Biochemistry Concepts and Connections 2nd edition Appling Test Bank

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***Biochemistry: Concepts and Connections, 2e* (Appling et al.)**
Chapter 2 The Chemical Foundation of Life: Weak Interactions in an Aqueous Environment

1) Each of the following is a noncovalent interaction EXCEPT _____.
A) Hydrogen bond
B) Carbon-hydrogen bond
C) Dipole-dipole
D) Van der Waals interaction
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.1

2) Which of the following is an important noncovalent interaction in biochemistry?
A) Sulfhydryl bonds
B) Phosphate bonds
C) Hydrogen bonds
D) Electron bonds
Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.1

3) Which of the following is FALSE when considering van der Waals interactions?
A) The van der Waals radius represents the most stable distance between two interacting centers.
B) Van der Waals radii can determine molecular surfaces.
C) Molecules that interact by van der Waals forces do not interpenetrate.
D) They are not important in determining the stability of three-dimensional structures of proteins.
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.2

4) Which of the following in biological compounds are sufficiently electronegative to serve as strong donors in a hydrogen bond?
A) Hydrogen and oxygen
B) Oxygen and nitrogen
C) Nitrogen and hydrogen
D) Hydrogen and carbon
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.2

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5) Hydrogen bond donors must be covalently attached to atoms that are _____.
A) Electronic
B) Electronegative
C) Electrostatic
D) Elastic
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.2

6) Which of the following is TRUE of hydrophobic molecules?
A) They have limited solubility in water.
B) Water forms a cage-like structure around them.
C) Dissolving in water decreases the entropy of the mixture.
D) All of the above
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

7) Which of the following can serve as both a hydrogen bond donor and acceptor?
A) CH_4
B) Water
C) A carbonyl group
D) An internal methionine
Answer: B
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Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

8) Amphipathic molecules are _____; not able to interact via van der Waals forces.
A) Polar only
B) Nonpolar only
C) Neither polar nor nonpolar
D) Both polar and nonpolar
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

9) Ionic compounds can be readily dissolved in water because the high dielectric constant of water screens and decreases the _____ force between the oppositely charged ions.
A) Entropic
B) Enthalpic
C) Electrostatic
D) Enantiomeric
Answer: C
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Learning Outcome: 2.3

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10) The _____ describes the tendency for hydrophobic molecules to aggregate because of the exclusion of water with the consequent increase of entropy of the solvent.
A) Hydrophobic effect
B) Hydrophilic effect
C) Hypertonic effect
D) Hypotonic effect
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

11) Which of the following can serve as a buffer because it has two ionizable groups?
A) Benzene
B) Sulphur
C) CH_4
D) Glycine
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

12) The average charge on an amino acid below its pI will be _____.
A) Positive
B) Negative
C) Neutral
D) There will be no charges on an amino acid below its pI.
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

13) Calculate the acid dissociation constant K_a of a 0.2 M solution of weak acid that is 0.1% ionized is _____.
A) 2×10^{1}
B) 2×10^{-1}
C) 2×10^{7}
D) 2×10^{-7}
Answer: D
Bloom's Level: 3-4: Applying/Analyzing
Learning Outcome: 2.4

14) What is the pH of a 0.1 M phosphate buffer (pKa = 6.86) that contains equal amounts of acid and conjugate base?
A) 5.86
B) 6.86
C) 5.61
D) 8.11
Answer: B
Bloom's Level: 3-4: Applying/Analyzing
Learning Outcome: 2.4

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15) What is the pH of a 0.2 M acetate buffer (pKa = 4.77) that contains twice as much acid as conjugate base?
A) 4.07
B) 4.47
C) 5.46
D) 5.07
Answer: B
Bloom's Level: 3-4: Applying/Analyzing
Learning Outcome: 2.4

16) Which of the following amino acid functional groups will influence the pKa of an amino acid residue the least if it is on an adjacent residue?
A) —OH
B) —COOH
C) —CH_3
D) —NH_3
Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.5

