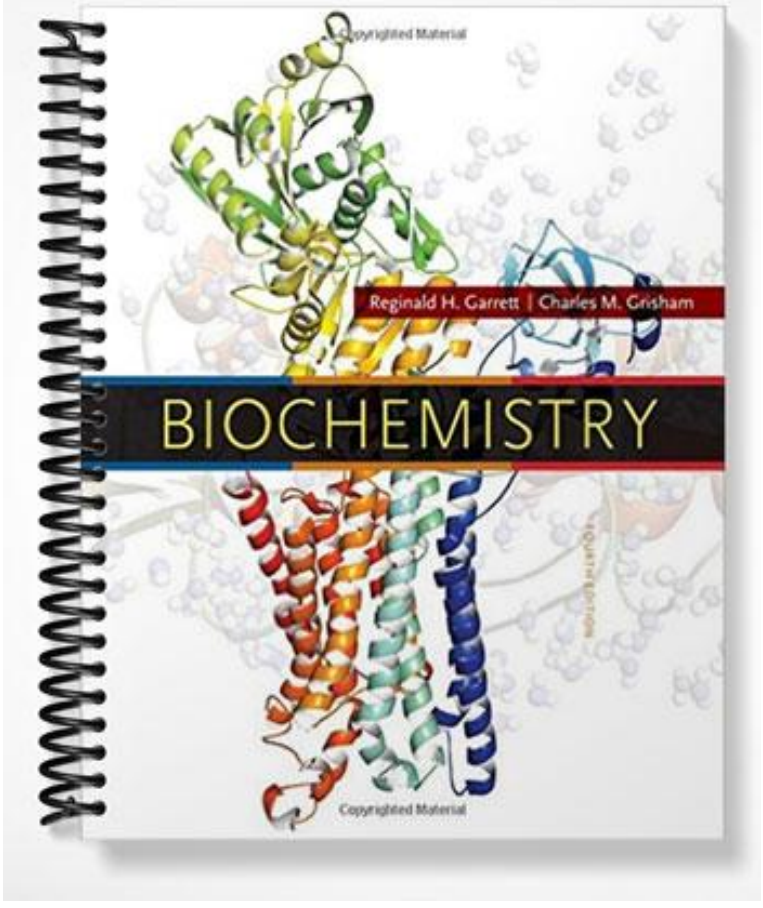
TEST BANK


Copyrighted Material
Reginald H. Garrett | Charles M. Grisham
BIOCHEMISTRY
4 QUARTER EDITION
Copyrighted Material

Chapter 2--Water: The Medium of Life

Student: _____

1. Properties of water that render it so suited to its role as a medium of life include all EXCEPT:

   A. Unrivaled ability to form hydrogen bonds.
   B. Unusually high dielectric constant of water explains water's ability to surround ions and increase the ions' attraction for one another.
   C. Unparalleled ability to orient around nonpolar solutes to promote hydrophobic interactions.
   D. The small, but significant, tendency to form H^+ and OH^- ions.
   E. None, all are true.

2. All are true for water for a substance of its molecular weight that is neither metallic nor ionic EXCEPT:

   A. a high surface tension.
   B. a chemically inert solvent, which has a great capacity to dissolve a diverse spectrum of molecules and ions.
   C. a positive volume of melting.
   D. a high dielectric constant.
   E. a high capacity to form hydrogen bonds

3. The unrivaled ability to form ____ hydrogen bonds per liquid water molecule is the source of the strong intermolecular attractions unique to water.

   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

4. Because of its highly polar nature, water is an excellent solvent for polar substances, but NOT for:

   A. salts.
   B. sugars.
   C. aldehydes and ketones.
   D. hydrocarbons.
   E. alcohols and amines.

5. The solvent with the highest dielectric constant in this group is:

   A. water.
   B. acetic acid.
   C. ethanol.
   D. hexane.
   E. benzene.

6. Hydrogen bonds in ice are all EXCEPT:

   A. directional.
   B. straight.
   C. weak.
   D. responsible for the lower density of ice over liquid water.
   E. holding water molecules in ice apart.

7. Pure liquid water consists of H_2O molecules:

   A. held in a rigid three-dimentional network.
   B. with local preference for linear geometry.
   C. with large numbers of strained or broken hydrogen bonds.
   D. which do not switch H-bonds readily.
   E. all are true.

