

Part One: Multiple choice. Make sure to **write your name on the information side** of the scantron and **bubble your 10 digit PHONE # for the ID # on the answer side.** (Use the phone # you provided on Exam 1.) Bubble Form A on the answer side. (33 pts: 3 pts each)

- The pH of Budweiser beer is 4.30. The $[\text{OH}^-]$ is ____ and the solution would be _____.
A. 5.0×10^{-5} M, acidic B. 5.0×10^{-5} M, basic C. 2.0×10^{-10} M, acidic
D. 2.0×10^{-10} M, basic E. 2.0×10^{-11} M, acidic
- Select the conjugate acid for HPO_4^{2-}
A. H_3PO_4 B. H_2PO_4^- C. H^+ D. PO_4^{3-} E. OH^-
- Select the solution with the **lowest pH**.
A. 0.10 M $\text{Ba}(\text{OH})_2$ B. 0.10 M HNO_2 C. 0.010 M HClO_4 D. 0.10 M HCl E. 0.10 M NaOH
- According to the **Bronsted-Lowry theory**, a **base** is
A. an electron pair donor B. an electron pair acceptor C. a proton donor
D. a proton acceptor E. a hydroxide ion donor
- Consider the K_a values for the following acids:

NH_4^+	$K_a = 5.6 \times 10^{-10}$
$\text{HC}_3\text{H}_3\text{O}_2$	$K_a = 5.5 \times 10^{-5}$
HCO_2H	$K_a = 1.8 \times 10^{-4}$
$\text{HC}_6\text{H}_5\text{O}$	$K_a = 1.6 \times 10^{-10}$
HNO_2	$K_a = 4.5 \times 10^{-4}$

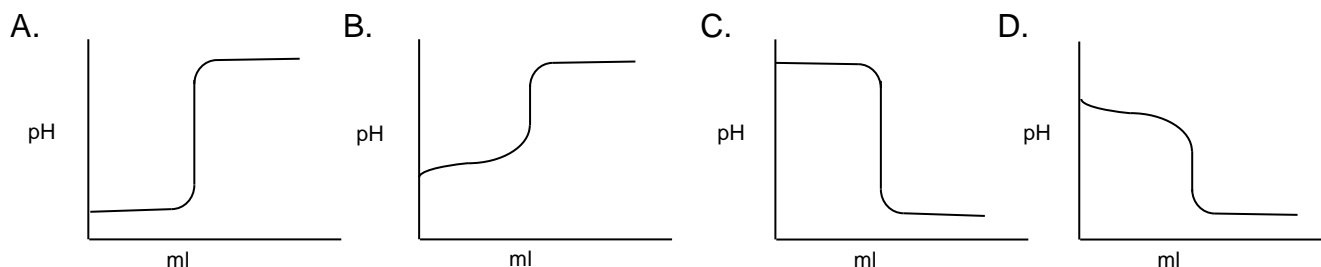
Which of the following conjugate bases is the **weakest base**?

A. NH_3 B. $\text{C}_3\text{H}_3\text{O}_2^-$ C. HCO_2^- D. $\text{C}_6\text{H}_5\text{O}^-$ E. NO_2^-
- When comparing two different 0.10 M acid solutions, which statement is **True**?
A. The stronger acid has a lower percent ionization.
B. The weaker acid has a lower $\text{p}K_a$ value.
C. The weaker acid has a lower pH reading.
D. The stronger acid is a better proton donor.
E. The weaker acid has a larger K_a value.
- What change will be caused by the addition of a small amount of $\text{HI}(aq)$ to a buffer solution containing $\text{LiHCO}_2(aq)$ and $\text{HCO}_2\text{H}(aq)$?
A. $[\text{H}_3\text{O}^+]$ will significantly increase
B. $[\text{OH}^-]$ will significantly increase
C. $[\text{HCO}_2\text{H}]$ will increase and $[\text{HCOO}^-]$ will decrease
D. $[\text{HCO}_2\text{H}]$ will decrease and $[\text{HCOO}^-]$ will increase
E. $[\text{HCO}_2\text{H}]$ and $[\text{HCOO}^-]$ will both increase
- Which of the following combinations could produce an effective **buffer solution**?
A. KClO_4 , HClO_4 B. HBrO , KBrO C. HI , NaOH D. NaOH , NaCl E. KBr , HBr
- When **$\text{HC}_2\text{H}_3\text{O}_3(aq)$ is titrated by a solution of $\text{RbOH}(aq)$** , the pH at the equivalence point is _____ because a _____ salt has formed.
A. 7, neutral B. $\text{pH} < 7$, acidic C. $\text{pH} < 7$, basic D. $\text{pH} > 7$, acidic E. $\text{pH} > 7$, basic

10. What occurs when $\text{NH}_4\text{NO}_3(\text{aq})$ is added to an $\text{NH}_3(\text{aq})$ solution?

- A. pH decreases and $[\text{OH}^-]$ decreases
- B. pH decreases and $[\text{OH}^-]$ increases
- C. pH increases and $[\text{OH}^-]$ decreases
- D. pH increases and $[\text{OH}^-]$ increases
- E. the pH and $[\text{OH}^-]$ do not change

11. Which plot shows the titration curve expected when $\text{LiOH}(\text{aq})$ is titrated by $\text{HClO}_4(\text{aq})$?



Part Two. Short Answer.

1. (6 pts) Predict whether each of the following salt solutions is **acidic, basic or neutral**.

- A. Li_2CO_3 _____
- B. NH_4ClO_4 _____
- C. $\text{Sr}(\text{NO}_3)_2$ _____

Part Three. Problems. Please **SHOW YOUR WORK** for full credit. Use the correct number of **significant figures** for your answers and **circle your final answer** for each problem. (61 pts)

1. Ethylamine, $\text{C}_2\text{H}_5\text{NH}_2$, acts as a **weak base** in its reaction with H_2O .

a) Write the hydrolysis reaction that occurs for ethylamine ($\text{C}_2\text{H}_5\text{NH}_2$). (4 pts)

b) A 0.015 M ethylamine solution has a pH of 11.42. Calculate the K_b for ethylamine. (9 pts)

c) Calculate the % ionization for this 0.015 M ethylamine solution. (3 pts)

2. Calculate the pH, pOH, $[\text{OH}^-]$ and $[\text{H}_3\text{O}^+]$ for a 2.75×10^{-2} M $\text{Ba}(\text{OH})_{2(aq)}$ solution. (8 pts)
3. You have 200.0 mL of a buffer solution containing 0.175 M HCO_2H and 0.225 M NaHCO_2 . What is the pH after 25.0 mL of 0.300 M KOH is added to this buffer solution? For HCO_2H , $K_a = 1.8 \times 10^{-4}$. (13 pts)

4. A solution of perchloric acid, $\text{HClO}_4(\text{aq})$, is being titrated with $\text{LiOH}(\text{aq})$. Calculate the pH after 15.0 mL of 0.200 M $\text{LiOH}(\text{aq})$ is added to 30.0 mL of 0.150 M $\text{HClO}_4(\text{aq})$. (10 pts)
5. A sample of benzoic acid, $\text{HC}_7\text{H}_5\text{O}_2$, is being titrated with KOH solution. What is the pH after 20.0 mL of 0.250 M KOH has been added to 25.0 mL of 0.200 M $\text{HC}_7\text{H}_5\text{O}_2$? For $\text{HC}_7\text{H}_5\text{O}_2$, $K_a = 6.4 \times 10^{-5}$. (14 pt)

	pts earned	pts possible
Multiple Choice		33
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Total Pts		100