17) What would the pH be at the end of an enzyme-catalyzed reaction if it were carried out in a 0.1 M phosphate buffer of pKa 6.86 and 0.005 M of acid was produced during the reaction?
A) 6.86
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B) 6.77
C) 6.15
D) 6.00
Answer: B
Bloom's Level: 3-4: Applying/Analyzing
Learning Outcome: 2.5

18) If hydroxide is added to an amino acid, how will this affect the charge on the amino acid?
A) It will become more positively charged.
B) It will become more negatively charged.
C) It will become more neutrally charged.
D) It will have a higher charge than before the —OH group was added.
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.6

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19) What is the pH of a weak acid that is 0.2% ionized in a 0.2 M solution?
A) 2.76
B) 3.05
C) 3.21
D) 3.39
Answer: D
Bloom's Level: 3-4: Applying/Analyzing
Learning Outcome: 2.6

20) The net charge on an amino acid at its isoelectric point (pI) is _____.
A) 0
B) +1
C) -1
D) +2
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.7

21) Many proteins interact with DNA at physiological pH because _____.
A) Proteins are naturally attracted to DNA regardless of the pH
B) The negatively charged DNA is electrostatically attracted to positively charged regions on proteins
C) The positively charged DNA is electrostatically attracted to negatively charged regions on proteins
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D) Proteins and DNA interact using mainly hydrophobic interactions
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.8

22) Small ions in biological fluids _____.
A) Encourage strong electrostatic interactions between oppositely charged macro-ions at low ionic strengths
B) Encourage strong electrostatic interactions between oppositely charged macro-ions at high ionic strengths
C) Have no effect on the interactions between oppositely charged macro-ions
D) Tend to cluster around macro-ions of the same charge
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.8

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23) Which statement does NOT explain the polarity of water?
A) Oxygen is more electronegative than hydrogen.
B) Water molecules have a bent geometry (V-shaped).
C) The oxygen in water has sp2 hybrid orbitals.
D) In water the hydrogen carries a partial positive charge (δ+).
Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.1

24) Which substance do you expect to be most soluble in water?
A) Ammonia, NH_3
B) Methane, CH_4
C) Carbon dioxide, CO_2
D) Nitrogen, N_2
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.2

25) What is the maximum number of hydrogen bonds that one water molecule can have with neighboring water molecules?
A) 1
B) 2
C) 3
D) 4
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.2

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26) Which statement is TRUE about hydrogen bonds between water molecules?
A) They are about as strong as the covalent bonds in a water molecule.
B) They arise because of the linear geometry of water.
C) They cause water to have an unusually low freezing point for its molecular weight.
D) They involve the unequal sharing of a proton between water molecules.
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.2

27) Compounds that ionize when dissolved in water are called _____.
A) Electrolytes
B) Polar compounds
C) Hydrophobic compounds
D) Amphipathic compounds
Answer: A
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Learning Outcome: 2.3

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28) Poorly soluble molecules such as lipids and nucleoside bases can be made more soluble in cells by attaching _____ to them.
A) Water
B) Oxygen
C) Carbohydrates
D) Salt ions
Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

29) Electrolytes dissolve readily in water because _____.
A) They are held together by electrostatic forces
B) They are hydrophobic
C) Water molecules can cluster around cations
D) Water molecules can cluster around cations and anions
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

30) What is the difference between a particle, being hydrated versus being solvated?
A) A hydrated particle is surrounded by a shell of water. A solvated molecule is surrounded by a shell of solvent molecules, not necessarily water.
B) The terms hydrated and solvated mean exactly the same thing.
C) A hydrated particle has reacted with hydrogen. A solvated particle is dissolved in a solvent.
D) The word hydrated is used only when the solute is an electrolyte.
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

31) Micelles, formed by detergents in water, have _____.
A) Hydrophilic interiors and hydrophobic exteriors
B) Hydrophobic interiors and hydrophilic exteriors
C) Hydrophilic interiors and exteriors
D) Hydrophobic interiors and exteriors
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

32) Molecules that are both hydrophobic and hydrophilic are _____.
A) Amphipathic
B) Amphoteric
C) Bipolar
D) Cannot exist
Answer: A
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Learning Outcome: 2.3