8. The average lifetime of a hydrogen bond connection in water is on the order of 10:

   A. picoseconds.
   B. microseconds.
   C. milliseconds.
   D. seconds.
   E. nanoseconds.

9. The ____ bonding of water with the polar functional groups on nonionic polar solutes such as sugars are ____ than the intermolecular attractions between solute molecules allowing solute molecules to readily dissolve in water.

   A. ionic, stronger
   B. hydrogen, weaker
   C. hydrophobic, stronger
   D. hydrogen, stronger
   E. ionic, weaker

10. The H-bonded water around an ionic substance tends to ____; and the H-bonded water around nonpolar solutes tends to ____.

    A. inhibit ionization, promote hydrophobic interactions
    B. inhibit ionization, inhibit hydrophobic interactions
    C. not impact ionization, inhibit hydrophobic interactions
    D. promote ionization, not impact hydrophobic interactions
    E. promote ionization, promote hydrophobic interactions

11. Amphiphilic (amphipathic) molecules include:

    A. sugars.
    B. acidic amino acids.
    C. inorganic salts.
    D. water.
    E. salts of fatty acids.

12. In micelles:

    A. polar ends form hydrophobic interactions with water.
    B. nonpolar ends form hydrophilic interactions with water.
    C. hydrocarbon tails form hydrophobic interactions with water.
    D. polar ends are hydrophobic and nonpolar ends are hydrophilic.
    E. hydrocarbon tails are excluded from the water into hydrophobic domains.

13. By limiting the orientation that neighboring water molecules can assume, solutes give ____ to the solvent and ____ the dynamic interplay among H_2O molecules that occurs in pure water.

    A. pressure, disrupt
    B. disorder, increase
    C. disorder, decrease
    D. order, diminish
    E. order, increase

14. To ____ the osmotic pressure created by the contents of their cytosol, cells tend to store substances such as amino acids and sugars in ____ form.

    A. increase, monomeric
    B. minimize, polymeric
    C. minimize, monomeric
    D. maximize, polymeric
    E. increase, polymeric

15. Water ionizes because:

    A. the smaller electronegative oxygen atom strips the electron from one of its hydrogen atoms, leaving the proton to dissociate.
    B. the larger electronegative oxygen atom strips the electron from one of its hydrogen atoms, leaving the proton to dissociate.
    C. the smaller electropositive oxygen atom strips the electron from one of its hydrogen atoms, leaving the proton to dissociate.
    D. the larger electropositive oxygen atom strips the electron from one of its hydrogen atoms, leaving the proton to dissociate.
    E. None of the above

16. Grapefruit juice at pH 3.2 contains about ____ times as much H^+ as orange juice at pH 4.3.

A. 0.9
B. $10^{-7.5}$
C. 10^{-2}
D. 12
E. 101

17. All are examples of weak electrolytes EXCEPT:

A. hydrochloric acid.
B. acetic acid.
C. lactic acid.
D. phosphoric acid.
E. carbonic acid.

18. If equal amounts of Na_2HPO_4 and NaH_2PO_4 are mixed in water, calculate the resulting pH. The pK_as of phosphoric acid are 2.1, 7.2, 12.4.

A. 2.1
B. 4.65
C. 7.2
D. 9.8
E. 12.4

19. Estimate the pH of the resulting solution prepared by mixing 1.0 mole of solid disodium phosphate (Na_2HPO_4) and 1.25 mole of hydrochloric acid. The pK_as of phosphoric acid are 2.1, 7.2, 12.4.

A. pH < 2.1
B. pH = 2.1
C. 2.1 < pH < 7.2
D. pH = 7.2
E. pH = 12.4

20. Which of the following pairs would be the best buffer at pH 10.0?

A. Acetic acid and sodium acetate (pK_a = 4.76)
B. H_2CO_3 and $NaHCO_3$ (pK_as are 3.77 and 10.4)
C. Lactic acid and sodium lactate (pK_a = 3.86)
D. NaH_2PO_4 and Na_2HPO_4 (pK_as are 2.1, 7.2, 12.4)
E. Sodium succinate and succinic acid (pK_a = 4.21)

21. What ionic forms are present at pH 7.0? The pK_as of phosphoric acid are 2.1, 7.2, 12.4.

A. HPO_4^{-2}
B. $H_2PO_4^-$
C. HPO_4^{-2} and PO_4^{-3}
D. $H_2PO_4^-$ and HPO_4^{-2}
E. All are correct

22. A plasma pH of 6.8 doesn't seem too far away from a normal pH of 7.4, but at pH 6.8 the H^+ concentration is ____ times greater than at pH 7.4 and results in severe acidosis.

