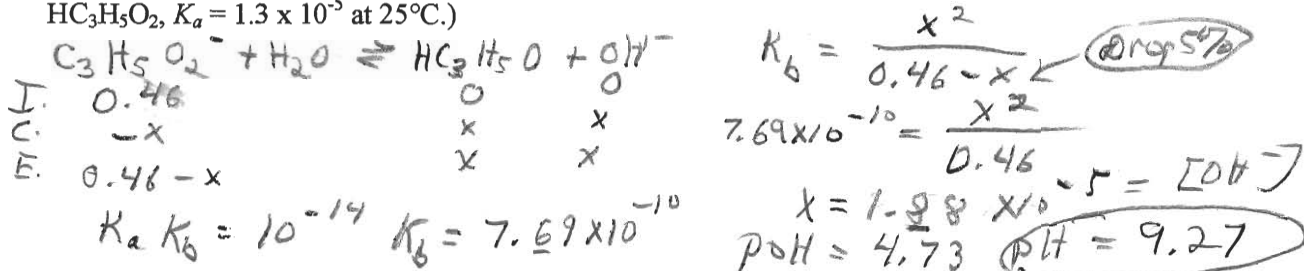


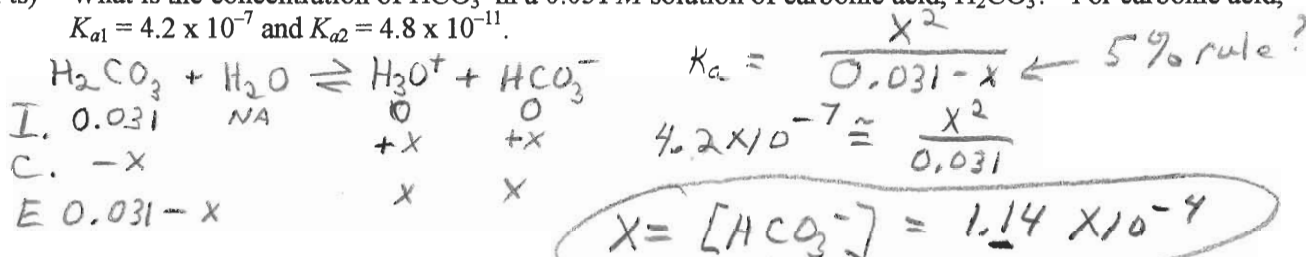
1. (5 Pts) What is the pH of a 0.46 M solution of sodium propionate, $\text{NaC}_3\text{H}_5\text{O}_2$, at 25°C? (For propionic acid, $\text{HC}_3\text{H}_5\text{O}_2$, $K_a = 1.3 \times 10^{-5}$ at 25°C.)



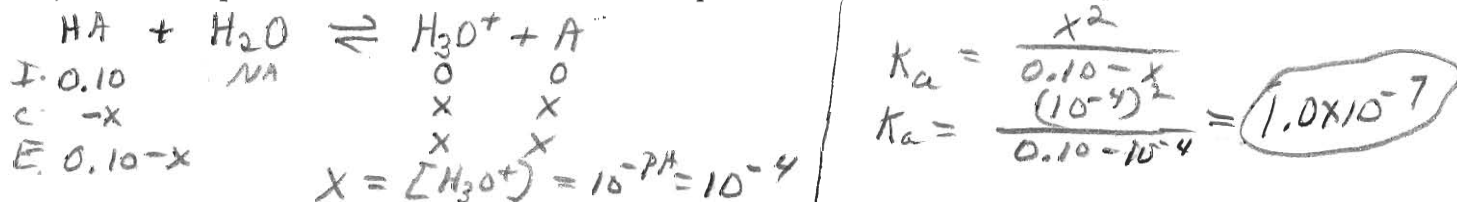
2. (2 Pts) The hydronium-ion concentration of a 0.050 M solution of a weak acid is 6.9×10^{-3} M. The acid-dissociation constant is 1.37×10^{-4} at 25°C. What is the pH of this solution?

$$\text{pH} = -\text{Log} [\text{H}_3\text{O}^+] = -\text{Log} 6.9 \times 10^{-3} = 2.16$$

