بسم الله الرحمن الرحيم

BIOCHEMISTRY
Test Bank 1

Lecture 1: Introduction

Lecture 2: Acids and Bases

Lecture 3: pH and Buffers (pt. 1)

Lecture 4: pH and Buffers (pt. 2)

QUIZ LINK
SCAN or TAP

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APPROVED
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TB1 (L1 – L4)

Q1: Which of the following is **not** a requirement for the occurrence of hydrogen bonding?

A. A donor
B. An acceptor
C. The presence of a hydrogen atom
D. Full charges
E. Partial charges

Answer: D

Q2: How does the strength of hydrogen bonds compare with covalent bonds?

A. Hydrogen bonds are much stronger than covalent bonds.

B. Hydrogen bonds are much weaker than covalent bonds.

C. Hydrogen bonds and covalent bonds have similar strengths.

D. The question cannot be answered without knowing which covalent bonds are being referred to

Answer: B

Q3: What is one characteristic of non-covalent interactions?

A. They are irreversible and relatively strong.
B. They are reversible and relatively weak.
C. They are formed between two neutral particles
D. They are not affected by distance.

Answer: B

Q4: Which type of non-covalent bond is the strongest?

A. Hydrogen bond
B. Van der Waals force
C. Ionic bond
D. Dipole-dipole interaction

Answer: C

Q5: The equation shows the first dissociation of the acid H_3AsO_4 in water. $H_3AO_4 + H_2O \rightarrow H_2AsO_4^- + H_3O^+$ Which pair is an acid-conjugate base pair?

A. H_3AsO_4 and H_2O

B. H_3AsO_4 and $H_2AsO_4^-$

C. H_3AsO_4 and H_3O^+

D. H_3O^+ and $H_2AsO_4^-$

E. H_3O^+ and OH-

Answer: B

Q6: The pH of a sample of blood is 7.4, while gastric juice is pH 1.4. The blood sample has:

A. 0.189 times the $[H^+]$ as the gastric juice.
B. 5.29 times lower $[H^+]$ than the gastric juice.
C. 6 times lower $[H^+]$ than the gastric juice.
D. 6,000 times lower $[H^+]$ than the gastric juice.
E. a million times lower $[H^+]$ than the gastric juice

Answer: E

Q7: If a solution is a buffer (given that acid and its conjugate base has the same molarity) its pH should be:

A. At its pK_a value
B. At is Ka value
C. At 7
D. At 14

Answer: A

Q8: The total ion product constant for water K_w is equal to (in M^2):

A. 10^{14}

B. 10^{7}

C. 10^{0}

D. 10^{-7}

E. 10^{-14}

Answer: E

Q9: Three unknown solutions are given with pH value of 6, 8, and 9.5, respectively. Which solution contains the highest concentration of OH^- ions?

A. Solution sample 1
B. Solution sample 2
C. Solution sample 3
D. Data are insufficient

Answer: C

Q10:

Solution X: pH = 6.8; Contains a weak acid and its conjugate base
Solution Y: pH = 8.2; Contains a weak base and its conjugate acid
Solution Z: pH = 5.5; Contains a strong acid and a strong base
Based on the information provided, which of the following statements is correct?

A. Solution X is a buffer, Solution Y is a non-buffer, and Solution Z is a buffer.
B. Solution X is a non-buffer, Solution Y is a buffer, and Solution Z is a non-buffer.
C. Solution X is a buffer, Solution Y is a buffer, and Solution Z is a non-buffer.
D. Solution X is a non-buffer, Solution Y is a non-buffer, and Solution Z is a buffer.

Answer: C

Q11: Consider a solution initially containing 0.40 mol fluoride anion and 0.30 mol of hydrogen fluoride (HF). How many moles of hydrogen fluoride are present after addition of 0.20 mol of HCl to this solution?

A. 0.20 mol
B. 0.30 mol
C. 0.40 mol
D. 0.50 mol
E. none of the above

Answer: D

Q12: If the [H_3O^+] of a solution is less than the [OH^-], the solution is:

A. acidic
B. basic
C. neutral
D. might be acidic, basic, or neutral

Answer: B

Q13: The pK_a of a weak acid was determined by measuring the acid molarity at 0.30 M and its conjugate base at 0.03 M. The measured pH was 6.0. What is the pK_a of the weak acid?

