1. Amphiphilic or amphipathic molecules contain:
   A. charged groups
   B. hydrophobic groups
   C. two charged groups of opposite sign
   D. a weak acid and a weak base

2. When added to water, the amphiphilic molecule oleic acid forms:
   A. bilayers
   B. monolayers
   C. micelles
   D. all of the above
   E. none of the above

3. When phospholipids form bilayers in water:
   A. the negative enthalpy change due to the formation of induced dipoles between hydrocarbons is minimized.
   B. the positive enthalpy change due to the formation of induced dipoles between hydrocarbons is maximized.
   C. the negative entropy change due to the formation of ordered arrays of water molecules is maximized.
   D. the positive entropy change due to the formation of ordered arrays of water molecules is minimized.
   E. the positive entropy change due to the relaxation of ordered arrays of water molecules is maximized.

4. Which form of glycine (pK_{a1} = 2.3, pK_{a2} = 9.6) predominates at physiological pH?
   A. H₂NCH₂COOH
   B. H₃N⁺CH₂COOH
   C. H₃N⁺CH₂COO⁻
   D. H₂NCH₂COO⁻
   E. cannot be calculated from the information given.

5. Read this statement and chose the BEST answer. A common practice of 100m sprinters is to hyperventilate before a race. This raises the pH of the blood (respiratory alkalosis) by lowering the CO₂ sol allowing the HCO₃⁻ fraction of the HCO₃⁻/CO₂ buffer to more readily neutralize the lactic acid produced by muscles during the sprint.
   A. the statement is true.
   B. the statement is false because hyperventilation lowers the pCO₂ in the lungs leading to a lower blood pH.
   C. the statement is false because hyperventilation raises the pCO₂ in the lungs leading to respiratory acidosis.
   D. the statement is false because hyperventilation raises both the HCO₃⁻ and the pCO₂ component of the buffer system with not change in pH.
E. the statement is false because hyperventilation raises lowers both the HCO₃⁻ and the pCO₂ component of the buffer system with no change in pH.

6. The pH of a sample of blood is 7.4; the pH of a sample of gastric juice is 1.4. The gastric juice sample has:
A. 5.29 times [H+] of the blood sample
B. 6 times [H+] of the blood sample
C. 6 x 10³ times [H+] of the blood sample
D. 1 x 10⁶ times [H+] of the blood sample
E. 0.189 times [H+] of the blood sample

7. Buffer A has a pKₐ of 6.3 and buffer B has a pKₐ of 7.3. Which is the BEST choice to buffer a reaction producing ions at pH 6.8?
A. buffer A
B. buffer B
C. you don’t need to buffer reactions at physiological pH
D. both buffers would be equally effective for this reaction
E. Neither buffer would be effective for this reaction

8. Which two groups of an amino acid react to from a peptide bond?
A. the α-amino group and the side chain carboxyl group
B. the α-amino group and the α-carboxyl group
C. the α-carboxyl group and the side chain amine
D. the side chain amine and the side chain carboxyl group
E. none of the above

9. Understanding the unique characteristic behavior of amino acid side-chains is important because:
A. the chemical reactivity of some side-chains can be used to modify proteins in specific ways.
B. the chemical and physical properties of some side-chains allow detection and quantification.
C. the chemical and physical properties of side-chains bestow proteins with specific biological function.
D. A and C
E. A, B, and C.

10. Determining the amino acid sequence of a protein (its primary structure) involves both chemical and enzymatic strategies. A procedure for the cleavage of disulfide bonds is:
A. reaction with phenylisothiocyanate to from a PTH-derivative that is identified by chromatography.
B. specific hydrolysis with trypsin or other proteins
C. specific hydrolysis with cyanogen bromide (CNBr)
D. reduction with 2-mercaptopethanol and alkylation with iodoacetate
E. derivatization with urea.
11. Determining the amino acid sequence of a protein involves both chemical and enzymatic strategies. A procedure for determining the N-terminal amino acid is:
A. reaction with phenylisothiocyanate to form a PTH-derivative that is identified by chromatography.
B. specific hydrolysis with trypsin or other proteins
C. specific hydrolysis with cyanogen bromide (CNBr)
D. reduction with 2-mercaptoethanol and alkylation with iodoacetate
E. derivatization with urea.

12. Determining the amino acid sequence of a protein involves both chemical and enzymatic strategies. A chemical procedure for specifically cleaving next to methionine is:
A. reaction with phenylisothiocyanate to form a PTH-derivative that is identified by chromatography.
B. specific hydrolysis with trypsin or other proteins
C. specific hydrolysis with cyanogen bromide (CNBr)
D. reduction with 2-mercaptoethanol and alkylation with iodoacetate
E. derivatization with urea.

13. You treat peptide A with CNBr and isolate two peptides. You also treat peptide A with trypsin and isolate three additional peptides. The sequence of the five peptides are:
   a. Gly-Arg
   b. Phe-Ala-Lys
   c. Trp-Glu-Val
   d. Met-Trp-Glu-Val
   e. Gly-Arg-Phe-Ala-Lys-Met

   What is the sequence of peptide A?
   A. Gly-Arg-Phe-Ala-Lys-Met-Trp-Glu-Val
   B. Phe-Ala-Lys-Gly-Arg-Met-Trp-Glu-Val
   C. Met-Trp-Glu-Val-Gly-Arg-Phe-Ala-Lys
   D. Met-Trp-Glu-Val-Phe-Ala-Lys-Gly-Arg
   E. Trp-Glu-Val-Phe-Ala-Lys-Gly-Arg-Met

14. A conformational change in hemoglobin brings a Histidine side chain into close proximity to an Aspartic acid side chain. Predict the effect on the pKₐ’s of the two residues.
   A. pKₐ His will increase and pKₐ Asp will increase.
   B. pKₐ His will decrease and pKₐ Asp will decrease.
   C. pKₐ His will decrease and pKₐ Asp will increase.
   D. pKₐ His will increase and pKₐ Asp will decrease.
   E. there is no effect on the pKₐ’s of the amino acids.

