 1), what is the ionization state of an amino acid?
   a. The amino group is deprotonated; the carboxyl group is protonated.
   b. The amino group is not dissociated; the carboxyl group is not dissociated.
   c. The amino group is protonated; the carboxyl group is deprotonated.
   d. The amino group is protonated; the carboxyl group is not dissociated.
   e. The amino group is deprotonated; the carboxyl group is not dissociated.

ANSWER: d

5. Choose the correct groups for Thr, Lys, His, Met, respectively, on the basis of general chemical characteristics.
   a. polar but uncharged; negatively charged; positively charged; hydrophobic
   b. polar but uncharged; positively charged; positively charged; hydrophobic
   c. positively charged; hydrophobic; polar but not charged; positively charged
   d. negatively charged; hydrophobic; positively charged; polar but not charged

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e. positively charged; positively charged; polar but not charged; negatively charged

ANSWER: b

6. Which amino acid has the one-letter abbreviation K?

a. histidine
b. asparagine
c. alanine
d. valine
e. lysine

ANSWER: e

7. Choose the statement that does NOT reflect why a particular set of 20 amino acids becomes the building block of proteins.

a. Other possible amino acids may have simply been too reactive.
b. The rings in their cyclic forms are too big.
c. They provide proteins with the versatility to assume many functional roles.
d. Many of these amino acids were probably available from prebiotic reactions.
e. As a set, they are diverse.

ANSWER: b

8. The amide bond is a linkage between the:

a. β-amino group of one amino acid and the α-amino group of another amino acid.
b. β-carboxyl group of one amino acid and the β-amino group of another amino acid.
c. δ-carboxyl group of one amino acid and the α-carboxyl group of another amino acid.
d. α-amino group of one amino acid and the ε-amino group of another amino acid.
e. α-carboxyl group of one amino acid and the α-amino group of another amino acid.

ANSWER: e

9. What is the amino-terminal residue and what is the carboxyl-terminal residue in the sequence of amino acids Gly-Tyr-Gly-Phe-Leu?

a. Leucine is N-terminal and glycine is C-terminal.
b. Glycine is N-terminal and leucine is C-terminal.
c. Tyrosine is N-terminal and leucine is C-terminal.
d. Phenylalanine is N-terminal and leucine is C-terminal.
e. There are no N-terminal and C-terminal residues in the sequences of amino acids.

ANSWER: b

10. Oligopeptide is a polypeptide chain made of:

a. numerous amino acids.
b. amino acids with a low molecular weight.
c. positively charged amino acids.

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d. small numbers of amino acids.

e. negatively charged amino acids.

ANSWER: d

11. A protein with a molecular weight of 75 550 g mol^{-1} has a mass of:

a. 75,550 Da or 755.5 kDa.

b. 7555 Da or 75.55 kDa.

c. 75,550 Da or 75.55 kDa.

d. 755,500 Da or 7.555 kDa.

e. 7,555,000 Da or 75550 kDa.

ANSWER: c

12. Knowledge of the amino acid sequences is important for several reasons. What is NOT one of those reasons?

a. Amino acid sequences determine the three-dimensional structures of proteins.

b. The sequence of a protein reveals much about its evolutionary history.

c. Knowledge of the sequence of a protein can help to prevent mutations.

d. Changes in the amino acid sequence can lead to abnormal protein functioning and disease.

e. The sequence of a protein is necessary to determine its function.

ANSWER: c

13. Choose atoms that lie in a plane in a pair of linked amino acids.

a. $C_{\alpha 3}$, C, O, N, $C_{\alpha 2}$

b. C_{α}, C, N, H, $C_{\alpha 2}$

c. C_{α}, C, O, N, H, $C_{\alpha 3}$

d. C_{α}, $C_{\alpha 2}$, $C_{\alpha 3}$, N, H, C

e. C_{α}, C, O, N, H, $C_{\alpha 2}$

ANSWER: e

14. Which statement CORRECTLY describe a peptide bond?

a. The C–N distance in a peptide bond is 1.49 Å; the peptide bond is positively charged.

b. The C–N distance in a peptide bond is 1.27 Å; the bond resonates between a single bond and a double bond; the peptide bond is negatively charged.

c. The C–N distance in a peptide bond is 1.32 Å; the bond resonates between a double bond and a triple bond; the peptide bond is a kind of dipole.

d. The C–N distance in a peptide bond is 1.35 Å; the bond resonates between a single bond and a triple bond; the peptide bond is a kind of dipole.

e. The C–N distance in a peptide bond is 1.30 Å; the bond resonates between a double bond and a triple bond; the peptide bond is positively charged.

