

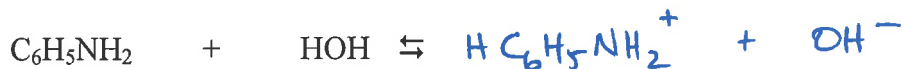
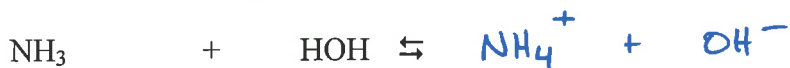
Acids & Bases Worksheet #3

Hydrolysis Reactions:

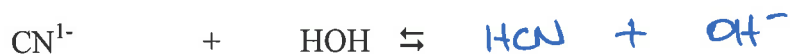
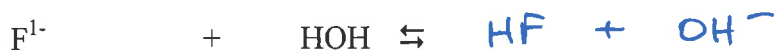
I. Weak Acids "Dump a proton onto water" $HA + H_2O \rightleftharpoons H_3O^+ + A^{1-}$



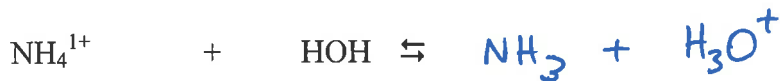
II. Weak Bases "Take a proton from water to make a weak acid" $A^{1-} + H_2O \rightleftharpoons HA + OH^{1-}$



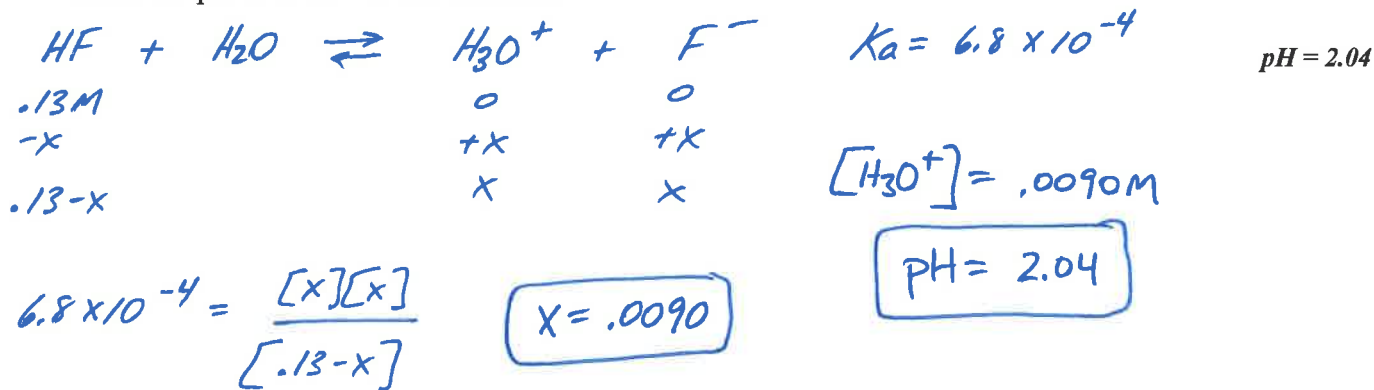
III. Conjugate Base of a Weak Acid "One proton away from weak acid"



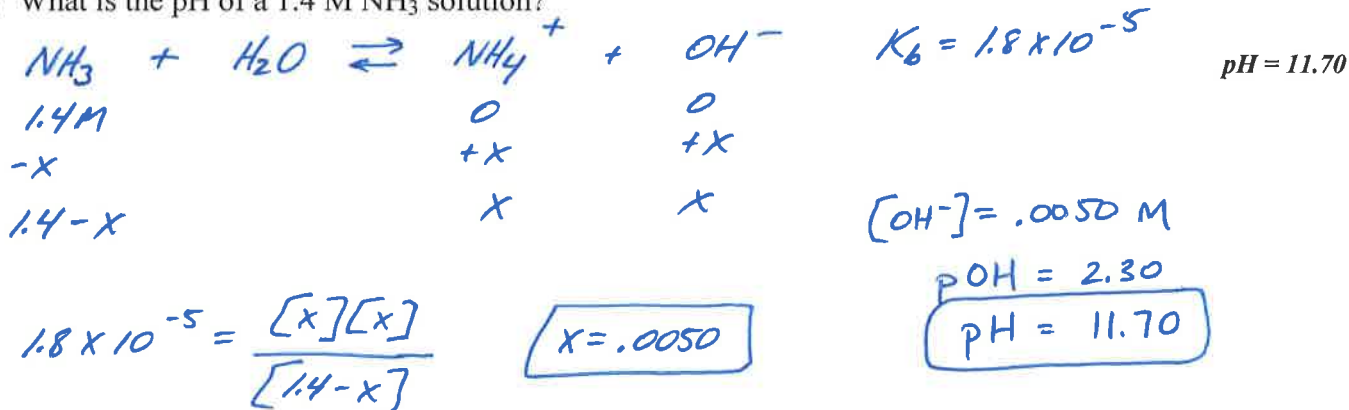
IV. Conjugate Acid of a Weak Base "Act like weak acids"