A. 5.00
B. 6.00
C. 7.00
D. 8.00
E. 9.00.

Answer: C

Q14: Calculate the pH of a buffer containing 0.1M of HA, and 0.1M of NaA, when 0.02 NaOH is added. (Ka = 10^{-4}).

A. 1.18
B. 2.18
C. 3.18
D. 4.18
E. 5.18

Answer: D

Q15: What is the molarity ratio (acid to conjugate base) that is present when the pH of a buffer is 2 units more than pKa?

A. 0.01
B. 0.1
C. 1
D. 10
E. 100

Answer: A

Q16: How many moles of sodium acetate must be added to 500 mL of 0.25 M acetic acid solution to produce a buffer with a pH of 4.94? The pK_a of acetic acid is 4.74.

A. 0.011 moles
B. 0.198 moles
C. 0.021 moles
D. 0.206 moles
E. 0.125 moles

Answer: B

Q17: The aqueous solution with the highest pH is:

A. 1M HCL
B. 1 M NH_3 (pK_a = 9.25).
C. 0.5 M NaHCO2 (pK_a = 3.77).
D. 0.1 M NaOH.
E. 0.001 M NaOH

Answer: D

Q18: Consider a solution initially containing 0.400 mol fluoride anion (F^-) and 0.300 mol of hydrogen fluoride (HF). How many moles of fluoride ion and hydrogen fluoride are present after addition of 70.0 mL of 0.600 M HCl to this solution?

A. 0.400 mol fluoride anion, 0.300 mol HF
B. 0.442 mol fluoride anion, 0.258 mol HF
C. 0.358 mol fluoride anion, 0.342 mol HF
D. 0.213 mol fluoride anion, 0.567 mol HF
E. none of the above

Answer: C

Q19: Oxalic acid $C_2H_2O_4$ (pK_a = 5.5) is a weak acid and its conjugate base $C_2HO_4^-$. At a physiological pH of 7.4, what is the ratio of concentrations $[C_2HO_4^-]$ / $[C_2H_2O_4]$?

A. 6.7
B. 67
C. 7.9
D. 79

Answer: D

Q20: At what point in a titration curve for a diprotic acid being fully titrated by NaOH is the pH equal to the pK_a of the acid (not its conjugate base)?
The x-axis scale goes from 0.0 mL to 20.0 mL of added base.

A. 10.0 mL

B. 5.0 mL

C. 18.0 mL

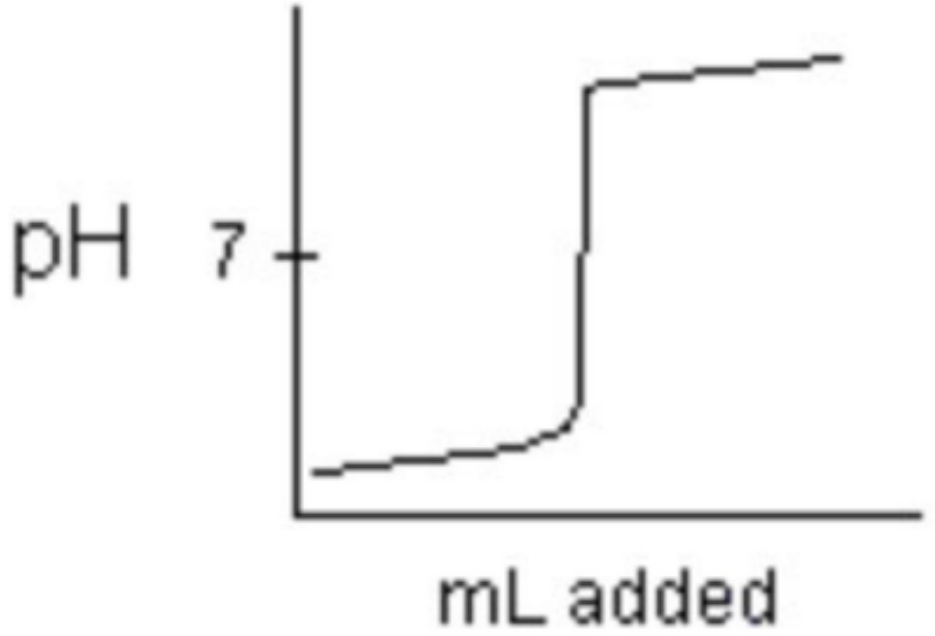
D. 9.0 mL

E. 15.0 mL

Answer: B

Q21: The following titration curve is the kind of curve expected for the titration of a _____ acid with a _____ base.