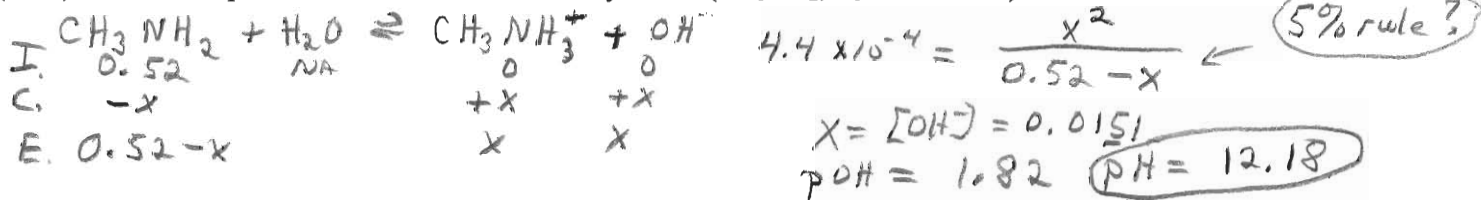
3. (4 Pts) What is the concentration of HCO_3^- in a 0.031 M solution of carbonic acid, H_2CO_3 ? For carbonic acid, $K_{a1} = 4.2 \times 10^{-7}$ and $K_{a2} = 4.8 \times 10^{-11}$.



4. (4 Pts) A 0.10 M aqueous solution of a weak acid HA has a pH of 4.00. What is the value of K_a for HA?



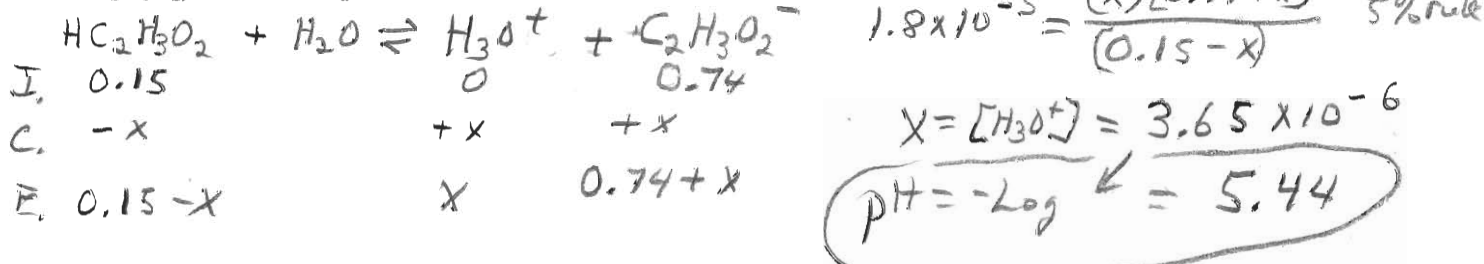
5. (4 Pts) What is the pH of a 0.52 M solution of methylamine (CH_3NH_2 , $K_b = 4.4 \times 10^{-4}$) at 25°C?



6. (2 Pts) What is the pH of a 0.035 M HClO_4 solution?

Strong Acid $\text{pH} = -\text{Log} 0.035 = 1.46$

7. (4 Pts) What is the pH of a solution that is 0.15 M in acetic acid, $\text{HC}_2\text{H}_3\text{O}_2$, and 0.74 M in sodium acetate, $\text{NaC}_2\text{H}_3\text{O}_2$, at 25°C? K_a of acetic acid is 1.8×10^{-5} .



Key

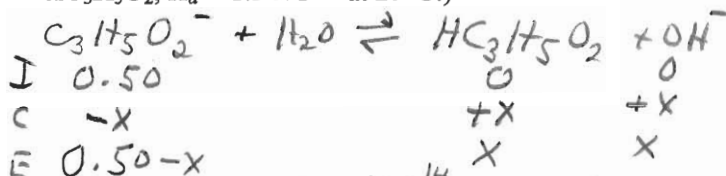
1. (2Pts) What is the pH of a 0.077 M HClO
- ₄
- solution?

strong Acid $pH = -\log 0.077 = 1.11$

2. (2Pts) The hydronium-ion concentration of a 0.050 M solution of a weak acid is
- 5.7×10^{-3}
- M. The acid-dissociation constant is
- 1.37×10^{-4}
- at 25°C. What is the pH of this solution?

