

*Principles of Biochemistry, 5e* (Moran/Horton/Scrimgeour/Perry/Rawn)

**Chapter 2 Water**

1) 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 sp<sup>2</sup> hybrid orbitals.
- D) In water the hydrogen carries a partial positive charge ( $\delta^+$ ).

Answer: C

Page Ref: Section 2-1

2) The polarity of small molecules is a result of

- A) the presence of oxygen.
- B) the geometry of the bonds in the molecule.
- C) the polar covalent bonds.
- D) All of the above.
- E) B and C.

Answer: E

Page Ref: Section 2-1

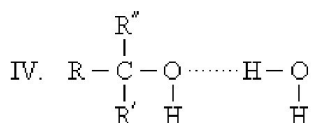
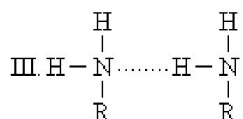
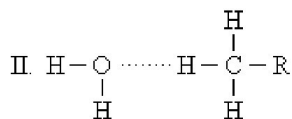
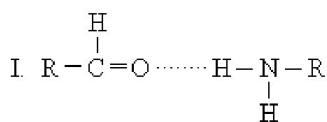
3) Which substance do you expect to be most soluble in water?

- A) Ammonia, NH<sub>3</sub>.
- B) Methane, CH<sub>4</sub>.
- C) Carbon dioxide, CO<sub>2</sub>.
- D) Nitrogen, N<sub>2</sub>.

Answer: A

Page Ref: Section 2-1

4) Which is NOT a proper way to form a hydrogen bond? (The symbol "R" represents a general organic group. The hydrogen bonding is represented by dashed lines.)



- A) I
- B) II
- C) III
- D) IV

Answer: B

Page Ref: Section 2-2

5) 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

Page Ref: Section 2-2

6) 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.
- E) In liquid water the same molecules attract to each other over long time periods.

Answer: D

Page Ref: Section 2-2

7) The abundance of water in the cells and tissues helps to minimize temperature fluctuations. This is due to what property of water?

- A) Density.
- B) Viscosity.
- C) Specific heat.
- D) Boiling point.

Answer: C

Page Ref: Section 2-2

8) Compounds that ionize when dissolved in water are called \_\_\_\_\_.

- A) electrolytes
- B) polar compounds
- C) hydrophobic compounds
- D) amphipathic compounds

Answer: A

Page Ref: Section 2-3

9) 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

Page Ref: Section 2-3

10) Electrolytes dissolve readily in water because

- A) they are held together by electrostatic forces.
- B) they are hydrophobic.
- C) water molecules can cluster about cations.
- D) water molecules can cluster about anions.
- E) water molecules can cluster about cations and anions.

Answer: E

Page Ref: Section 2-3

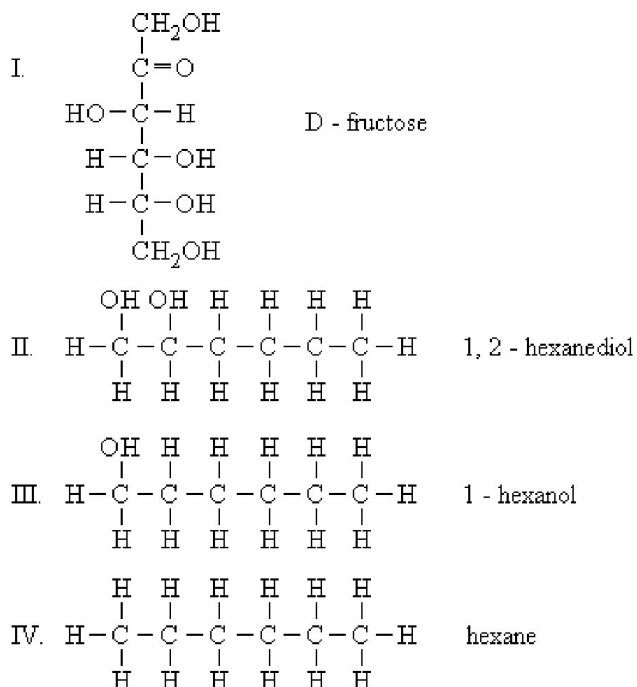
11) A molecule or ion is said to be hydrated when it \_\_\_\_\_.