ANSWER: c

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15. What is the configuration of peptide bonds in proteins?
    a. Almost all peptide bonds are in the *cis* configuration.
    b. Almost all peptide bonds are in the *trans* configuration.
    c. Half of all peptide bonds are in the *trans* configuration and the other half are in the *cis* configuration.
    d. Approximately one third are in the *trans* configuration and rest are in the *cis* configuration.
    e. Approximately one third are in the *cis* configuration and rest are in the *trans* configuration.

ANSWER: b

16. What is the name of the angle of rotation about the bond between the α carbon and the carbonyl carbon atoms?
    a. α
    b. δ
    c. ε
    d. ψ
    e. ϕ

ANSWER: d

17. An α helix is a coil stabilized by:
    a. intrachain hydrogen bonds between the carbonyl oxygen of a residue and the amide hydrogen of the fourth residue away.
    b. intrachain nitrogen bonds between the carbonyl nitrogen of a residue and the amide nitrogen of the second residue away.
    c. extrachain oxygen bonds between the carbonyl oxygen of a residue and the amide nitrogen of the fifth residue away.
    d. intrachain nitrogen bonds between the carbonyl nitrogen of a residue and the amide nitrogen of the sixth residue away.
    e. extrachain hydrogen bonds between the carbonyl hydrogen of a residue and the amide oxygen of the third residue away.

ANSWER: a

18. A β sheet is formed by linking two or more β strands lying next to one another through:
    a. nitrogen bonds.
    b. oxygen bonds.
    c. ionic bonds.
    d. disulfide bridges.
    e. hydrogen bonds.

ANSWER: e

19. What is the difference between β strands and loops?
    a. Loops do not have regular, periodic structures.
    b. Loops do not have hydrogen bonds.

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c. Loops have a greater molecular weight.
d. Loops do not have amino acid residues.
e. Loops do not have a three-dimensional structure.

ANSWER: a

20. What describes the direction in which a helical structure rotates with respect to its axis?
a. turn
b. translation
c. rise
d. screw sense
e. pitch

ANSWER: d

21. What muscle protein is composed of a single polypeptide chain of 153 amino acids and serves as the oxygen storage location?
a. keratin
b. hemoglobin
c. myoglobin
d. protoporphyrin
e. heme

ANSWER: c

22. What is the secondary structure of myoglobin's main chain?
a. about 70% β sheets and 30% turns and loops between helices
b. about 70% eight α helices and 30% turns and loops between helices
c. about 30% five α helices, 30% β sheets, and 40% turns and loops between helices
d. about 50% five α helices, 20% β sheets, and 30% turns and loops between helices
e. about 60% seven α helices and 40% turns and loops between helices

ANSWER: b

23. Why are all charged residues such as aspartate, glutamate, lysine, and arginine absent inside myoglobin?
a. They help molecules to go through the cytoplasmic membrane.
b. They play a critical role in regulatory activity.
c. They play critical roles in signaling.
d. They help to form the tertiary structure.
e. They play critical roles in binding of iron and oxygen.

ANSWER: d

24. Why are porins considered to be "inside out" relatives to proteins that function in aqueous solution?
a. Porins are positively charged while usual proteins are negatively charged.
b. Porins interact with the neighboring alkane chains while usual proteins interact with alkene chains.

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c. Porins function in outer membranes while usual proteins function in inner membranes.
d. Porins function only in bacteria while usual proteins function in all organisms.
e. Porins have a reverse distribution of hydrophobic and hydrophilic amino acids.

ANSWER: e

25. What is the term for the combination helix-turn-helix?
a. supersecondary structure
b. supertetriary structure
c. globular protein
d. domain
e. tertiary structure

ANSWER: a

26. How many domains does the extracellular part of CD4 comprise?
a. five similar domains of approximately 150 amino acids each
b. three different domains of approximately 150 amino acids each
c. four similar domains of approximately 100 amino acids each
d. two similar domains and two different domains of approximately 50 amino acids each
e. five similar domains and four different domains of approximately 70 amino acids each

ANSWER: c

27. What are the interactions that associate the two helices in α-keratin?
a. hydrogen bonds and electrostatic forces
b. van der Waals forces and covalent interactions
c. electrostatic forces and metallic bonds
d. van der Waals forces and ionic interactions
e. metallic bonds and van der Waals forces

ANSWER: d

28. Why are hair and wool flexible, unlike horns, claws, and hooves?
a. Hair and wool have fewer ionic bonds than horns, claws, and hooves do.
b. Hair and wool have fewer disulfide bond cross-links than horns, claws, and hooves do.
c. Hair and wool have fewer metallic bonds than horns, claws, and hooves do.
d. Hair and wool have fewer domains than horns, claws, and hooves do.
e. Hair and wool have more loops than horns, claws, and hooves do.