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33) Which molecule or ion below is amphipathic?
A) H_2NCH_2COOH (glycine)
B) H_2O
C) $CH_3(CH_2)_{14}COO^-$
D) $CH_3CH_2CH_2CH_2CH_3$
Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

34) Which statement explains the cleaning action of soap on greasy dishes?
A) The soap changes the water-solubility of the grease so that it is easily dissolved by the water.
B) The grease is trapped inside the hydrophobic interior of micelles made of soap molecules.
C) The soap chemically breaks down the grease into smaller, more water-soluble molecules.
D) The soap hydrates the grease with its polar head groups and holds it in suspension.
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

35) Which of the following is NOT a "weak" interaction?
A) Hydrogen bonds
B) Van der Waals forces
C) Disulfide bonds
D) Ionic interactions
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Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.2

36) Which of the following weak interactions is NOT an electrostatic interaction?
A) Hydrogen bonds
B) Charge-charge interactions
C) Hydrophobic interactions
D) Van der Waals forces
Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.2

37) Which of these noncovalent forces in biological systems is usually the strongest?
A) Hydrogen bonds
B) London dispersion forces
C) Hydrophobic interactions
D) Van der Waals forces
Answer: A
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Learning Outcome: 2.2

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38) Hydrogen bonds can occur when hydrogen is covalently bonded to atoms like nitrogen and oxygen. What property of nitrogen and oxygen is important for this?
A) Atomic mass
B) Ionizability
C) Hydrophobicity
D) Electronegativity
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.1

39) Which statement is TRUE about the ability of carbon to participate in hydrogen bonds in living organisms?
A) There are too many carbon atoms competing for the hydrogens in biomolecules to allow for the stable formation of hydrogen bonds.
B) Carbon's electronegativity is too low to participate in hydrogen bonding.
C) Most carbons in biomolecules are hydrogen bonded to water.
D) Carbon is too large to participate in hydrogen bonding.
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.1

40) Attractions of oppositely charged functional groups of proteins are sometimes called _____.
A) Salt bridges or electrostatic interactions
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B) Disulfide bridges
C) London bridges
D) Hydrophilic bridges
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.1

41) Which is TRUE about hydrogen bonding for biological molecules?
A) Hydrogen bonds are strong enough to confer structural stability, for example in DNA.
B) Hydrogen bonds are weak enough to be easily broken (weaker than covalent bonds).
C) They contribute to the water solubility of many macromolecules.
D) All of the above
Answer: D
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Learning Outcome: 2.1

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42) London dispersion forces are attractive forces that arise due to _____.
A) Infinitesimal dipoles generated by the constant random motion of electrons
B) Permanent dipoles of molecules containing covalent bonds between atoms of very different electronegativities
C) The hydrophobic effect
D) Ion pairing between oppositely charged functional groups
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.2

43) The aggregation of nonpolar molecules or groups in water is thermodynamically due to the _____.
A) Increased entropy of the nonpolar molecules when they associate
B) Decreased enthalpy of the system
C) Increased entropy of the water molecules
D) Very strong van der Waals forces among the nonpolar molecules or groups
Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.2

44) Water molecules clustered around nonpolar molecules contribute to hydrophobic interactions because _____.
A) Their number is minimized to increase the total entropy of water
B) Nonpolar molecules are more highly organized than polar molecules
C) Water molecules in the cell are more organized in the regions away from the nonpolar molecule
D) Water molecules will aggregate around nonpolar molecules
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

45) The three dimensional structure of most proteins is largely determined by _____.
A) Other proteins which fold them
B) Weak noncovalent interactions
C) Denaturation
D) Hydrogen bonds
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

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46) Enzymes that condense subunits of macromolecules during their synthesis usually _____.
A) Transfer an acyl or carbonyl group to an electrophile
B) Exclude water from the active site
C) Contain inhibitors of hydrolases
D) Are catalyzing thermodynamically favored reactions
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

47) The ion-product constant for water, Kw, is _____.
A) 1×10^{-7} M^2
B) 1×10^{-7} M
C) 1×10^{-14} M^2
D) 1×10^{-14} M
Answer: C
Bloom's Level: 3-4: Applying/Analyzing
Learning Outcome: 2.4

