Essential Biochemistry 5th edition Pratt Test Bank

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Essential Biochemistry Test Bank, Chapter 2: Aqueous Chemistry

Question type: Multiple Choice

1) In a water molecule, hydrogens are partially _____; oxygens are partially _____.

A) negative; negative
B) negative; positive
C) positive; positive
D) positive; negative
E) none of the above

Answer: D

Difficulty: Easy
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

2) At any given moment, a single water molecule participates in _____ strong hydrogen bond(s). The role played by the water molecule is best characterized as _____.

A) two ; one H-bond donor, one H-bond acceptor
B) two ; two H-bond donor
C) two ; two H-bond acceptor
D) one; H-bond donor
E) one; H-bond acceptor

Answer: A

Difficulty: Medium
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

3) Which of the following is a physical property of water that results from hydrogen bonding?

A) high boiling point relative to molecular weight
B) a solid state that is less dense than the liquid state
C) high surface tension
D) ability to solubilize polar molecules
E) all of the above

Answer: E

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Difficulty: Medium
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

4) In a hydrogen bond between a water molecule and another biomolecule, _____.

A) a hydrogen ion on the water molecule forms an ionic bond with a hydride ion on the other molecule
B) the hydrogen bond will typically form between a hydrogen atom and either a nitrogen, sulfur, or oxygen atom
C) the partial charge on a hydrogen of the water interacts with the partial charge on a hydrogen of the other molecule
D) a hydrogen on the water molecule forms a covalent bond to an oxygen or nitrogen atom on the other molecule
E) the hydrogen atom is located between an oxygen atom of the water and a carbon atom of the other molecule

Answer: B

Difficulty: Medium
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

5) The strongest non-covalent interactions are _____.

A) van der Waals interactions
B) London dispersion forces
C) hydrogen bonds
D) dipole-dipole interactions
E) ionic interactions

Answer: E

Difficulty: Easy
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

6) Hydrogen bonds are approximately _____% of the bond strength of covalent C-C or C-H bonds.

A) 1
B) 5

C) 20
D) 50
E) 95

Answer: B

Difficulty: Easy
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

7) Due to the formation of hydrogen bonds, _____ is highly soluble in water.

A) carbon dioxide
B) sodium chloride
C) methanol
D) octane
E) cholesterol

Answer: C

Difficulty: Medium
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

8) Which of the following explains the interactions that occur between the atoms of water molecules and the ions that form when sodium chloride dissolves in water?

A) hydrogens interact with the sodium ion, oxygens interact with the chloride ion
B) hydrogens interact with the chloride ion, oxygens interact with the sodium ion
C) hydrogens interact with the sodium ion and the chloride ion
D) oxygens interact with the sodium ion and the chloride ion
E) none of the above

Answer: B

Difficulty: Medium
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

9) Which of the following functional groups has two hydrogen bond donors and one hydrogen bond acceptor?

A) alcohol

B) ester
C) thiol
D) amine
E) amide

Answer: D

Difficulty: Hard
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

10) Hydrogen bonds within liquid water are _____.

A) attractions between the protons of the oxygen nuclei
B) ion-induced dipole interactions
C) dipole-dipole interactions
D) attractions between two oxygen atoms
E) attractions between the H^+ and ^-OH ions of the liquid

Answer: C

Difficulty: Medium
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

11) When a non-polar substance is added to water, how do the molecules of water behave?

A) the regular hydrogen bond pattern is disrupted resulting in a decrease of entropy
B) the regular hydrogen bond pattern is disrupted resulting in an increase of entropy
C) the regular hydrogen bond pattern is disrupted resulting in a decrease of enthalpy
D) the regular hydrogen bond pattern is disrupted resulting in an increase of enthalpy
E) none of the above

Answer: A

Difficulty: Medium
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

12) What term is used to describe the exclusion of nonpolar substances from an aqueous solution?

A) nonpolar effect

B) lipid effect
C) hydrophobic effect
D) oil droplet effect
E) amphiphilic effect

Answer: C

Difficulty: Easy
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

13) Which of the following is an example of the hydrophobic effect?