$pH = -\log [H_3O^+] = -\log 5.7 \times 10^{-3}$
 $pH = 2.24$

3. (5Pts) What is the pH of a 0.50 M solution of sodium propionate, NaC
- ₃
- H
- ₅
- O
- ₂
- , at 25°C? (For propionic acid, HC
- ₃
- H
- ₅
- O
- ₂
- ,
- $K_a = 1.3 \times 10^{-5}$
- at 25°C.)



$$K_b = K_w / K_a = \frac{10^{-14}}{1.3 \times 10^{-5}} = 7.69 \times 10^{-10}$$

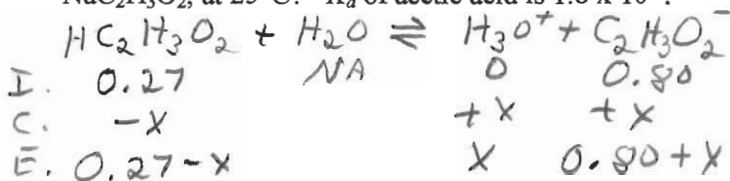
$$K_b = \frac{x^2}{0.50 - x} \leftarrow 5\% \text{ rule?}$$

$$7.69 \times 10^{-10} \approx \frac{x^2}{0.50}$$

$$x = [OH^-] = 1.96 \times 10^{-5}$$

$pOH = 4.71$ $pH = 9.29$

4. (4 Pts) What is the pH of a solution that is 0.27 M in acetic acid, HC
- ₂
- H
- ₃
- O
- ₂
- , and 0.80 M in sodium acetate, NaC
- ₂
- H
- ₃
- O
- ₂
- , at 25°C?
- K_a
- of acetic acid is
- 1.8×10^{-5}
- .

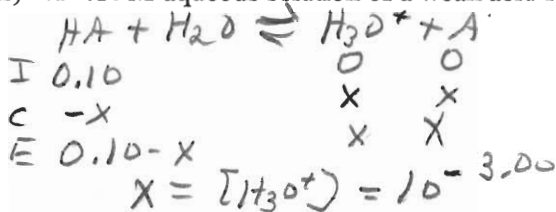


$$K_a = \frac{(x)(0.80+x)}{(0.27-x)} \leftarrow 5\% \text{ rule?}$$

$$x = 6.025 \times 10^{-6} = [H_3O^+]$$

$pH = -\log(x) = 5.22$

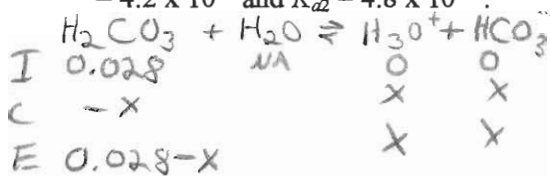
5. (4 Pts) A 0.10 M aqueous solution of a weak acid HA has a pH of 3.00. What is the value of
- K_a
- for HA?



$$K_a = \frac{x^2}{0.10 - x}$$

$$K_a = \frac{(10^{-3})^2}{0.10 - 10^{-3}} = 1.01 \times 10^{-5}$$

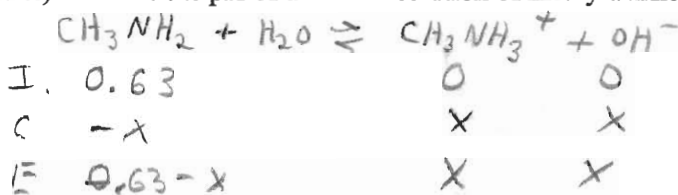
6. (4Pts) What is the concentration of HCO
- ₃
- ⁻
- in a 0.028 M solution of carbonic acid, H
- ₂
- CO
- ₃
- ? For carbonic acid,
- $K_{a1} = 4.2 \times 10^{-7}$
- and
- $K_{a2} = 4.8 \times 10^{-11}$
- .



$$K_{a1} = \frac{[H_3O^+][HCO_3^-]}{[H_2CO_3]} = \frac{x^2}{0.028-x} = 4.2 \times 10^{-7}$$

$x = [HCO_3^-] = 1.08 \times 10^{-4}$

7. (4Pts) What is the pH of a 0.63 M solution of methylamine (CH
- ₃
- NH
- ₂
- ,
- $K_b = 4.4 \times 10^{-4}$
-) at 25°C?



$$4.4 \times 10^{-4} = \frac{x^2}{0.63-x} \leftarrow (5\% \text{ rule?})$$

$$x = 0.017 = [OH^-]$$

$pOH = 1.78$ $pH = 12.22$