- A) is neutralized by water
- B) is surrounded by water molecules
- C) reacts and forms a covalent bond to water
- D) aggregates with other molecules or ions to form a micelle in water

Answer: B

Page Ref: Section 2-3

12) Which would you expect to be most soluble in water?



- A) I
- B) II
- C) III
- D) IV

Answer: A

Page Ref: Section 2-3

13) Solutes diffuse more slowly in cytoplasm than in water because of

- A) the higher viscosity of water.
- B) the higher heat of vaporization of water.
- C) the presence of many crowded molecules in the cytoplasm.
- D) the absence of charged molecules inside cells.

Answer: C

Page Ref: Section 2-3

14) The \_\_\_\_\_ pressure is the pressure required to prevent the flow of solvent through a solvent-permeable membrane that separates two solutions of different solute concentration.

- A) hydrostatic
- B) electromotive
- C) osmotic
- D) partial

Answer: C

Page Ref: Section 2-3

15) Which is true about the solubility of electrolytes in water?

- A) They are all insoluble in water.
- B) They are usually only sparingly soluble in water.
- C) They often form super-saturated aqueous solutions.
- D) They readily dissolve and ionize in water.

Answer: D

Page Ref: Section 2-3

16) 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

Page Ref: Section 2-3

17) The osmotic pressure of an aqueous solution depends on

- A) the chemical nature of the solute.
- B) the molar concentration of solute.
- C) the hydrophobic effect of the solute.
- D) All of the above.
- E) None of the above.

Answer: B

Page Ref: Section 2-3

18) Cells keep the osmotic pressure from being too great by

- A) existing in hypertonic solutions.
- B) making macromolecules from smaller molecules.
- C) existing in a hypotonic solution.
- D) existing in an isotonic solution.
- E) Both B and D.

Answer: E

Page Ref: Section 2-3

19) The osmotic pressure of a 0.010 M sucrose ( $C_{12}H_{22}O_{11}$ ) solution at 25°C is 0.24 atm. How does the osmotic pressure of a 0.010 M glucose ( $C_6H_{12}O_6$ ) solution at 25°C compare to this?

Note that neither solute is volatile or ionizable.

- A) The glucose solution has a lower osmotic pressure because its molar mass is lower than sucrose.
- B) The glucose solution has a higher osmotic pressure because its molar mass is lower than sucrose.
- C) The osmotic pressures are equal because the solutions have the same molar concentration.
- D) Nothing can be said about the osmotic pressure of the glucose solution without more information.

Answer: C

Page Ref: Section 2-3

20) Oil and water do not form a solution due to \_\_\_\_\_.

- A) the hydrophobic effect
- B) the inability of oil to hydrogen bond with water
- C) the nonpolarity of oil
- D) All of the above.
- E) A and C only.

Answer: D

Page Ref: Section 2-4

21) 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.
- E) None of the above.

Answer: B

Page Ref: Section 2-4

22) Molecules that are both hydrophobic and hydrophilic are \_\_\_\_\_.

- A) amphipathic
- B) amphoteric
- C) bipolar
- D) not possible

Answer: A

Page Ref: Section 2-4

23) Which molecule or ion below is amphipathic?

- A)  $\text{H}_2\text{NCH}_2\text{COOH}$  (glycine)
- B)  $\text{H}_2\text{O}$
- C)  $\text{CH}_3(\text{CH}_2)_{14}\text{COO}^-$
- D)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$

Answer: C

Page Ref: Section 2-4

24) 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

Page Ref: Section 2-4

25) Some ions such as thiocyanate that are poorly solvated in water and can enhance the solubility of nonpolar compounds in water by disordering the water molecules are called \_\_\_\_\_.

- A) azeotropes
- B) hydrophobic ions
- C) zeolytes
- D) chaotropes

Answer: D

Page Ref: Section 2-4

26) Which of the following is NOT a "weak" interaction?