A) the lipid membrane of cells and organelles
B) protein folding that places hydrophobic amino acids in the interior of the protein
C) the separation of salad dressing
D) oil sheens seen on the ocean following an oil spill
E) all of the above

Answer: E

Difficulty: Easy
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

14) Which of the following explains the attractive forces between hydrophobic molecules in an aqueous solution?

A) in an aqueous environment, London dispersion forces between hydrophobic molecules become stronger
B) in an aqueous environment, London dispersion forces between hydrophobic molecules and water become stronger
C) since nonpolar molecules do not form hydrogen bonds with hydrogen bonds with water, they can form hydrogen bonds with other nonpolar molecules
D) there is no increase in attractive forces between nonpolar molecules in an aqueous environment
E) none of the above

Answer: D

Difficulty: Hard
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

15) Considering the energetics of transferring nonpolar molecules from water to a nonpolar solvent, the factor $T\Delta S$ is generally _____, causing ΔG to be _____.

A) positive; negative
B) negative; negative
C) positive; positive
D) positive; positive
E) negligible; either positive or negative

Answer: A

Difficulty: Hard
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

16) A molecule that has both a polar and nonpolar region is called _____.

A) micelleic
B) amphiphilic
C) endergonic
D) a membrane
E) none of the above

Answer: B

Difficulty: Easy
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

17) Which of the following is an example of an amphipathic molecule?

A) adenine, a base found in nucleic acids
B) glucose, a monosaccharide
C) serine, an amino acid
D) palmitic acid, a fatty acid
E) none of the above

Answer: D

Difficulty: Medium
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

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18) In aqueous solution, globules of up to several thousand amphiphilic molecules arranged with the hydrophilic groups on the surface and the hydrophobic groups buried in the center are called _____.

A) micelles
B) vacuoles
C) liposomes
D) bilayers
E) none of the above

Answer: A

Difficulty: Easy
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

19) Fatty acid anions most commonly assemble into _____ in aqueous solution.

A) lipid bilayers
B) solvent-filled vesicles
C) micelles
D) liposomes
E) none of the above

Answer: C

Difficulty: Easy
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

20) Which of the following molecules would be prevented from readily crossing a lipid bilayer?

A) glucose
B) sodium ions
C) potassium ions
D) water
E) all of the above

Answer: E

Difficulty: Medium
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

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21) Which of the following is true regarding hydrophobic interactions between nonpolar molecules or groups?

A) they result from the tendency to maximize water's contact with nonpolar molecules
B) they require the presence of surrounding water molecules
C) they are the result of strong attractions between nonpolar regions
D) they are the result of strong repulsion between water and nonpolar regions
E) they depend on strong permanent dipoles in the nonpolar molecules

Answer: B

Difficulty: Medium
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

22) In an aqueous solution, if the $[OH^-]$ is 3.0×10^{-5} M, what is the $[H^+]$?

A) 7.0×10^{-9}
B) 7.0×10^{-2}
C) 3.3×10^{-3}
D) 3.3×10^{-10}
E) none of the above

Answer: D

Difficulty: Medium
Section Reference: 2-3
Learning Objective: Determine the effect of acids and bases on a solution's pH

23) What is the $[H^+]$ of an aqueous solution with a pH of 6.2?

A) 6.2×10^{-6}
B) 1.6×10^{-8}
C) 6.3×10^{-7}
D) $3.\ 3\times10^{-5}$
E) none of the above

Answer: C

Difficulty: Medium
Section Reference: 2-3
Learning Objective: Determine the effect of acids and bases on a solution's pH

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24) What would be the resulting pH if one drop (0.05 ml) of 1.0 M HCl was added to one liter of pure water (assume pH 7.0)?

A) 2.7
B) 4.3
C) 5.0
D) 7.0 (there would be no significant change)
E) 9.7

Answer: B

Difficulty: Hard
Section Reference: 2-3
Learning Objective: Determine the effect of acids and bases on a solution's pH

25) What would be the resulting pH if one ml of 1.0 M NaOH was added to one liter of pure water (assume pH 7.0)?