48) What is the concentration of hydroxide ion in an aqueous solution with an H^+ concentration of 2×10^{-5} M?
A) 2×10^{9} M
B) 2×10^{19} M
C) 2×10^{-19} M
D) 5×10^{-10} M
Answer: D
Bloom's Level: 3-4: Applying/Analyzing
Learning Outcome: 2.4

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49) Pure water has a concentration of _____.
A) 18 g/ml
B) 1 g/ml
C) 1000 g/ml
D) 55 M
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

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50) How does the ion-product of water, K_w, relate to the equilibrium constant, K_{eq}, for the dissociation reaction of water?
A) K_w is calculated by multiplying K_{eq} by the concentration of water.
B) K_w is just another symbol for K_{eq}, so they are equal.
C) K_w is calculated by dividing K_{eq} by the ideal gas constant.
D) K_w is calculated by multiplying K_{eq} by the concentrations of hydronium ion and hydroxide ion.
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

51) In pure water, the concentration of H^+ equals _____.
A) 1×10^{-7} M
B) 1×10^{-14} M
C) 1 M
D) .07 M
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

52) The pH of a 10^{-4} M solution of HCl is _____.
A) 3.0
B) 3.5
C) 4.0
D) 4.5
Answer: C
Bloom's Level: 3-4: Applying/Analyzing
Learning Outcome: 2.4

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53) Compare solution A with pH 4 to solution B with pH 6.
A) The concentration of hydronium ion in solution A is twice that in solution B.
B) Solution A has greater buffering capacity than solution B.
C) The concentration of hydronium ion in solution A is 100 times that in solution B.
D) The hydroxide concentrations are equal in the two solutions since pH only measures the concentration of H^+.
Answer: C
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54) The Henderson-Hasselbalch equation cannot be used to calculate _____.
A) The pH of a solution of an organic acid
B) The amount of salt and acid to add to form a specific buffer
C) The pK_a of a weak acid
D) The amount of a divalent cation being used in a buffer
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

55) Two weak acids, A and B, have pK_a values of 4 and 6, respectively. Which statement is TRUE?
A) Acid A dissociates to a greater extent in water than acid B.
B) For solutions of equal concentration, acid B will have a lower pH.
C) Acid B is the conjugate base of Acid A.
D) Acid A is more likely to be a polyprotic acid than acid B.
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

56) Calculate the value of pK_a for an acid when $K_a = 2.6 \times 10^{-4}$.
A) -3.59
B) +3.59
C) -8.25
D) +8.25
Answer: B
Bloom's Level: 3-4: Applying/Analyzing
Learning Outcome: 2.4

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57) What is the approximate pH of a 0.10 M solution of a weak acid that has a K_a of 5×10^{-5} M?
A) 2.7
B) 5.3
C) 4.8
D) 11.3
Answer: A
Bloom's Level: 3-4: Applying/Analyzing
Learning Outcome: 2.4

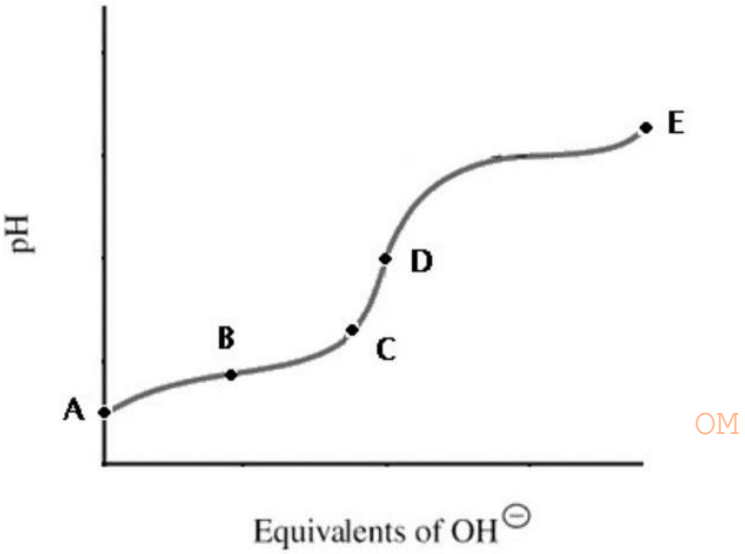
58) The ratio of the concentration of a(n) _____ over _____ describes the proportions of a weak acid necessary to satisfy the Henderson-Hasselbalch equation.
A) Conjugate acid; conjugate base
B) Conjugate base; conjugate acid
C) Proton donor; proton acceptor
D) Electron acceptor; electron donor
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