- A) Hydrogen bonds
- B) Van der Waals forces.
- C) Disulfide bonds.
- D) Ionic interactions.
- E) Hydrophobic interactions.

Answer: C

Page Ref: Section 2-5

27) 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

Page Ref: Section 2-5

28) 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

Page Ref: Section 2-5

29) 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

Page Ref: Section 2-5

30) 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

Page Ref: Section 2-5

31) Attractions of oppositely charged functional groups of proteins are sometimes called \_\_\_\_\_.

- A) salt bridges or ion pairing
- B) disulfide bridges
- C) London bridges
- D) hydrophilic bridges

Answer: A

Page Ref: Section 2-5

32) 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

Page Ref: Section 2-5

33) 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

Page Ref: Section 2-5

34) 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

Page Ref: Section 2-5

35) Water molecules clustered about 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) All of the above.
- E) B and C.

Answer: A

Page Ref: Section 2-5

36) 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.
- E) All of the above.

Answer: B

Page Ref: Section 2-5

37) The oxygen atom of water is nucleophilic because

- A) it has a negative oxidation number.
- B) it carries a partial positive charge.
- C) it has two unshared pair of electrons.
- D) it seeks electron-rich molecules.
- E) All of the above.

Answer: C

Page Ref: Section 2-6

38) Water is a nucleophile, yet it does not usually hydrolyze macromolecules in cells because

- A) covalent bonds linking macromolecule subunits are stable at cell pH.
- B) covalent bonds linking macromolecule subunits are stable at cell temperature.
- C) the concentration of water is much too small in cells.
- D) A and B.

Answer: D

Page Ref: Section 2-6

39) Enzymes which 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.
- E) All of the above.

Answer: B

Page Ref: Section 2-6

40) The ion-product constant for water,  $K_w$ , is

- A)  $1 \times 10^{-7} \text{ M}^2$ .
- B)  $1 \times 10^{-7} \text{ M}$ .
- C)  $1 \times 10^{-14} \text{ M}^2$ .
- D)  $1 \times 10^{-14} \text{ M}$ .

Answer: C

Page Ref: Section 2-7

41) Which parameter has the greatest correlation to reaction rate?

- A) Activation energy.
- B) Gibb's free energy.
- C) Enthalpy.
- D) Entropy.
- E) None of the above.

Answer: A

Page Ref: Section 2-7

42) What is the concentration of hydroxide ion in an aqueous solution with an  $\text{H}^+$  concentration of  $2 \times 10^{-5} \text{ M}$ ?

- A)  $2 \times 10^9 \text{ M}$
- B)  $2 \times 10^{-19} \text{ M}$
- C)  $2 \times 10^{-19} \text{ M}$
- D)  $5 \times 10^{-10} \text{ M}$
- E) Cannot calculate from the information given.

Answer: D

Page Ref: Section 2-7

43) In pure water hydronium ions are formed by \_\_\_\_\_ attack of oxygen on a proton in an adjacent water molecule.

- A) ionic
- B) nucleophilic
- C) electrophilic
- D) covalent

Answer: B

Page Ref: Section 2-7

44) Pure water has a concentration of

- A) 18 g/ml.
- B) 1 g/ml.
- C) 1000 g/ml.
- D) 55 M.

Answer: D

Page Ref: Section 2-7

45) Which statement best characterizes the distribution of charge in the hydronium ion,  $\text{H}_3\text{O}^+$ ?

- A) The positive charge is distributed over all of the atoms in the ion.
- B) The positive charge is localized only on the oxygen atom.
- C) The positive charge is distributed between the three hydrogen atoms only.
- D) The positive charge is localized on only one of the hydrogen atoms.

Answer: A

Page Ref: Section 2-7

46) Which statement below is true about the relative lifetime of a hydrogen bond, compared to the rate of water's ionization to hydroxide ions and hydronium ions?

