

1443

# FIRST WEEK

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DOCTOR 2022

1- If the pH of a solution decreased from 7.5 to 7. What change has occurred to the concentration of  $H_3O^+$ ?

- a- increased 3 times
- b- Increased 5 times
- c- Increased 500 times
- d- Increased  $10^5$  times
- e- Increased  $10^{(1/2)}$  times

2- Which of the following pairs can't make acid/conjugate base pair?

- a-  $CH_3CH_3 / CH_3CH_2$
- b-  $CH_3COOH / CHCOO^-$
- c-  $HSO_4^- / SO_4^{2-}$
- d-  $H_2CO_3 / NaHCO_3$
- e-  $H_3PO_4 / NaH_2PO_4$

3- Given pka of different acids, which one will have the strongest conjugate base when being dissociated with water?

- a- 3.5
- b- 2.9
- c- 4.76
- d- 7.2
- e- 12.4

1	2	3
a	a	e

4- What's the best description of water ion product?

a- the product of the concentration of positively and negatively charged ions resulting from the dissociation of water.

b- The product of the concentration of positively and negatively charged ions resulting from the dissociation of electrolyte solutions.

c- The product of the concentration of positively and negatively charged ions resulting from the dissociation of water and other electrolyte solutions.

d- None of the above

5-How many molecules of water dissociate into OH<sup>-</sup> and H<sub>3</sub>O<sup>+</sup>?

a- one in 7

b- One in 10<sup>7</sup>

c- One in 10<sup>12</sup>

d- One in 10<sup>-7</sup>

6- One of the following statements is not true about Carbonic acid/Bicarbonate buffer:

a- The most common extracellular buffer.

b- Under physiological conditions the ratio of [HCO<sub>3</sub><sup>-</sup>]/ [H<sub>2</sub>CO<sub>3</sub>]=20.

c- Its buffering range is less than the desirable pH and that's compensated by CO<sub>2</sub> mobility.

d- When adding a strong acid, it will react with HCO<sub>3</sub><sup>-</sup>

e- When adding a strong base, it will react with CO<sub>3</sub><sup>2-</sup>

4	5	6
C	b	e

7- All of the following will cause mild or severe acidosis except:

a- the presence of ketone bodies in untreated diabetic patient

b- The production of acids like lactic acid during metabolism

c- Excessive breathing

d- Repeated vomiting from the stomach containing HCL

8- If you have X moles of KOH, how many moles of an acid must be added to have a buffer with equal concentrations of A- and HA?

a- X

b- X/2

c- 2X

d- 1.5 X

e- None of the above

9- A 0.1 M base (B) has dissociated in water. Its  $pK_b = 5$ , Calculate its pH

a- 3

b- 11

c- 14

d- 5

e- 12

7	8	9
D	c	b

10- 100 mL of a buffer has a concentration of 0.2 M. The buffer is composed of a weak acid component and a conjugate base component and its pH=7.57. If 1 mL of 1 M HCl is added, what will be the new pH value? (Pka=7.57)

- a- 7
- b- 7,5
- c- 6
- d- 6,5

11- Which of the following has ion-dipole interaction:

- a- H<sub>2</sub>O
- b- Hydrophobic interaction
- c- NH<sub>3</sub>/NH<sub>3</sub>
- d- NaCl
- e- Na<sup>+</sup> (H<sub>2</sub>O)

12- Below is the pKa of some weak acids. Which weak acid will be 91 % undissociated at pH=4.86? a- Acetoacetic acid pka = 3.6

- b- Lactic acid pKa=3.9
- c- beta-hydroxyl butyric acid pka=4.8
- d- propionic acid pka=4.9
- e- Imidazolium pka=5.9

10	11	12
B	e	e

13- Which of the following acids or bases can make a buffer with its conjugate acid or its conjugate base?

- a- HCl
- b- KOH
- c- H<sub>2</sub>SO<sub>4</sub>
- d- None of the above

14- 100 mmol of a triprotic acid were titrated with KOH. PKa values = 3, 6, 9. How many mmoles of KOH must be added to have pH=6?

- a- 100- 200
- d- 250
- e- 300

15- If 10 mmoles of NaOH were dissolved in 1 L of water. What will be the pH of the solution?