15. Which of these non-covalent bonds has the most energy in a protein? The bond between:
A. a positively charged histidine side chain and a negatively charged aspartate side chain.
B. a negatively charged aspartate side chain and a polar amide in a glutamine side chain.
C. functional groups in the interior of a protein (van der Waals forces)
D. the amide H and carbonyl O of the peptide bonds in parallel β-sheet.
E. two planar aromatic phenylalanine side-chains (induced dipoles)

16. the peptide bond:
a. has a partial double bond character in the C-N bond
b. is planar
c. rotates only around the Ca-C and N-Ca
d. has a trans configuration for the C-O and N-H
e. is polar and forms H-bonds

Choose the correct answer:
A. all the above
B. a and b
C. a, b, and c
D. c, d, and e
E. a, b, c, and e

17. Choose the correct answer. The α-helical structure of proteins is an example of a molecular conformation stabilized by the presence of hydrogen bonds. Each of these bonds
A. has an energy of about 400 kJ/mol
B. contains two hydrogen atoms
C. is entirely covalent in nature
D. has a hydrogen atom between an oxygen atom and a nitrogen atom
E. is entirely non-covalent in nature

18. Choose the correct answer. The repeating structural motifs making up the secondary structure of proteins are predominantly the results of
A. intramolecular hydrogen bonds
B. electrostatic interactions
C. the hydrophobic effect
D. intramolecular disulfide bonds
E. all of the above

19. Choose the correct answer. The tertiary structure of proteins is a result of which interaction?
A. intramolecular hydrogen bonds
B. electrostatic interactions
C. the hydrophobic effect
D. intramolecular disulfide bonds
E. all of the above

20. Choose the correct answer. The quaternary structure of a protein is associated with:
A. the overall 3-D shape of a polypeptide.  
B. the sum of the secondary and super secondary structure  
C. the sum of the secondary and tertiary structure  
D. proteins with one subunit containing a prosthetic group  
E. the 3-D orientation of polypeptide subunits in a multisubunit protein

21. Choose the BEST answer.  The native folded structure of a protein is dictated by several factors. Which is the most important?  
A. interactions with solvent  
B. pH and ionic strength of solvent  
C. the primary structure of the protein  
D. disulfide bonds  
E. ionic bonds

22. For globular proteins in aqueous solution, the predominant force driving folding of globular proteins is:  
A. S solvent  
B. S protein  
C. H solvent  
D. H protein  
E. G protein for unfolded native conformations.

23. What are the advantages of forming quaternary structure?  
   a. stability: a decrease in the surface to volume ratio and shielding of hydrophobic residues from the solvent.  
   b. genomic economy: less DNA required to code for a monomer that forms a homodimer.  
   c. catalytic site: the monomer may not constitute a complete enzyme active site. The active site may only form in the oligomer using side chains from two-or-more monomers.  
   d. substrate channeling: oligomeric enzymes may carry out different but related reactions on different subunits with the product from one active site on one subunit passing directly to the next active site on an adjacent subunit.  
   e. cooperativity: many enzymes are controlled by means of conformational changes involving movement of one subunit relative to the others in the oligomer.

Choose the correct answer:  
A. all the above  
B. all the above except c  
C. all the above except c and d  
D. all the above except a, b, and e  
E. all the above except a and e

24. The release of bisphosphoglycerate from hemoglobin:  
A. has no effect on oxygen affinity.  
B. lowers the oxygen affinity.  
C. raises the oxygen affinity  
D. has the same effect as lowering pH.
E. favors the binding of Bohr protons.

25. The trigger for the conformational change in quaternary structure of hemoglobin is:
   A. oxygen binding to the distal histidine
   B. oxygen binding to the Fe(II)
   C. oxygen binding to the proximal histidine
   D. the loss of Bohr protons
   E. the loss of 2,3- bisphosphoglycerate

26. Choose the correct answer
   A. carbon monoxide increases the affinity of Hb for oxygen
   B. a decrease in pH from 7.4 to 7.2 decreases the affinity of Hb for oxygen
   C. carbon dioxide decreases the affinity of Hb for oxygen
   D. bisphosphoglycerate decreases the affinity of Hb for oxygen
   E. all the above

27. The binding of one oxygen to hemoglobin results in:
   a. dissociation of the hemoglobin into ab dimers
   b. an increased affinity for oxygen in the remaining subunits
   c. a decreased affinity for bisphosphoglycerate
   d. a decreased affinity for oxygen in the remaining subunits
   e. the release of any other oxygen that may have been bound

   Choose the correct answer:
   A. a, b, and c
   B. a, c, d, and e.
   C. c, d, and e
   D. b and e
   E. d and e

28. what is the pH of 0.001M HCl?

29. Calculate the final pH when you mix together 100 ml 0.1M acetic acid, pK_a 4.76, with 100 ml 0.1 M sodium acetate.

30. Which amino acid has a charged side chain with a pK_a close to physiological pH?

Answers:
1D
2C
3E
4C
5A
6D
7A
28 pH = 3
29 [acid] = [base], therefore pH = pK_a = 4.76
30 histidine