A) 1
B) 3
C) 7.3
D) 11
E) 13

Answer: D

Difficulty: Medium
Section Reference: 2-3
Learning Objective: Determine the effect of acids and bases on a solution's pH

26) Which of the following would be the strongest acid?

A) formic acid, pK=3.75
B) succinic acid, a diprotic acid with pK=4.21 and 5.64
C) acetic acid, pK=4.76
D) ammonium ion, pK=9.25
E) cannot be determined from the given information

Answer: A

Difficulty: Easy
Section Reference: 2-3

Essential Biochemistry 5th edition Pratt Test Bank

Learning Objective: Determine the effect of acids and bases on a solution's pH

27) What is the pH of a solution that contains three parts of acetic acid and one part sodium acetate? The p*K* for acetic acid is 4.76.

A) 5.24
B) 5.06
C) 4.46
D) 4.28
E) cannot be determined from the given information

Answer: D

Difficulty: Medium
Section Reference: 2-3
Learning Objective: Determine the effect of acids and bases on a solution's pH

28) If the p*K* values for phosphoric acid are 2.15, 6.82 and 12.38, at what pH would one observe equal amounts of $H_2PO_4^-$ and HPO_4^{2-}?

A) 2.15
B) 4.49
C) 6.82
D) 9.60
E) 12.38

Answer: C

Difficulty: Medium
Section Reference: 2-3
Learning Objective: Determine the effect of acids and bases on a solution's pH

29) If 1.0 mL of 1.0 M acetic acid (pK = 4.76, $K = 1.74 \times 10^{-5}$) was added to one liter of pure water, what is the resulting pH?

A) 1.0
B) 1.3
C) 3.0
D) 3.9
E) 10.1

Answer: D

Difficulty: Hard

Section Reference: 2-3
Learning Objective: Determine the effect of acids and bases on a solution's pH

30) If the p*K* values for phosphoric acid are 2.15, 6.82 and 12.38, _____ would predominate at pH 5 while _____ would predominate at pH 10.

A) H_3PO_4; $H_2PO_4^-$
B) H_3PO_4; HPO_4^{2-}
C) H_3PO_4; PO_4^{3-}
D) $H_2PO_4^-$; PO_4^{3-}
E) $H_2PO_4^-$; HPO_4^{2-}

Answer: E

Difficulty: Medium
Section Reference: 2-3
Learning Objective: Determine the effect of acids and bases on a solution's pH

31) What is the conjugate acid of $H_2PO_4^-$?

A) HPO_4^{2-}
B) H_2PO_4
C) H_3PO_4
D) PO_4^{3-}
E) none of the above

Answer: C

Difficulty: Easy
Section Reference: 2-3
Learning Objective: Determine the effect of acids and bases on a solution's pH

32) Considering a 0.1 M formic acid buffer, what is the concentration of formic acid present in a solution of pH 4.25 if the p*K* of formic acid is 3.75?

A) 0.024 M
B) 0.033 M
C) 0.067 M
D) 0.076 M
E) none of the above

Answer: A

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Difficulty: Hard
Section Reference: 2-4
Learning Objective: Describe how buffer solutions resist changes in pH

33) Which of the following shows the buffer that is found in the blood stream?

A) $H_3PO_4 \rightleftharpoons H_2PO_4^{2-} + H^+$
B) $H_2PO_4^- \rightleftharpoons HPO_4^{2-} + H^+$
C) $HPO_4^{2-} \rightleftharpoons PO_4^{3-} + H^+$
D) $H_2CO_3 \rightleftharpoons HCO_3^- + H^+$
E) $HCO_3^- \rightleftharpoons CO_3^{2-} + H^+$

Answer: D

Difficulty: Medium
Section Reference: 2-5
Learning Objective: Explain how the human body maintains a constant pH

34) Which of the following shows the intracellular buffer?