- a- 2
- b- 1
- c- 3
- d- 12
- e- 9

13	14	15
D	b	d

16- A patient was found to have undetected diabetes mellitus for a while, in the urine sample taken  $[HCO_3^-] = 14.1$  and  $[CO_2] = 1.1$ , most likely pH of blood was

A) 7.1

B) 7.2

C) 7.4

D) 7.5

E) 7.6

ANSWER B

17. The pKa of a base is 4. If you have a 0.01M solution of this base, what is the pH?

A) 8

B) 9

C) 10

D) 11

E) 12

ANSWER D

18-. If 10 m moles of NaOH were dissolved in 1 L of water. What will be the pH of the solution?

A) 2

B) 1

C) 3

D) 12

E) 9

ANSWER D

19. What initial effects does hyperventilation have on the human's blood pH and  $\text{H}_2\text{CO}_3$  concentration?

- A) pH increases and  $[\text{H}_2\text{CO}_3]$  increases
- B) pH increases and  $[\text{H}_2\text{CO}_3]$  decreases
- C) pH decreases and  $[\text{H}_2\text{CO}_3]$  increases
- D) pH decreases and  $[\text{H}_2\text{CO}_3]$  decreases

ANSWER B

20. Gastric juice (pH= 1.4) compared to human's blood (pH= 7.4):

- A)  $[\text{H}^+]$  in gastric juice is 6 times higher than in blood
- B)  $[\text{H}^+]$  in gastric juice is  $10^6$  times higher than in blood
- C)  $[\text{H}^+]$  in blood is  $10^6$  times higher than in gastric juice
- D)  $[\text{H}^+]$  in gastric juice is 7 times higher than in blood

ANSWER B

21-More  $\text{CO}_2$  is exhaled when:

- a. Protein buffer system is activated
- b. The cytosolic pH decreases
- c. The pH of the blood increases
- d. The pH of the blood decreases
- e. The cytosolic pH increases



22-The buffer system that provides the highest extracellular capacity is:

- a. Protein
- b. Bicarbonate carbonic acid
- c. Albumin
- d. Phosphate
- e. Hemoglobin

ANSWER - B

23- Water molecules have \_\_\_\_\_ than molecules of similar size, such as ammonia and methane, reflecting its capacity to absorb large amounts of heat.

- A. less surface tensions
- B. a higher boiling point
- C. a lower capacity for forming hydrogen bonds
- D. a lower melting point

ANSWER - B

24- Although van der Waals forces are small, hydrophobic substances form cohesive droplets in aqueous solutions due to:

- A. Ionic bonding between water molecules
- B. Hydrogen bonding between water molecules, forming cages around the nonpolar droplets

- C. Stabilization of the hydrophobic phase by van der Waals interactions between water molecules
- D. The strong van der Waals forces between the nonpolar molecule
- E. Formation of insoluble lipid droplets

Answer: B

25) Sweating has a cooling effect because of water's high?

- A. surface tension
- B. density
- C. heat of vaporization
- D. buffering capacity
- E. specific heat

Answer: C

26- The ability of water to form hydrogen bonds is attributed to: -

- A. the oxygen atom in a water molecule has a weak positive charge.
- B. each of the hydrogen atoms in a water molecule is weakly negative in charge
- C. the bonds that hold together the atoms in a water molecule are polar covalent bonds

Answer: C

5) Water can form the following noncovalent interactions except:

- A. Hydrophobic interactions
- B. Van der Waals interactions
- C. electrostatic interactions
- D. hydrogen bonding

Answer : A

27-The  $pK_b$  of base is 2, what is the pH of a .01 M solution of the base?

- A. 12
- B. 8
- C. 10
- D. 11
- E. 9

Answer : A

28-Which of the following statements best describes what is meant by ion product of water:

- A. Product of concentrations of hydrogen ions and hydroxyl ions in water or an aqueous solution of an electrolyte

B. The sum of concentrations of hydrogen ions and hydroxyl ions in water or solution of electrolytes

C. The product of concentrations of hydrogen ion and hydroxyl ions that are derived only from water molecules in aqueous solution of electrolytes

D. The number of ionized molecules of H<sub>2</sub>O in one mole of a pure water E. The total number of negatively and positively charged ions in one liter of an aqueous solution of electrolytes

Answer : C

29-Membrane formation occurs in part due to the lipid solubility in water because of which of the following?

A. Hydrogen bond formation between lipids and water

B. hydrophobic interaction between lipid molecules

C. hydrophobic interactions between lipids and water

D. vander waals forces between lipids and water

E. covalent bond formation between lipids and water

Answer : B

30-you prepare a sodium phosphate buffer by mixing 100ml of 0.1 M Na<sub>2</sub>HPO<sub>4</sub> with 100ml of 0.1 M NaH<sub>2</sub>PO<sub>4</sub> . The pH of the final solution is 7.8 what is the approximate PKa of the acid component of the buffer ?