A. 0.1
B. 0.6
C. 4
D. 10
E. 20

23. pH = pK_a when:

A. $[A^-]/[HA] = 0$
B. $\log([A^-]/[HA]) = 1$
C. $[A^-] >> [HA]$
D. $[A^-] = [HA]$
E. $\log([HA]/[A^-]) = 1$

24. Buffers have all of the following characteristics EXCEPT:

A. they have relatively flat titration curves at the pH(s) where they buffer.
B. they resist changes in their pH as acid or base is added.
C. they are typically composed of a weak acid and its conjugate base.
D. they buffer best for polyprotic acids half-way between the two pK_a values.
E. buffer where the amounts of conjugate base are nearly equivalent to the amounts of weak acid.

25. Buffer systems are effective when the pH values are within ____ pH unit(s) of the pK_a value.

A. 1
B. 2
C. 3
D. 4
E. 5

26. Intracellular pH is maintained primarily by the ____ and ____ buffer systems, and the extracellular pH by the ____ buffer system.

A. $HPO_4^{2-}/H_2PO_4^-$; HCO_3^-/H_2CO_3; histidine
B. $H_3PO_4/H_2PO_4^-$; histidine; HCO_3^-/H_2CO_3
C. HCO_3^-/H_2CO_3; $H_3PO_4/H_2PO_4^-$; histidine
D. $HPO_4^{2-}/H_2PO_4^-$; histidine; HCO_3^-/H_2CO_3
E. HCO_3^-/H_2CO_3; histidine; $H_3PO_4/H_2PO_4^-$

27. Hyperventilation is a physiological mechanism to:

A. lower $[CO_2(g)]$ in the blood and increase blood pH.
B. raise $[CO_2(g)]$ in the blood and increase blood pH.
C. lower $[CO_2(g)]$ in the blood and decrease blood pH.
D. raise $[CO_2(g)]$ in the blood and decrease blood pH.
E. lower $[CO_2(g)]$ in the blood and increase $[HCO_3^-]$.

28. Water is particularly suited as a solvent for biosystems because it has all of the following characteristics EXCEPT:

A. Water is a medium for ionization enhancing the variety of chemical species.
B. Water is innocuous, yet a powerful solvent.
C. Water is an excellent solvent for nonpolar substances.
D. Water is relatively chemically inert, yet dissolves a variety of solutes.
E. Through hydrophobic interactions, lipids coalesce into membranes in water.

29. Which of the following weak acids would make the best buffer at pH = 5.0?

A. acetic acid ($K_a = 1.74 \times 10^{-5}$, $pK_a = 4.76$)
B. $H_2PO_4^-$ ($K_a = 1.38 \times 10^{-7}$, $pK_a = 7.20$)
C. bicarbonate ($K_a = 6.3 \times 10^{-11}$, $pK_a = 10.24$)
D. *tris*-hydroxymethyl aminomethane ($K_a = 8.32 \times 10^{-9}$, $pK_a = 8.07$)
E. lactic acid ($K_a = 1.38 \times 10^{-4}$, $pK_a = 3.86$)

30. The enzyme fumarase has a pH optimum of about 7.6. What would be the buffer of choice to study this enzyme?

A. lactic acid ($K_a = 1.38 \times 10^{-4}$, $pK_a = 3.86$)
B. bicarbonate ($K_a = 6.3 \times 10^{-11}$, $pK_a = 10.24$)
C. acetic acid ($K_a = 1.74 \times 10^{-5}$, $pK_a = 4.76$)
D. succinate ($K_a = 2.34 \times 10^{-6}$, $pK_a = 5.63$)
E. tris-hydroxymethyl aminomethane ($K_a = 8.32 \times 10^{-9}$, $pK_a = 8.07$)

31. When preparing an acetate buffer at pH 4.5 with 0.01 M solutions of acetic acid ($pK_a = 4.8$) and sodium acetate, the volume of acetic acid needed would be ____ the volume of sodium acetate solution.