A. strong , strong
B. weak , weak
C. weak , strong
D. strong , weak
E. non of the above.



Answer: A

Q22: What is indicated by the shape of the titration curve?

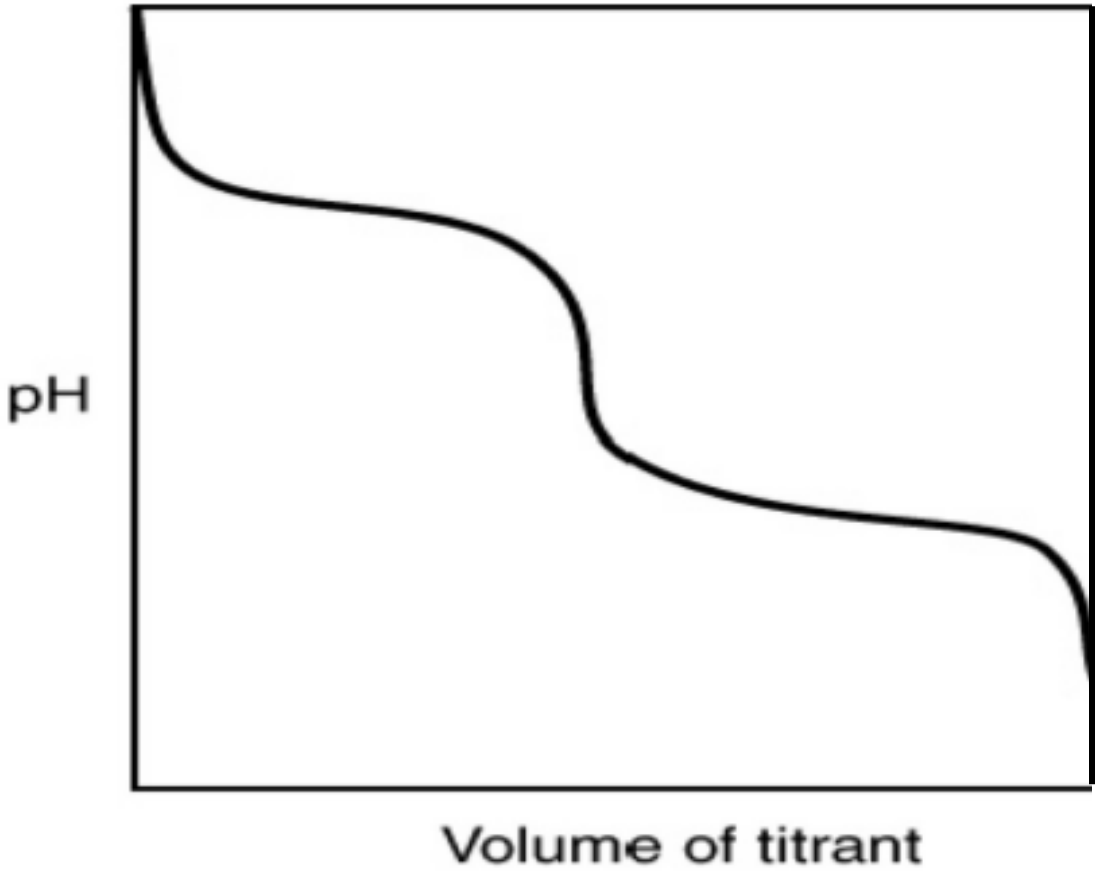
A. A diprotic acid was titrated with a strong base.