A. 7.8

B. 10 to the power of - 5.8

C. 10 to the power of 7.8

D. 6.8

E. 5.8

Answer : A

31) laboratory tests of the urine of a patient identified the presence of methylmalonate ( $-\text{OOC}-\text{CH}(\text{CH}_3)-\text{COO}-$ ). Methylmalonate is best described as one which one of the following ?

A. A strong acid

B. it is a triprotic acid

C. The conjugate base of a weak acid

D. It is 100% dissociated at its pka

E. It's a major intracellular buffer

Answer : C

32) hydrogen bonds can form between electronegative atoms such as oxygen and nitrogen and a hydrogen atom bonded to:

A. oxygen only

B. hydrogen

C. nitrogen only

D. carbon

E. an electronegative atom

Answer : E

33) a decrease blood pH from 7.5 to 7 would be accompanied by which of the following changes in ion concentration ?

- A. A ten-fold decrease in hydrogen concentration
- B. An increase in hydrogen ion concentration by a factor of  $7.5 / 7$
- C. five fold increase in hydroxyl ion concentration
- D. shift in concentration of buffer and ions with no change in hydrogen ion concentration
- E. A 3 fold increase in hydrogen ion concentration

Answer : E

34) during a short distance run, the muscles produce a large amount of lactic acid from their glucose stores. hyperventilation can be used for in this situation because:

- A. Adds  $H^+$  lowering the pH of the blood
- B. Increase the composition of bicarbonates
- C. remove  $H^+$  raising the pH of the blood
- D. Reduce the capacity of hemoglobin buffer system
- E. decreases the production of carbonic acid

Answer : E

35) in a titration curve of a weak acid the point in the plateau region between that inflection point and the equivalence point has the following characteristics

- A. it has a higher concentration of weak acid than the conjugate base
- B. all the equivalents needed for the titration were used up
- C. can act as a buffer
- D. the pH of the solution is definitely above 7
- E. repeat value equals the value of the acid PK

Answer : C

36) you have been observing an insect that defends itself from enemies by secreting a liquid . Analysis of lipid shows it to have a concentration of formic acid ( $K_a = 1.8 \times 10^{-4}$ ) of 1.45M and a concentration of formate ion of 0.015M what is the pH of the secretion ?

- A. 5.73
- B. 1.76
- C. 7
- D. 3.37
- E. 1.91

ANSWER – B

37) What is the pH if the concentration of the conjugate base ( $A^-$ ) is 0.35M and the concentration of the weak acid (HA) is 0.25M after adding 0.05 M of NaOH ? ( $pK_a = 7$ )

- A. pH =7.3
- B. pH=6.3
- C. pH=8.6
- D. others

Answer : A

38) We have a drug that has [HA] IONIZABLE ACID with pKa of 4.5, that enters the cell via the membrane , what is the best pH that enhances the entry of the drug ?

- A. pH=1
- B. Ph=4.8
- C. PH=3.9

Answer : A

39) A patient was found to have undetected diabetes mellitus for a while, in the urine sample taken  $[HCO_3^-] = 14.1$  and  $[CO_2] = 1.1$ , most likely pH of blood was ?

- A. 7.1
- B. 7.2
- C. 7.4
- D. 7.5
- E. 7.6

Answer: B



40) If you have x moles of KOH how many moles of an acid must be added to make a buffer solution?

- A. 2X HCl
- B. X/2 acetic acid
- C. 1.5 X acetic acid
- D. X acetic acid

Answer: C

41) What initial effects does hyperventilation have on the human's blood pH and  $\text{H}_2\text{CO}_3$  concentration?

- A. pH increases and  $[\text{H}_2\text{CO}_3]$  increases
- B. pH increases and  $[\text{H}_2\text{CO}_3]$  decreases
- C. pH decreases and  $[\text{H}_2\text{CO}_3]$  increases
- D. pH decreases and  $[\text{H}_2\text{CO}_3]$  decreases

Answer : B

45 ) Gastric juice (pH= 1.4) compared to human's blood (pH= 7.4): A.  $[\text{H}^+]$  in gastric juice is 6 times higher than in blood

- B.  $[\text{H}^+]$  in gastric juice is  $10^6$  times higher than in blood
- C.  $[\text{H}^+]$  in blood is  $10^6$  times higher than in gastric juice
- D.  $[\text{H}^+]$  in gastric juice is 7 times higher than in blood

Answer : B

46) Below is the pKa for weak acids, which weak acid will be approximately 9% dissociated at pH 3.88?