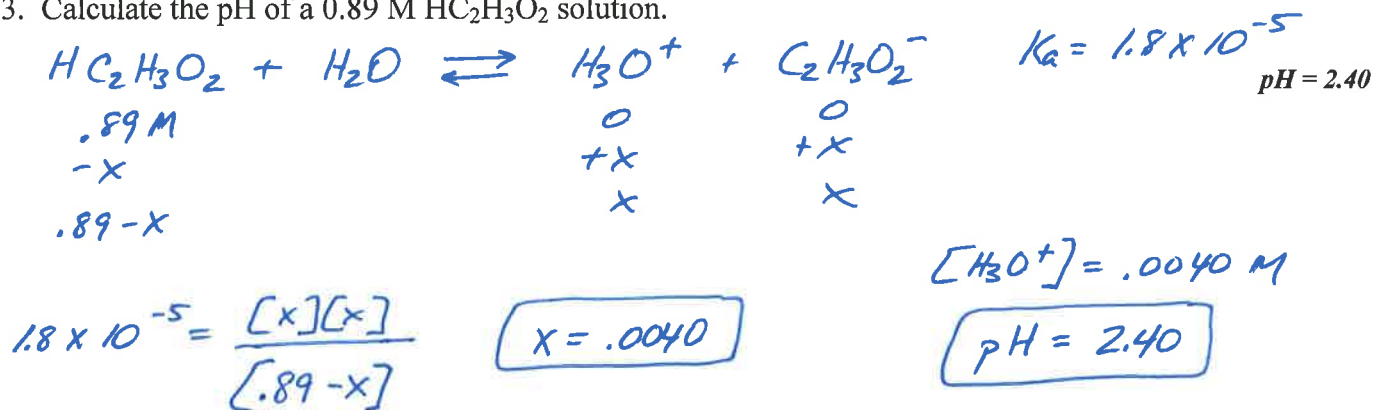
1. What is the pH of a 0.13 M HF solution?



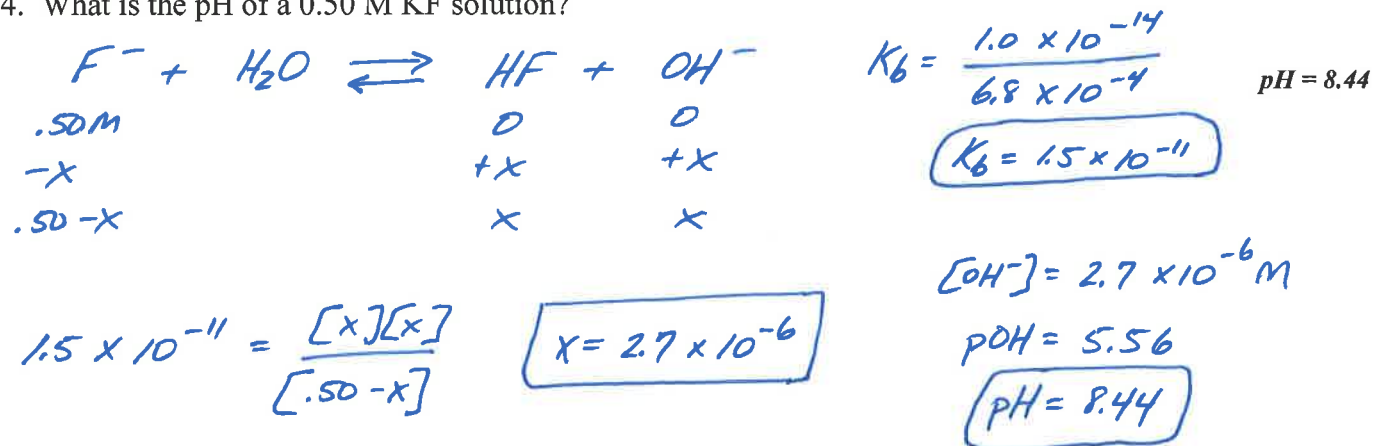
2. What is the pH of a 1.4 M NH_3 solution?