A. equal to
B. less than half of
C. more than half of
D. about six times
E. about twice

32. Hypoventilation is characterized by inability to excrete CO_2 rapidly enough and can be caused by all EXCEPT:

A. anesthetics.
B. depressant drugs.
C. narcotics.
D. lung diseases.
E. encephalitis.

33. If an abundance of an organic acid with a pK_a of 3.9 is found in the bloodstream, which of the following is true?

A. it will be mostly protonated
B. it will be mostly deprotonated
C. it will form an effective buffer
D. it will cause metabolic acidosis
E. both b and d are correct

34. Aspirin contains a carboxylic acid with a pK_a of 3.5. Which of the following is true?

A. Aspirin will be mostly protonated in the stomach
B. Aspirin will be mostly protonated in the bloodstream
C. Aspirin will be easily absorbed in the stomach due to its negative charge
D. Aspirin will be easily transported in the bloodstream due to its negative charge
E. both a and d are correct

35. If a weak acid is 25% deprotonated at pH 4, what would the pK_a be?

A. 3.40
B. 3.52
C. 4.48
D. 4.60
E. cannot determine from given information

Chapter 2--Water: The Medium of Life Key

1. Properties of water that render it so suited to its role as a medium of life include all EXCEPT:

   A. Unrivaled ability to form hydrogen bonds.
   B. Unusually high dielectric constant of water explains water's ability to surround ions and increase the ions' attraction for one another.
   C. Unparalleled ability to orient around nonpolar solutes to promote hydrophobic interactions.
   D. The small, but significant, tendency to form H^+ and OH^- ions.
   E. None, all are true.

2. All are true for water for a substance of its molecular weight that is neither metallic nor ionic EXCEPT:

   A. a high surface tension.
   B. a chemically inert solvent, which has a great capacity to dissolve a diverse spectrum of molecules and ions.
   C. a positive volume of melting.
   D. a high dielectric constant.
   E. a high capacity to form hydrogen bonds

3. The unrivaled ability to form ____ hydrogen bonds per liquid water molecule is the source of the strong intermolecular attractions unique to water.

   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

4. Because of its highly polar nature, water is an excellent solvent for polar substances, but NOT for:

   A. salts.
   B. sugars.
   C. aldehydes and ketones.
   D. hydrocarbons.
   E. alcohols and amines.

5. The solvent with the highest dielectric constant in this group is:

   A. water.
   B. acetic acid.
   C. ethanol.
   D. hexane.
   E. benzene.

6. Hydrogen bonds in ice are all EXCEPT:

A. directional.
B. straight.
C. weak.
D. responsible for the lower density of ice over liquid water.
E. holding water molecules in ice apart.

7. Pure liquid water consists of H_2O molecules:

A. held in a rigid three-dimentional network.
B. with local preference for linear geometry.
C. with large numbers of strained or broken hydrogen bonds.
D. which do not switch H-bonds readily.
E. all are true.

8. The average lifetime of a hydrogen bond connection in water is on the order of 10:

A. picoseconds.
B. microseconds.
C. milliseconds.
D. seconds.
E. nanoseconds.

9. The ____ bonding of water with the polar functional groups on nonionic polar solutes such as sugars are ____ than the intermolecular attractions between solute molecules allowing solute molecules to readily dissolve in water.

A. ionic, stronger
B. hydrogen, weaker
C. hydrophobic, stronger
D. hydrogen, stronger
E. ionic, weaker

10. The H-bonded water around an ionic substance tends to ____; and the H-bonded water around nonpolar solutes tends to ____.

A. inhibit ionization, promote hydrophobic interactions
B. inhibit ionization, inhibit hydrophobic interactions
C. not impact ionization, inhibit hydrophobic interactions
D. promote ionization, not impact hydrophobic interactions
E. promote ionization, promote hydrophobic interactions

11. Amphiphilic (amphipathic) molecules include:

A. sugars.
B. acidic amino acids.
C. inorganic salts.
D. water.
E. salts of fatty acids.

12. In micelles:

A. polar ends form hydrophobic interactions with water.
B. nonpolar ends form hydrophilic interactions with water.
C. hydrocarbon tails form hydrophobic interactions with water.
D. polar ends are hydrophobic and nonpolar ends are hydrophilic.
E. hydrocarbon tails are excluded from the water into hydrophobic domains.