- A. Acetoacetic acid (pKa=3.6)
- B. Lactic acid (pKa=3.9)
- C. Beta-hydroxyl butyric acid (pKa=4.6)
- D. Propionic acid (pKa=4.9)
- E. Imidazolium (pKa=5.9)

Answer: D

47) A solution of a weak base (B) with a Volume of 2 L , Concentration = 0.01 M , pH =9 ,upon the addition of 0.685 g of its salt (BHCL) , the pH value changed by a 3 unit difference ,the M.W of the Salt BHCL (Hint: [B] remains the same) :-

- A. 68.5 B. 34.25
- C. 6.85
- D. 137

Answer: B

48) The pH of 0.1M HCL is 1.0 ,Of 0.1 M Acetic Acid is 2.8. What volume of 0.1N NaOH would be required to titrate 10 mL of each acid solution to their respective End point respectively ?

- A. 10 mL , 10 mL.
- B. 16 mL , 10 mL

C. 10 mL , 16 mL

D. 100 ml , 16 mL

Answer : A

56) A medical student is attempting to understand the buffering system of the human body and has set up the following experiment in the lab to help with his understanding. Consider a biochemical reaction that is taking place in a Total 0.1 M buffer. The initial pH is 7.4, and the pKa of the buffer is 7.2. If, in a final reaction, a volume of 1.0 mL, 10  $\mu\text{mol}$  of protons are generated, what would be the final pH of the solution?

A. 7.59

B. 7.25

C. 7.22

D. 7.00

E. 7.15

Answer: C

57) 4.13g OF  $\text{NaC}_2\text{H}_7\text{O}_4$  is added to 250 mL of a 0.150 M  $\text{HC}_2\text{H}_7\text{O}_4$  solution. With a  $K_a = 2.75 \times 10^{-5}$ , M.W of the salt 202.14 g/mol, What is the pH of the buffer system?

A. 6.54

B. 5.43

C. 4.28

D. 7.42

Answer: C

58) A buffer is made by adding 0.200 M  $\text{HC}_2\text{H}_3\text{O}_2$  and 0.150 M  $\text{NaC}_2\text{H}_3\text{O}_2$ . If 0.005 mol of NaOH is added to 125 mL of this buffer, What is the pH? ( $K_a = 1.8 \times 10^{-5}$  :-

A. 4.82

B. 4.18

C. 5.23

D. 6.47

Answer: A

59) Given that  $K_a$  for Pyruvate  $= 3.1 \times 10^{-3}$ , What is the pH of a buffer made by mixing 0.1 M Pyruvate with 0.12 M Sodium Pyruvate ?

A. 4.02

B. 2.45

C. 1.60

D. 2.59

Answer: D

60) Homeostasis maintains a blood plasma pH ranging between 7.35 and 7.45. The kidneys control the amount of bicarbonate ion, and the lungs

control the amount of carbon dioxide in plasma. If a person suffered from acidosis (caused, perhaps, by drinking acid):

- A. The respiratory system would hypoventilate, keeping more CO<sub>2</sub> in the plasma
- B. The lungs would hyperventilate, keeping CO<sub>2</sub> levels high in plasma
- C. The kidneys would remove HCO<sub>3</sub><sup>-</sup> from blood plasma and excrete it into the urine
- D. The lungs would hyperventilate, decreasing CO<sub>2</sub> in the plasma, and the kidneys would save HCO<sub>3</sub><sup>-</sup> and excrete it into blood plasma
- E. The kidneys would remove CO<sub>2</sub> and excrete it into blood plasma rather than into urine

Answer: D

61) Given a choice between acid A and acid B,:-

- A. Acid A is stronger if its conjugate base is stronger than that of Acid
- B. Acid A is stronger if its conjugate base is weaker than that of Acid
- C. Acid A is stronger if its conjugate base is a more complex ion than that of Acid
- D. Acid A is stronger if its conjugate base is a noble gas.
- E. There is no way to compare acid strength based on any of these factors

Answer: B

62) Carbon dioxide reacts with water to form carbonic acid which then ionizes according to the following equilibrium reaction:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{H}_2\text{CO}_3 \leftrightarrow \text{H}^+ + \text{HCO}_3^-$  - All the components of the reaction are water

soluble, but carbon dioxide is a gas. If you dissolve some sodium bicarbonate in water and then add hydrochloric acid, one of the following should be seen: -

- A. Carbon dioxide bubbling out.
- B. Carbon dioxide dissolving.
- C. Nothing, Carbon dioxide is an invisible gas
- D. The solution should turn blue
- E. The solution should turn red

Answer: A

63) The concentration of an acid is 0.1 with a volume of 5 mL the MW is 10 the  $K_a$  is  $1 \times 10^3$  and it was titrated by NaOH that has a concentration of 0.5 M and volume of 12 mL How much the  $[H^+]$  of the solution was?