A) $H_3PO_4 \rightleftharpoons H_2PO_4^{2-} + H^+$
B) $H_2PO_4^- \rightleftharpoons HPO_4^{2-} + H^+$
C) $HPO_4^{2-} \rightleftharpoons PO_4^{3-} + H^+$
D) $H_2CO_3 \rightleftharpoons HCO_3^- + H^+$
E) $HCO_3^- \rightleftharpoons CO_3^{2-} + H^+$

Answer: B

Difficulty: Medium
Section Reference: 2-4
Learning Objective: Describe how buffer solutions resist changes in pH

35) If a phosphate buffer (pK=6.82) was formulated such that its pH was 7.3, it would be best suited to buffer against _____. If instead, it was formulated such that its pH was 6.3, it would be best suited to buffer against _____.

A) acid; base
B) acid; acid
C) base; acid
D) base; base
E) a buffer with a pH that far from the pK would not be an effective buffer

Answer: A

Difficulty: Hard
Section Reference: 2-4
Learning Objective: Describe how buffer solutions resist changes in pH

36) Which of the following could be used to formulate 100 mls of a 0.10 M acetate buffer (p*K*=4.76) at pH 5 if you start with 64 mls of 0.10 M sodium acetate?

A) 3.6 mls of 1 M HCl
B) 3.6 mls of 1 M NaOH
C) 34 mls of 0.10 M HCl
D) 34 mls of 0.10 M NaOH
E) 34 mls of 0.10 M acetic acid

Answer: E

Difficulty: Hard
Section Reference: 2-4
Learning Objective: Describe how buffer solutions resist changes in pH

37) Which of the following could be used to formulate 100 mls of a 0.10 M phosphate buffer (p*K*=6.82) at pH 7.2?

A) 2.9 mmoles of Na_2HPO_4 and 7.1 mmoles of $NaHPO_4$
B) 10 mmoles of Na_2HPO_4 and 7.1 mmoles of NaOH
C) 10 mmoles of $NaHPO_4$ and 7.1 mmoles of HCl
D) 10 mmoles of H_3PO_4 and 17.1 mmoles of NaOH
E) all of the above

Answer: E

Difficulty: Hard
Section Reference: 2-4
Learning Objective: Describe how buffer solutions resist changes in pH

38) Metabolic acidosis often causes increased respiratory rates. What portion of the bloodstream buffer is lost through increased respiration?

A) H^+
B) HCO_3^-
C) H_2CO_3
D) CO_2
E) H_2O

Answer: D

Difficulty: Easy
Section Reference: 2-5
Learning Objective: Explain how the human body maintains a constant pH

39) What is the resulting pH if 10 millimoles of HCl is added to 1 liter of a 0.1 M phosphate buffer at pH 7.00 (p*K*=6.82)?

A) 6.82
B) 6.98
C) 7.01
D) 7.19
E) cannot be determined

Answer: A

Difficulty: Hard
Section Reference: 2-4
Learning Objective: Describe how buffer solutions resist changes in pH

40) During vigorous exercise, hydrogen ions are produced within cells as a result of increased metabolism. What component of the intracellular buffer would increase as a result of the increased H^+ production?

A) H_3PO_4
B) $H_2PO_4^-$
C) HPO_4^{2-}
D) PO_4^{3-}
E) none of the above

Answer: B

Difficulty: Medium
Section Reference: 2-4
Learning Objective: Describe how buffer solutions resist changes in pH

Question type: True/False

41) The most common disorder of acid-base chemistry in the human body is metabolic alkalosis.

Answer: False

Difficulty: Easy
Section Reference: 2-5
Learning Objective: Explain how the human body maintains a constant pH

Question type: Multiple-Selection

42) Which of the following can cause metabolic acidosis?

A) shock
B) overproduction of mineralcorticoids
C) slow, shallow breathing
D) renal failure
E) central nervous system depression

Answer 1: A
Answer 2: D

Difficulty: Medium
Section Reference: 2-5
Learning Objective: Explain how the human body maintains a constant pH

Question type: Dropdown

43) During metabolic acidosis, ___ ventilation excretes acid in the form of ___.