13. By limiting the orientation that neighboring water molecules can assume, solutes give ____ to the solvent and ____ the dynamic interplay among H_2O molecules that occurs in pure water.

A. pressure, disrupt
B. disorder, increase
C. disorder, decrease
D. order, diminish
E. order, increase

14. To ____ the osmotic pressure created by the contents of their cytosol, cells tend to store substances such as amino acids and sugars in ____ form.

A. increase, monomeric
B. minimize, polymeric
C. minimize, monomeric
D. maximize, polymeric
E. increase, polymeric

15. Water ionizes because:

A. the smaller electronegative oxygen atom strips the electron from one of its hydrogen atoms, leaving the proton to dissociate.
B. the larger electronegative oxygen atom strips the electron from one of its hydrogen atoms, leaving the proton to dissociate.
C. the smaller electropositive oxygen atom strips the electron from one of its hydrogen atoms, leaving the proton to dissociate.
D. the larger electropositive oxygen atom strips the electron from one of its hydrogen atoms, leaving the proton to dissociate.
E. None of the above

16. Grapefruit juice at pH 3.2 contains about ____ times as much H^+ as orange juice at pH 4.3.

A. 0.9
B. $10^{-7.5}$
C. 10^{-2}
D. 12
E. 101

17. All are examples of weak electrolytes EXCEPT:

A. hydrochloric acid.
B. acetic acid.
C. lactic acid.
D. phosphoric acid.
E. carbonic acid.

18. If equal amounts of Na_2HPO_4 and NaH_2PO_4 are mixed in water, calculate the resulting pH. The pK_as of phosphoric acid are 2.1, 7.2, 12.4.

A. 2.1
B. 4.65
C. 7.2
D. 9.8
E. 12.4

19. Estimate the pH of the resulting solution prepared by mixing 1.0 mole of solid disodium phosphate (Na_2HPO_4) and 1.25 mole of hydrochloric acid. The pK_as of phosphoric acid are 2.1, 7.2, 12.4.

A. pH < 2.1
B. pH = 2.1
C. 2.1 < pH < 7.2
D. pH = 7.2
E. pH = 12.4

20. Which of the following pairs would be the best buffer at pH 10.0?

A. Acetic acid and sodium acetate (pK_a = 4.76)
B. H_2CO_3 and $NaHCO_3$ (pK_as are 3.77 and 10.4)
C. Lactic acid and sodium lactate (pK_a = 3.86)
D. NaH_2PO_4 and Na_2HPO_4 (pK_as are 2.1, 7.2, 12.4)
E. Sodium succinate and succinic acid (pK_a = 4.21)

21. What ionic forms are present at pH 7.0? The pK_as of phosphoric acid are 2.1, 7.2, 12.4.

A. HPO_4^{-2}
B. $H_2PO_4^-$
C. HPO_4^{-2} and PO_4^{-3}
D. $H_2PO_4^-$ and HPO_4^{-2}
E. All are correct

22. A plasma pH of 6.8 doesn't seem too far away from a normal pH of 7.4, but at pH 6.8 the H^+ concentration is ____ times greater than at pH 7.4 and results in severe acidosis.

A. 0.1
B. 0.6
C. 4
D. 10
E. 20

23. $pH = pK_a$ when:

A. $[A^-]/[HA] = 0$
B. $\log([A^-]/[HA]) = 1$
C. $[A^-] >> [HA]$
D. $[A^-] = [HA]$
E. $\log([HA]/[A^-]) = 1$

24. Buffers have all of the following characteristics EXCEPT:

A. they have relatively flat titration curves at the pH(s) where they buffer.
B. they resist changes in their pH as acid or base is added.
C. they are typically composed of a weak acid and its conjugate base.
D. they buffer best for polyprotic acids half-way between the two pK_a values.
E. buffer where the amounts of conjugate base are nearly equivalent to the amounts of weak acid.