ANSWER: b

29. What is the simplest sort of quaternary structure?
a. a monomer
b. a dimer consisting of two different subunits
c. a dimer consisting of two identical subunits

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d. a trimer consisting of two identical subunits and one diverse subunit
e. a tetramer consisting of two identical subunits and diverse subunits

ANSWER: c

30. What is a structure of the hemoglobin molecule?
a. α_2 dimer
b. β_2 dimer
c. $\alpha_2\beta_1$ trimer
d. $\alpha_1\beta_2$ trimer
e. $\alpha_2\beta_2$ tetramer

ANSWER: e

31. What is the structure of the coat of human rhinovirus?
a. 50 copies of each of three subunits
b. 55 copies of each of five subunits
c. 70 copies of each of two subunits
d. 60 copies of each of four subunits
e. 100 copies of each of six subunits

ANSWER: d

32. What disrupts the noncovalent interactions in proteins?
a. guanidinium sulfide
b. β-mercaptoethanol
c. uric acid
d. urea
e. ammonia

ANSWER: d

33. What statement about prions is FALSE?
a. The infectious prions are aggregated forms of the PrP protein termed PrP^{SC}.
b. Prions cause scrapie in sheep.
c. Prions are proteins that can assume (after infection or by other causes) a new protein structure, which is self-propagating.
d. Mammalian prion diseases are fatal.
e. Prions are composed largely of a cellular protein called PrP, which is normally present in the liver.

ANSWER: e

34. The amino termini acetylation of proteins:
a. makes these proteins negatively charged.
b. makes these proteins more resistant to degradation.

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c. induces their conformation change.
d. makes these proteins hydrophobic.
e. makes these proteins less exposed to mutations.

ANSWER: b

35. In the ribonuclease experiments performed by Anfinsen, β-mercaptoethanol reduced:
a. all incorrectly paired bonds and stabilized the protein structure.
b. all bonds and destroyed the protein structure.
c. all charged residues, and the protein was unable to take part in signaling.
d. all bonds, and the unfolded protein molecules became tangled up with one another to form aggregates.
e. incorrectly paired disulfide bonds, allowing them to reform with the correct pairing until the most stable conformation of the protein had been obtained.

ANSWER: e

36. A protein has 400 residues. If each residue can assume four different conformations, the total number of different folded structures would be:
a. 3^{400}.
b. 400^{100}.
c. 4^{400}.
d. 400.
e. 1200.

ANSWER: c

37. What is the term for a molecule that contains both positive and negative charges but overall has a neutral charge?
a. enantiomer
b. amino acid
c. racemate
d. zwitterion
e. amphipath

ANSWER: d

38. Which amino acid forms disulfide bonds?
a. histidine
b. methionine
c. proline
d. serine
e. cysteine

ANSWER: e

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39. What amino acid 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

40. What plot type allows one to investigate the likely ϕ and ψ angles of the peptide backbone?
    a. Hill
    b. Lineweaver–Burk
    c. Hanes–Woolf
    d. Ramachandran
    e. Michaelis–Menten

ANSWER: d

41. What level of protein structure is composed of α helices, β sheets, and turns?
    a. primary
    b. secondary
    c. tertiary
    d. quaternary
    e. supersecondary

ANSWER: b

42. The overall three-dimensional structure of a single polypeptide is referred to as _____ structure.
    a. primary
    b. secondary
    c. tertiary
    d. quaternary
    e. supersecondary

ANSWER: c

43. At a pH of 12, what is the charged groups present in glycine?
    a. $–NH_3^+$
    b. $–COO^–$
    c. $–NH_2^+$
    d. $–NH^+$
    e. $–CO^–$

ANSWER: b

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44. The amino acids Tyr, Asn, and Thr:
    a. have aromatic rings.
    b. are negatively charged at pH = 7.0.
    c. are positively charged at pH = 7.0.
    d. have double bonds in side chains.
    e. are polar.

ANSWER: e

45. Which individual won a Nobel Prize for his or her landmark work in sequencing the protein insulin?
    a. Pauling
    b. McClintock
    c. Gilbert
    d. Maxam
    e. Sanger

ANSWER: e

46. What structures did Pauling and Corey predict in 1951?
    a. α helix, α sheet, and β turn
    b. α helix and α sheet
    c. α helix, β sheet, and β turn
    d. α turn and β sheet
    e. α helix and β sheet

ANSWER: e

47. The term *quaternary* with respect to protein structure stands for:
    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. the only four amino acids that can form hydrogen bonds.

ANSWER: c

48. What pair 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

ANSWER: a

49. What is NOT a modification acquired by proteins?

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a. cleavage and trimming of the protein
b. addition of carbohydrate groups
c. phosphorylation of certain groups
d. hydrolysis of all protein
e. addition of acetyl groups

ANSWER: d

50. What amino acid residue would MOST likely be buried in the interior of a water-soluble globular protein?
a. Asp
b. Ser
c. Phe
d. Lys
e. Gln

ANSWER: c