- A) The strength of hydrogen bonding makes its dissociation much slower than the ionization of water.
- B) The rate of dissociation of a hydrogen bond is the same order of magnitude as the rate of ionization of water.
- C) The two rates are linked in such a way that the more the water is ionized, the stronger and longer lasting hydrogen bonding will be.
- D) The lifetime of a water molecule before it is ionized is about  $10^9$  greater than the lifetime of a hydrogen bond.

Answer: D

Page Ref: Section 2-7

47) The self-ionization of water is \_\_\_\_\_.

- A) a unimolecular dissociation of a single water molecule to  $\text{H}^+$  and  $\text{OH}^-$
- B) a bimolecular reaction between two water molecules to yield  $\text{H}_3\text{O}^+$  and  $\text{OH}^-$
- C) a result of hydrophobic interactions
- D) a termolecular reaction involving the simultaneous collision of  $\text{H}_2\text{O}$ ,  $\text{H}^+$  and  $\text{OH}^-$

Answer: B

Page Ref: Section 2-7

48) 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 found by multiplying  $K_{eq}$  by the concentration of water.
- B)  $K_w$  just another symbol for  $K_{eq}$ , so they are equal.
- C)  $K_w$  is found by dividing  $K_{eq}$  by the ideal gas constant.
- D)  $K_w$  is found by multiplying  $K_{eq}$  by the concentrations of hydronium ion and hydroxide ion.

Answer: A

Page Ref: Section 2-7

49) A solution containing  $10^{-8}$  M HCl and  $10^{-8}$  M acetic acid contains  $H^+$  which is supplied mostly by

- A) the strong acid.
- B) the weak acid.
- C) both the strong and the weak acids.
- D) water.
- E) All of the above.

Answer: D

Page Ref: Section 2-8

50) In pure water, the concentration of  $H^+$  plus equals

- A)  $1 \times 10^{-7}$  M.
- B)  $1 \times 10^{-14}$  M.
- C) 1 M.
- D) .07 M.

Answer: A

Page Ref: Section 2-8

51) Basic solutions form when chemicals are dissolved in water and remove

- A)  $OH^-$ .
- B)  $H^+$ .
- C)  $Na^+$ .
- D) A and B.
- E) A, B and C.

Answer: B

Page Ref: Section 2-8

52) The pH of a  $10^{-4}$  M solution of HCl is

- A) 3.
- B) 3.5.
- C) 4.
- D) 4.5.
- E) greater than 4.5.

Answer: C

Page Ref: Section 2-8

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

Page Ref: Section 2-8

54) If human blood is not maintained at close to  $\text{pH} = 7.4$ , a person can develop

- A) acidosis.
- B) alkalosis.
- C) diabetes.
- D) Both A and B.
- E) None of the above.

Answer: D

Page Ref: Section 2-8

55) The Henderson-Hasselbalch equation can be used to calculate

- A) the  $\text{pH}$  of a solution of an organic acid.
- B) the amount of salt and acid to add to form a specific buffer.
- C) the  $\text{pK}_a$  of a weak acid.
- D) All of the above.
- E) A and C only.

Answer: D

Page Ref: Section 2-9

56) Two weak acids, A and B, have  $\text{pK}_a$  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  $\text{pH}$ .
- C) B is the conjugate base of A.
- D) Acid A is more likely to be a polyprotic acid than acid B.
- E) The equivalence point of acid A is higher than that of acid B.

Answer: A

Page Ref: Section 2-9

57) Calculate the value of  $\text{pK}_a$  for an acid when  $K_a = 2.6 \times 10^{-4}$ .

- A) -3.59
- B) +3.59
- C) -8.25
- D) +8.25
- E) +3800

Answer: B

Page Ref: Section 2-9

58) What is the approximate  $\text{pH}$  of a 0.10 M solution of a weak acid that has a  $K_a$  of  $5 \times 10^{-5}$  M?

- A) 2.7
- B) 5.3
- C) 4.8
- D) 11.3
- E) Cannot determine from the information given.