- A. 0.8
- B. 1.4
- C. 1.2

Answer: C

64) What is the concentration of  $H_2PO_4$  if we have 0.5 eq in 500ml ?

- A. 0.5 M
- B. 0.25 M
- C. 1M

Answer: A

65) We have 0.5 ml of HCl and it's titrated by 0.5 M of NaOH with a volume of 12 ml what is the pH of the acid :

- A. 0.8
- B. 0.08

Answer: b

66) What is the pH if the concentration of the conjugate base (A-) is 0.35M and the concentration of the weak acid (HA) is 0.25M after adding 0.05 M of NaOH ? ( $pK_a = 7$ )

ANSWER: pH = 7.348)

67) THE following pairs can't make a buffer when mixed together (TRUE OR FALSE)? NaOH / NaCH<sub>3</sub>COO & CH<sub>3</sub>CH<sub>3</sub> / CH<sub>3</sub>CH<sub>2</sub>

ANSWER: TRUE

68) Given pka of different acids, which one will have the strongest conjugate base when being dissociated with water?

- A. 3.5
- B. 2.9
- C. 4.76
- D. 7.2
- E. 12.4

Answer: E

69) - One of the following statements is not true about Carbonic acid/Bicarbonate buffer:

- A. The most common extracellular buffer.
- B. Under physiological conditions the ratio of  $[\text{HCO}_3^-]/ [\text{H}_2\text{CO}_3] = 20$ .
- C. Its buffering range is less than the desirable pH and that's compensated by  $\text{CO}_2$  mobility.
- D. When adding a strong acid, it will react with  $\text{HCO}_3^-$
- E. When adding a strong base, it will react with  $\text{CO}_3^{2-}$

Answer: E

70) - All of the following will cause mild or severe acidosis except:

- A. the presence of ketone bodies in untreated diabetic patient
- B. The production of acids like lactic acid during metabolism
- C. Excessive breathing
- D. Repeated vomiting from the stomach containing HCL.

Answer: D

71) If you have X moles of KOH, how many moles of an acid must be added to have a buffer with equal concentrations of  $\text{A}^-$  and HA?

- A. X
- B.  $X/2$
- C.  $2X$



D. 1.5 X

E. None of the above

Answer: C

72) Below is the pKa of some weak acids. Which weak acid will be 91 % undissociated at pH=4.86?

A. Acetoacetic acid pka = 3.6

B. Lactic acid pKa=3.9

C. C- beta-hydroxyl butyric acid pka=4.8

D. propionic acid pka=4.9

E. Imidazolium pka=5.9

Answer: E

73) Which of the following acids or bases can make a buffer with its conjugate acid or its conjugate base?

A. HCl

B. KOH

C. H<sub>2</sub>SO<sub>4</sub>

D. None of the above

Answer: D

74) 100 mmol of a triprotic acid were titrated with KOH. PKa values = 3, 6, 9. How many mmoles of KOH must be added to have pH=6?

- A. 100
- B. 150
- C. 200
- D. 250
- E. 300

Answer: B

75) If you have x moles of KOH how many moles of an acid must be added to make a buffer solution?

- A. 2X HCl
- B. X/2 acetic acid
- C. 1.5 X acetic acid
- D. X acetic acid ANSWER:C25 BIOCHEM 020

76) The pKa of a base is 4. If you have a 0.01M solution of this base, what is the pH?

- A. 8
- B. 9
- C. 10
- D. 11
- E. 12

Answer: D

77) Buffers work the best at all these conditions except :

- A. when the pH to be maintained using the buffer has a value close to the pKa of its acid component.
- B. When the concentration of the acid component is equal to that of the base component.
- C. When the acid component is completely dissociated

Answer: C

WHEN YOU FEEL LIKE QUITTING ...  
THINK ABOUT WHY YOU STARTED