B. A triprotic acid was titrated with a strong base.

C. A diprotic base was titrated with a strong acid.

D. A triprotic base was titrated with a strong acid.

E. A strong acid was titrated with a strong base.



Answer: C

Q23: Three buffers are made by combining a 1 M solution of acetic acid with a 1 M solution of sodium acetate in the ratios shown below. Which of these statements is true of the resulting buffers?

A. pH of buffer 1 < pH of buffer 2 < pH of buffer 3

B. pH of buffer 1 = pH of buffer 2 = pH of buffer 3

C. pH of buffer 1 > pH of buffer 2 > pH of buffer 3

D. The problem cannot be solved without knowing the value of pK_a

	1 M acetic acid	1 M sodium acetate
Buffer 1:	10 mL	90 mL
Buffer 2:	50 mL	50 mL
Buffer 3:	90 mL	10 mL

Answer: C

Q24: If 2 L , 4 L and 6 L of three separate solutions of concentrations 1 M, 2 M and 3 M, respectively, are mixed then what is the concentration of the resultant mixture?

A. 2.333 M
B. 6.000 M
C. 3.333 M
D. 1.500 M

Answer: A

Q25: If the pH of a solution changes from 3 to 5, what happens to its acidity?

A. It increases
B. It decreases
C. It remains the same
D. It cannot be determined

Answer: B

Q26: How many acid equivalents are contained in 300 mL of 4.00 M phosphoric acid? (Assume the acid is to be completely neutralized by a base.)

A. 0.60 eq
B. 1.20 eq
C. 2.40 eq
D. 3.60 eq
E. 4.80 eq

Answer: D

Q27: A buffer system is set up with [HA] = 2[A^-]. If pK_a = 5.5, what is the pH of the buffer?

A. 3.5

B. 5.2

C. 5.8

D. 7.00

E. 7.5

Answer: B

Q28: Which of the following would be the best choice for preparing a buffer with a pH = 8.0?

A. a solution of formic acid and sodium formate, $K_a = 1.8 \times 10^{-4}$
B. a solution of acetic acid and sodium acetate, $K_a = 1.8 \times 10^{-5}$
C. a solution of hypochlorous acid and sodium hypochlorite, $K_a = 3.5 \times 10^{-8}$
D. a solution of boric acid and sodium borate, $K_a = 5.8 \times 10^{-10}$
E. All these solutions would be equally good choices for making this buffer.

Answer: C

Q29: Which of the following is **not** a reason carbonic acid buffer is functional at 7.4 pH level?

A. It is present in high concentration in the ECF
B. Lungs and kidneys are in control of if
C. The pH of blood (7.4) lies in the buffering range
D. The human body is an open system

Answer: C

Q30: How many moles of barium hydroxide are needed to reach the second midpoint in the titration of 1 L of 1 M phosphoric acid?

A. 0.5
B. 0.75
C. 1
D. 1.5
E. 2

Answer: B

Q31: Find the concentration of HCl, if 10 ml of 0.5 M $Ca(OH)_2$, is required to titrate 50 ml of HCl.

A. 5 M
B. 1/10 M
C. 10 M
D. 1/5 M
E. 1 M

Answer: D

Q32: What type of acid-base disorder is most likely present in the case of a patient who has ingested a large amount of sodium bicarbonate?

A. Respiratory Alkalosis when pH < 7.35
B. Metabolic Alkalosis when pH < 7.35
C. Respiratory Alkalosis when pH > 7.45
D. Metabolic Alkalosis when pH > 7.45
E. Both metabolic alkalosis and respiratory alkalosis

Answer: D

Q33: A student is nervous for a big exam and is breathing rapidly, what do you expect out of the followings?

A. Metabolic Acidosis
B. Metabolic Alkalosis
C. Respiratory Acidosis
D. Respiratory Alkalosis
E. None of the above

Answer: D

Q34: A 35-year-old patient with a history of asthma presents to the emergency department with shortness of breath and wheezing that has worsened over the past 2 days. The patient reports using their rescue inhaler more frequently, but it is providing less relief. Physical exam reveals tachypnea, diffuse wheezing on auscultation. The following lab results are obtained: pH: 7.25. What is the most likely diagnosis?

A. Respiratory acidosis
B. Respiratory alkalosis
C. Metabolic acidosis
D. Metabolic alkalosis

Answer: A