Answer: A

Page Ref: Section 2-9

59) The ratio of the concentration of a \_\_\_\_\_ over \_\_\_\_\_ describes the proportions of forms 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) proton acceptor; proton donor
- E) B and D

Answer: E

Page Ref: Section 2-9

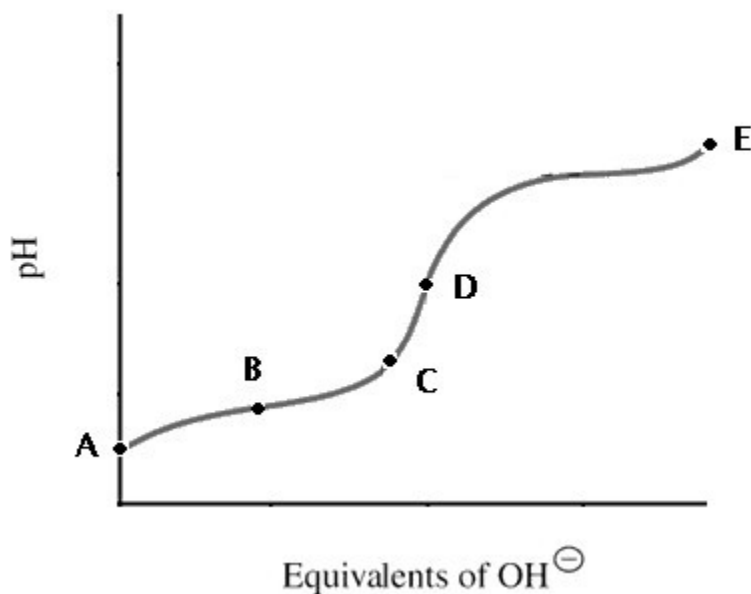
60) At the midpoint of a titration curve

- A) the concentration of a conjugate base is equal to the concentration of a conjugate acid.
- B) the pH equals the pKa.
- C) the ability of the solution to buffer is best.
- D) All of the above.
- E) A and B only.

Answer: D

Page Ref: Section 2-9

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



- A) A
- B) B
- C) C
- D) D
- E) E

Answer: B

Page Ref: Section 2-9

62) 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.
- E) 6.0 to 7.5.

Answer: D

Page Ref: Section 2-10

63) Since HCl is a strong acid its value of  $K_a$  is \_\_\_\_\_.

- A) effectively equal to infinity
- B) equal to  $K_w$
- C) zero
- D) dependent on the concentration of HCl

Answer: A

Page Ref: Section 2-9

64) For a weak acid with a  $pK_a = 6.5$ , 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.
- E) B and C.

Answer: C

Page Ref: Section 2-10

65) Blood pH is primarily regulated by

- A) a protein buffer system.
- B) the carbon dioxide - carbonic acid - bicarbonate buffer system.
- C) the phosphate buffering system.
- D) carbonic acid ( $H_2CO_3$ ).
- E) B and C.

Answer: B

Page Ref: Section 2-10

66) The  $pK_a$  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.

Answer: C

Page Ref: Section 2-10

67) Intracellular buffers include

- A) proteins.
- B) inorganic phosphate.
- C) cellulose.
- D) Both A and B.
- E) A, B and C.

Answer: D

Page Ref: Section 2-10

68) 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)  $\text{H}_2\text{PO}_4^-$  and  $\text{HPO}_4^{2-}$ .
- B)  $\text{HPO}_4^{2-}$  and  $\text{PO}_4^{3-}$ .
- C)  $\text{H}_3\text{PO}_4$  and HCl.
- D) None of the above.

Answer: A

Page Ref: Section 2-10

69) Acetic acid has a pKa of 4.8. How many milliliters of 0.2 M acetic acid and 0.2 M sodium acetate are required to prepare 1 liter of 0.1 M buffer solution having a pH of 4.8?

- A) 500 ml acetic acid and 500 ml sodium acetate.
- B) 250 ml acetic acid and 250 ml sodium acetate, then 500 ml water.
- C) 250 ml acetic acid and 500 ml sodium acetate, then 250 ml water.
- D) 500 ml acetic acid and 250 ml sodium acetate, then 250 ml water.

Answer: B

Page Ref: Section 2-10

70) The pH of human blood is primarily maintained at 7.4 by

- A) ATP.
- B) carbon dioxide-carbonic acid buffer systems.
- C) a bicarbonate buffer system.
- D) B and C.
- E) A, B and C.