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59) At the midpoint of a titration curve _____.
A) The concentration of a conjugate base is twice that of the concentration of a conjugate acid
B) The pH equals the pK_a
C) The ability of the solution to buffer is at its least effective
D) The concentration of a conjugate base is 1/2 that of the concentration of a conjugate acid
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

60) A titration curve for a weak acid is shown. Which point shows the most buffering?



A) A
B) B
C) C
D) D
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

61) The imidazolium ion has a $pK_a = 7.0$. Imidazolium buffers can be prepared for pH values of _____.
A) 6.5 to 7.5
B) 6.1 to 7.1
C) 5.5 to 8.5
D) 6.0 to 8.0
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

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62) Since HCl is a strong acid its value of K_a is _____.
A) Effectively equal to infinity
B) Equal to Kw
C) Zero
D) Dependent on the concentration of HCl
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

63) For a weak acid with a pKa = 6.5, the effective buffering range is usually considered to be _____.
A) pH 6 to pH 7
B) pH 6.4 to pH 6.6
C) pH 5.5 to pH 7.5
D) Dependent on the molarity of the acid
Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

64) The pKa of lactic acid is 3.9. A lactate buffer will be useful from pH values _____.
A) 3.5 through 4.4
B) 3.0 through 4.5
C) 2.9 through 4.9
D) 3.8 through 4.0
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Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

65) pKa values of phosphoric acid are 2.2, 7.2 and 12.7. A phosphate buffer of pH = 7.4 can be prepared using _____.
A) $H_2PO_4^-$ and HPO_4^{2-}
B) HPO_4^{2-} and PO_4^{3-}
C) H_3PO_4 and HCl
D) H_3PO_4 and PO_4^{3-}
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.4

66) Which of the following interaction(s) below is/are NOT considered non-covalent?
A) Hydrogen bonding
B) Disulfide bonding
C) Carbon-carbon bonding
D) The bonding of an amino group to the α-carbon in an amino acid
Answer: A
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Learning Outcome: 2.1

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67) In the detergent sodium dodecyl sulfate, which of the following is (are) TRUE about them being hydrophobic?
A) Sulfate is very hydrophobic.
B) Sodium is very hydrophobic.
C) Dodecyl is very hydrophobic.
D) Dodecyl is slightly hydrophilic.
Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.3

68) Van der Waals forces are _____.
A) Very strongly repulsive to each other at short nuclear distances
B) Very strongly repulsive to each other at long nuclear distances
C) Very strongly attractive to each other at short nuclear distances
D) Very strongly attractive to each other at long nuclear distances
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.5

69) The combined effect of many weak _____ interactions can be very significant in determining factors such as three-dimensional structure for large biological molecules.
A) Covalent
B) Noncovalent
C) Disulfide bridges
D) Modular
Answer: B
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.5

70) Water molecules that surround a less polar molecule in solution are _____.
A) Immobile and ordered
B) Immobile and disordered
C) Mobile and ordered
D) Mobile and disordered
Answer: A
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.5

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71) The strength of van der Waals forces between two molecules would be strongest if _____.
A) The distance between them was zero angstroms away
B) The distance between them was 10 angstroms away
C) The distance between them was 20 angstroms away
D) The distance between them was 4 angstroms away
Answer: D
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.5

72) Micelles are stabilized in water by _____.
A) Interactions of hydrogen-bonding molecules with each other
B) Interactions of electrostatic molecules with each other
C) Interactions of nonpolar molecules with each other
D) Interactions of salt-bridge containing molecules with each other
Answer: C
Bloom's Level: 1-2: Remembering/Understanding
Learning Outcome: 2.5

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