25. Buffer systems are effective when the pH values are within ____ pH unit(s) of the pK_a value.

A. 1
B. 2
C. 3
D. 4
E. 5

26. Intracellular pH is maintained primarily by the ____ and ____ buffer systems, and the extracellular pH by the ____ buffer system.

A. $HPO_4^{2-}/H_2PO_4^-$; HCO_3^-/H_2CO_3; histidine
B. $H_3PO_4/H_2PO_4^-$; histidine; HCO_3^-/H_2CO_3
C. HCO_3^-/H_2CO_3; $H_3PO_4/H_2PO_4^-$; histidine
D. $HPO_4^{2-}/H_2PO_4^-$; histidine; HCO_3^-/H_2CO_3
E. HCO_3^-/H_2CO_3; histidine; $H_3PO_4/H_2PO_4^-$

27. Hyperventilation is a physiological mechanism to:

A. lower $[CO_2(g)]$ in the blood and increase blood pH.
B. raise $[CO_2(g)]$ in the blood and increase blood pH.
C. lower $[CO_2(g)]$ in the blood and decrease blood pH.
D. raise $[CO_2(g)]$ in the blood and decrease blood pH.
E. lower $[CO_2(g)]$ in the blood and increase $[HCO_3^-]$.

28. Water is particularly suited as a solvent for biosystems because it has all of the following characteristics EXCEPT:

A. Water is a medium for ionization enhancing the variety of chemical species.
B. Water is innocuous, yet a powerful solvent.
C. Water is an excellent solvent for nonpolar substances.
D. Water is relatively chemically inert, yet dissolves a variety of solutes.
E. Through hydrophobic interactions, lipids coalesce into membranes in water.

29. Which of the following weak acids would make the best buffer at pH = 5.0?

A. acetic acid ($K_a = 1.74 \times 10^{-5}$, $pK_a = 4.76$)
B. $H_2PO_4^-$ ($K_a = 1.38 \times 10^{-7}$, $pK_a = 7.20$)
C. bicarbonate ($K_a = 6.3 \times 10^{-11}$, $pK_a = 10.24$)
D. *tris*-hydroxymethyl aminomethane ($K_a = 8.32 \times 10^{-9}$, $pK_a = 8.07$)
E. lactic acid ($K_a = 1.38 \times 10^{-4}$, $pK_a = 3.86$)

30. The enzyme fumarase has a pH optimum of about 7.6. What would be the buffer of choice to study this enzyme?

A. lactic acid ($K_a = 1.38 \times 10^{-4}$, $pK_a = 3.86$)
B. bicarbonate ($K_a = 6.3 \times 10^{-11}$, $pK_a = 10.24$)
C. acetic acid ($K_a = 1.74 \times 10^{-5}$, $pK_a = 4.76$)
D. succinate ($K_a = 2.34 \times 10^{-6}$, $pK_a = 5.63$)
E. tris-hydroxymethyl aminomethane ($K_a = 8.32 \times 10^{-9}$, $pK_a = 8.07$)

31. When preparing an acetate buffer at pH 4.5 with 0.01 M solutions of acetic acid ($pK_a = 4.8$) and sodium acetate, the volume of acetic acid needed would be ____ the volume of sodium acetate solution.

A. equal to
B. less than half of
C. more than half of
D. about six times
E. about twice

32. Hypoventilation is characterized by inability to excrete CO_2 rapidly enough and can be caused by all EXCEPT:

A. anesthetics.
B. depressant drugs.
C. narcotics.
D. lung diseases.
E. encephalitis.

33. If an abundance of an organic acid with a pK_a of 3.9 is found in the bloodstream, which of the following is true?

A. it will be mostly protonated
B. it will be mostly deprotonated
C. it will form an effective buffer
D. it will cause metabolic acidosis
E. both b and d are correct

34. Aspirin contains a carboxylic acid with a pK_a of 3.5. Which of the following is true?

A. Aspirin will be mostly protonated in the stomach
B. Aspirin will be mostly protonated in the bloodstream
C. Aspirin will be easily absorbed in the stomach due to its negative charge
D. Aspirin will be easily transported in the bloodstream due to its negative charge
E. both a and d are correct

35. If a weak acid is 25% deprotonated at pH 4, what would the pK_a be?

A. 3.40
B. 3.52
C. 4.48
D. 4.60
E. cannot determine from given information