Answer: D

Page Ref: Section 2-10

71) The solubility rule "like dissolves like" refers primarily to similarities in amphipathic nature between the solute and solvent.

Answer: FALSE

Page Ref: Section 2-1

72) The hydrogen bonding between water molecules in ice gives water an unusually low melting point compared to other molecules of similar size and molecular weight that cannot form hydrogen bonds.

Answer: FALSE

Page Ref: Section 2-2

73) The water solubility of alcohols with a single hydroxyl group increases as a function of molecular weight.

Answer: FALSE

Page Ref: Section 2-3

74) A hydrated potassium ion is surrounded by a shell of water molecules oriented primarily with their oxygen atoms toward the potassium ion.

Answer: TRUE

Page Ref: Section 2-3

75) The ionic composition of sea water and blood plasma is similar, and this is evidence that the earliest form of life lived in oceans.

Answer: FALSE

Page Ref: Section 2-3

76) In the detergent sodium dodecyl sulfate, the sulfate groups are very hydrophobic.

Answer: FALSE

Page Ref: Section 2-4

77) Van der Waals forces are very strongly repulsive at short nuclear distances and very weak at long internuclear distances.

Answer: TRUE

Page Ref: Section 2-5

78) The combined effect of many weak noncovalent interactions can be very significant in determining factors such as three-dimensional structure for large biological molecules.

Answer: TRUE

Page Ref: Section 2-5

79) Water molecules that surround a less polar molecule in solution are immobile and ordered.

Answer: TRUE

Page Ref: Section 2-5

80) The strength of van der Waals forces between two molecules changes as the distance between them changes.

Answer: TRUE

Page Ref: Section 2-5

81) The attractive force between two atoms is maximized when they are separated by the sum of their van der Waals radii.

Answer: TRUE

Page Ref: Section 2-5

82) Salt bridges are often found on the surfaces of proteins where they are stabilized by water.

Answer: FALSE

Page Ref: Section 2-5

83) Hydrogen bonds in the interior of a protein or other macromolecule are stronger than those on the exterior.

Answer: FALSE

Page Ref: Section 2-5

84) Micelles are stabilized in water by interactions of nonpolar molecules with each other.

Answer: TRUE

Page Ref: Section 2-5

85) Hydrophobic interactions are sometimes called "bonds", because each one is as strong as a covalent bond.

Answer: FALSE

Page Ref: Section 2-5

86) Proteins dissolved in water can be hydrolyzed by nucleophilic attack from the water molecules.

Answer: TRUE

Page Ref: Section 2-6

87) An intermediate formed by the enzyme glutamine synthetase, gamma-glutamyl phosphate, is rapidly hydrolyzed by water if the enzyme is not around to protect it.

Answer: TRUE

Page Ref: Section 2-6

88) When acid is added to pure water,  $K_w$ , the ion-product constant of water, changes.

Answer: FALSE

Page Ref: Section 2-7

89) The equilibrium constant of water ( $K_{eq}$ ) is the rate that dissociation of the molecule occurs at room temperature.

Answer: FALSE

Page Ref: Section 2-7

90) The  $H^+$  (or  $H_3O^+$ ) in cells is the same concentration as that of undissociated water.

Answer: FALSE

Page Ref: Section 2-8

91) Hyperventilation can result in alkalosis because there is excessive loss of carbon dioxide and, therefore a loss of carbonic acid.

Answer: TRUE

Page Ref: Section 2-8

92) Since the  $pK_a$  of acetic acid is 4.8, it can be used to prepare a buffer to maintain physiological pH.

Answer: FALSE

Page Ref: Section 2-9

93) The buffering capacity of a weak acid and its conjugate base is strongest when the  $\text{pH} = \text{pK}_a$ .

Answer: TRUE

Page Ref: Section 2-10

94) Synthetic compounds used as buffers are not as valuable for experiments as naturally occurring compounds used as buffers.

Answer: FALSE

Page Ref: Section 2-10