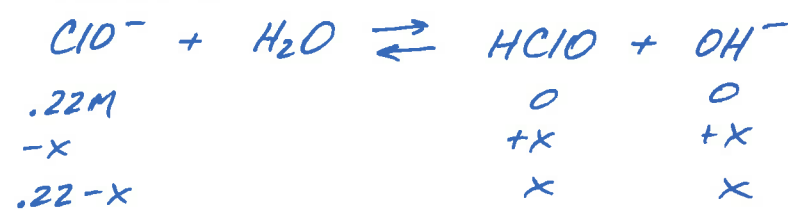
3. Calculate the pH of a 0.89 M $\text{HC}_2\text{H}_3\text{O}_2$ solution.



4. What is the pH of a 0.50 M KF solution?



5. What is the pH of a 0.22 M solution of NaClO ?



$$K_b = \frac{1.0 \times 10^{-14}}{3.0 \times 10^{-8}} \quad \text{pH} = 10.43$$

$$K_b = 3.3 \times 10^{-7}$$

$$3.3 \times 10^{-7} = \frac{[x][x]}{[.22-x]}$$

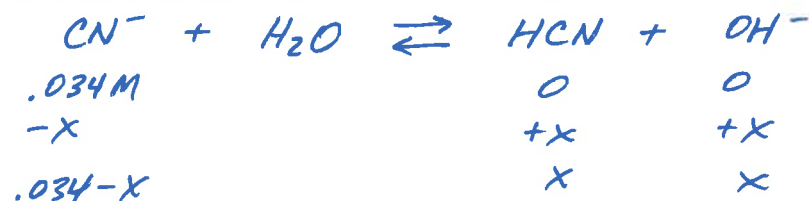
$$x = 2.7 \times 10^{-4}$$

$$[\text{OH}^-] = 2.7 \times 10^{-4} \text{ M}$$

$$\text{pOH} = 3.57$$

$$\text{pH} = 10.43$$

6. What is the pH of a 0.034 M solution of KCN ?



$$K_b = \frac{1.0 \times 10^{-14}}{4.9 \times 10^{-10}} \quad \text{pH} = 10.91$$