Dropdown 1: **increased**, decreased
Dropdown 2: H_2CO_3, HCO_3^-, **CO_2**

Difficulty: Medium
Section Reference: 2-5
Learning Objective: Explain how the human body maintains a constant pH

Question type: Dropdown

44) The amino acid ___ is metabolized in the kidney to produce ___ molecules of ammonia.

Dropdown 1: glutamic acid, **glutamine**, lysine
Dropdown 2: 1, **2**, 3

Difficulty: Medium
Section Reference: 2-5

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Learning Objective: Explain how the human body maintains a constant pH

Question Type: True/false

45) Free amine groups are excreted as the ammonium ion, NH_4^+, and thus help to lower blood pH.

Answer: True

Difficulty: Medium
Section Reference: 2-5
Learning Objective: Explain how the human body maintains a constant pH

Question type: Dropdown

46) Metabolic alkalosis most commonly results from ___ or ___.

Dropdown 1: central nervous system depression, **excessive vomiting**, renal failure
Dropdown 2: rapid, deep breathing, **overproduction of mineralcorticoids**, severe diarrhea

Difficulty: Medium
Section Reference: 2-5
Learning Objective: Explain how the human body maintains a constant pH

Question type: Text entry

47) The 104.5° bond angle in the water molecule is the result of the _____ of electron orbitals around oxygen.

Answer: tetrahedral arrangement

Difficulty: Easy
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

48) The polarity of the O–H bond is caused by the _____ of oxygen relative to that of hydrogen.

Answer: higher electronegativity

Difficulty: Easy
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

Question type: Multiple choice

49) Which of the following statements about water is not true?

A) It has a high dielectric constant.
B) It dissolves salts and polar substances.
C) It can form two hydrogen bonds per water molecule.
D) It packs in a hexagonal- (honeycomb-) shaped lattice when the temperature falls below 0°C.
E) In the liquid state it is only 15% less hydrogen bonded than in the solid state at 0°C.

Answer: C

Difficulty: Easy
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

50) Molecules such as methanol and ethanol are very soluble in water because _____.

A) they tend to avoid contact with each other
B) they contain C─H groups that donate H-bonds to water
C) they contain C─H groups that accept H-bonds from water
D) they contain O─H groups that can form multiple H-bonds with water
E) they do not form intermolecular H-bonds

Answer: D

Difficulty: Easy
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

51) Hydrophobic interactions between nonpolar molecules _____.

A) result from the tendency of water to maximize contact with nonpolar molecules
B) are the result of strong attractions between nonpolar molecules
C) are the result of strong repulsion between water and nonpolar molecules
D) depend on strong permanent dipoles in the nonpolar molecules
E) require the presence of surrounding water molecules

Answer: E

Difficulty: Easy
Section Reference: 2-2
Learning Objective: Relate the solubility of substances to the hydrophobic effect

52) Urea is a water-soluble product of nitrogen metabolism. How many hydrogen bonds can one urea molecule donate to surrounding water molecules?

A) 2
B) 3
C) 4
D) 5
E) 6

Answer: C

Difficulty: Moderate
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds

53) Phosphoric acid is a polyprotic acid, with pK values of 2.14, 6.86, and 12.38. Which ionic form predominates at pH 9.3?

A) H_3PO_4
B) $H_2PO_4^-$
C) HPO_4^{2-}
D) PO_4^{3-}
E) none of the above

Answer: C

Difficulty: Moderate
Section Reference: 2-3
Learning Objective: Determine the effect of acids and bases on a solution's pH

Question type: Short Answer

54) Biological processes can be best understood in the context of water.
a. What effect does water have on the noncovalent interactions between either charged or polar groups/molecules?

b. Why is this effect important with respect to biochemical processes?

Answer: a. Water reduces the strength of those interactions.
b. Water reduces the strength of polar and ionic interactions. This makes those interactions reversible and life is based on reversible interaction between biomolecules.

Difficulty: Difficult
Section Reference: 2-1
Learning Objective: Explain water's properties in terms of its ability to form hydrogen bonds.