$$K_b = 2.0 \times 10^{-5}$$

$$2.0 \times 10^{-5} = \frac{[x][x]}{[.034-x]}$$

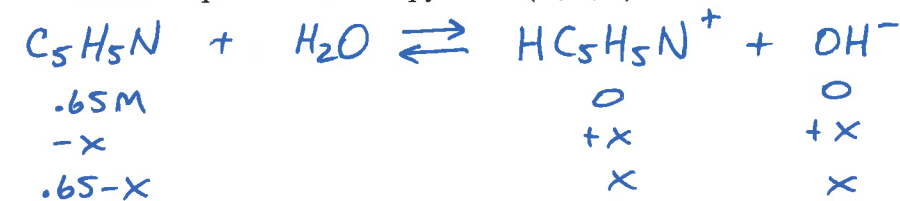
$$x = 8.1 \times 10^{-4}$$

$$[\text{OH}^-] = 8.1 \times 10^{-4} \text{ M}$$

$$\text{pOH} = 3.09$$

$$\text{pH} = 10.91$$

7. What is the pH of a 0.65 M pyridine (C₅H₅N) solution?



$$K_b = 1.7 \times 10^{-9} \quad \text{pH} = 9.52$$

$$1.7 \times 10^{-9} = \frac{[x][x]}{[.65-x]}$$

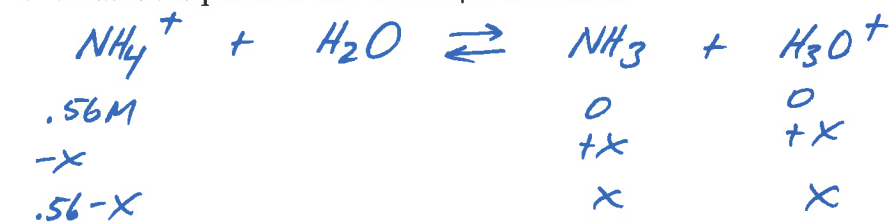
$$x = 3.3 \times 10^{-5}$$

$$[\text{OH}^-] = 3.3 \times 10^{-5} \text{ M}$$

$$\text{pOH} = 4.48$$

$$\text{pH} = 9.52$$

8. What is the pH of a 0.56 M NH₄Br solution?



$$K_a = \frac{1.0 \times 10^{-14}}{1.8 \times 10^{-5}} \quad \text{pH} = 4.75$$

$$K_a = 5.6 \times 10^{-10}$$

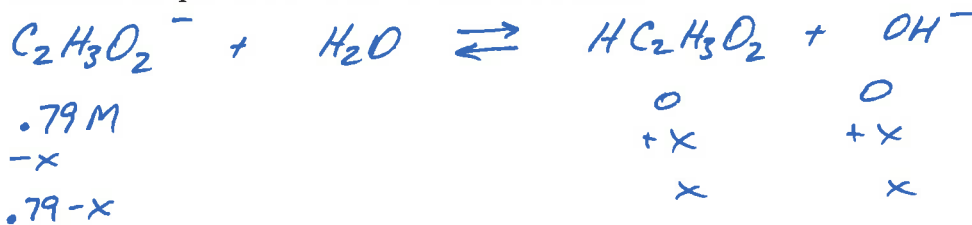
$$5.6 \times 10^{-10} = \frac{[x][x]}{[.56-x]}$$

$$x = 1.8 \times 10^{-5}$$

$$[\text{H}_3\text{O}^+] = 1.8 \times 10^{-5} \text{ M}$$

$$\text{pH} = 4.74$$

9. Calculate the pH of a 0.79 M $\text{NaC}_2\text{H}_3\text{O}_2$ solution.



pH = 9.32

$$K_b = \frac{1.0 \times 10^{-14}}{1.8 \times 10^{-5}} = 5.6 \times 10^{-10}$$

$$K_b = 5.6 \times 10^{-10}$$

$$5.6 \times 10^{-10} = \frac{[x][x]}{[.79-x]}$$

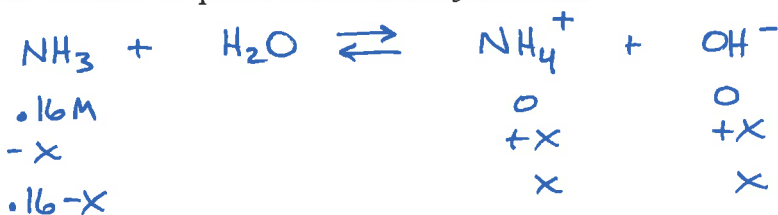
$$x = 2.1 \times 10^{-5}$$

$$[\text{OH}^-] = 2.1 \times 10^{-5} \text{ M}$$

$$\text{pOH} = 4.68$$

$$\text{pH} = 9.32$$

10. What is the pH of a 0.16 M NH_3 solution?



$$K_b = 1.8 \times 10^{-5}$$

pH = 11.23

$$1.8 \times 10^{-5} = \frac{[x][x]}{[.16-x]}$$

$$x = .0017$$

$$[\text{OH}^-] = .0017$$

$$\text{pOH} = 2.77$$

$$\text{pH} = 11.23$$

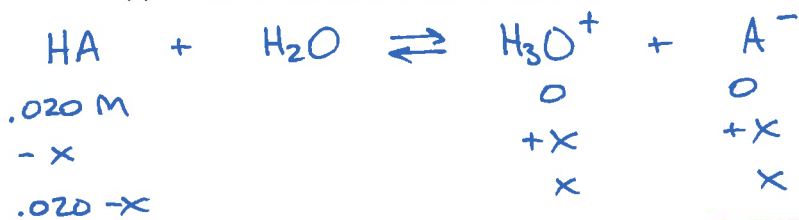
Slight Thinker!

11. A 0.020 M solution of a weak acid (HA) has a pH of 3.26.

(a) What is the K_a for this weak acid?

from pH, $[\text{H}_3\text{O}^+] = 5.5 \times 10^{-4} \text{ M}$
thus, $x = 5.5 \times 10^{-4}$

$$K_a = 1.6 \times 10^{-5}$$



$$K_a = \frac{[5.5 \times 10^{-4}]^2}{[.020 - 5.5 \times 10^{-4}]}$$

$$K_a = 1.6 \times 10^{-5}$$

(b) What percentage of this weak acid HA is ionized in this 0.020 M solution?

$$\frac{5.5 \times 10^{-4}}{.020} \times 100 = 2.75\%$$

2.7%