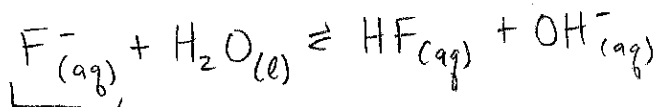
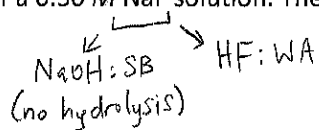


2. Calculate the pH of a 0.30 M NaF solution. The K_a value for HF is 7.2×10^{-4} .



Acting as a weak base \Rightarrow need $K_b = \frac{K_w}{K_a} = \frac{1 \times 10^{-14}}{7.2 \times 10^{-4}} = 1.4 \times 10^{-11}$

$$K_b = \frac{[\text{HF}][\text{OH}^-]}{[\text{F}^-]} = \frac{x^2}{0.30 - x} \approx \frac{x^2}{0.30} = 1.4 \times 10^{-11}$$

$K_b \ll 1$, x negligible

$$x = [\text{OH}^-] = \sqrt{(0.30)(1.4 \times 10^{-11})} = 2.0 \times 10^{-6} \text{ M}$$

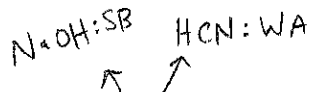
$$\text{pOH} = -\log(2.0 \times 10^{-6}) = 5.69 \Rightarrow \text{pH} = 14 - 5.69 = \boxed{8.31}$$

Multiple Choice Practice

3. What is the pH of a 1.0×10^{-2} M solution of NaCN? (For HCN, $K_a = 1.0 \times 10^{-10}$).

- a. between 0 and 3
b. between 3 and 7

- c. between 7 and 10
d. between 10 and 14



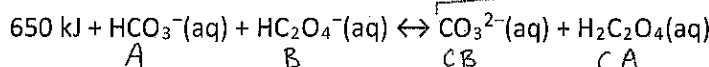
$$K_b(\text{CN}^-) = \frac{1 \times 10^{-14}}{1 \times 10^{-10}} = 1 \times 10^{-4}$$

$$K_b = \frac{x^2}{1 \times 10^{-2}} = 1 \times 10^{-4} \Rightarrow x = [\text{OH}^-] = \sqrt{(1 \times 10^{-2})(1 \times 10^{-4})} = \sqrt{1 \times 10^{-6}} = 1 \times 10^{-3}$$

$$\Rightarrow \text{pOH} = 3$$

$$\text{pH} = 14 - 3 = 11$$

favored = weaker!



4. If $K > 1$, all of the following statements are true about the reaction above EXCEPT:

- a. HC_2O_4^- is a weaker base than CO_3^{2-} .
b. HCO_3^- and $\text{H}_2\text{C}_2\text{O}_4$ are both acting as acids in the reaction.
c. The reaction lies far to the right (favors products).
d. Lowering the temperature of the solution will decrease the value of K .

5. Which of the following would form a basic solution when dissolved in water?

a. HCl
SA!

b. LiCl
 \swarrow \searrow
LiOH HCl
SB SA

\Rightarrow neutral

c. NH_4Cl
 \swarrow \searrow
 NH_3 HCl
WB SA

\Rightarrow acidic

d. $\text{NaC}_2\text{H}_3\text{O}_2$
 \swarrow \searrow
NaOH $\text{HC}_2\text{H}_3\text{O}_2$
SB WA

6. Estimate the pH of a 1.0×10^{-5} M solution of the weak base $C_6H_5NH_2$? ($K_b = 4.0 \times 10^{-10}$).

- a. between 0 and 3 c. between 7 and 10
 (b.) between 3 and 7 d. between 10 and 14

$$K_b = \frac{x^2}{1E-5} = 4E-10 \Rightarrow x = [OH^-] = \sqrt{4E-15} = 2E-7.5 \approx 1E-7.5$$

$$\Rightarrow pOH = 7.5 \Rightarrow pH = 14 - 7.5 = 6.5$$

7. Which of the following would a solution with the lowest pH?

a. NaOH

SB

b. LiCl

LiOH HCl
 SB SA
 \Rightarrow neutral

(c.) HClO₄

SA

d. NaC₂H₃O₂

NaOH HC₂H₃O₂
 SB WA
 \Rightarrow basic

8. A solution of a monoprotic acid, HA, has a pH of 5.00. Calculate the acid dissociation constant for the weak acid if the solution has a molar concentration of 0.50 M.

a. 2.0×10^{-11}

(b.) 2.0×10^{-10}

c. 2.0×10^{-7}

d. 2.0×10^{-6}

$$x = [H_3O^+] = 10^{-5} \quad \left. \vphantom{x} \right\} K_a = \frac{x^2}{[HA]} = \frac{(1E-5)^2}{0.5} = \frac{1E-10}{1/2} = 2E-10$$

9. Which of the following can act as an amphoteric species?

I. SO_4^{2-}

II. HCO_3^-

III. NH_4^+

a. I only

(b.) II only

c. II and III only

d. I, II, and III

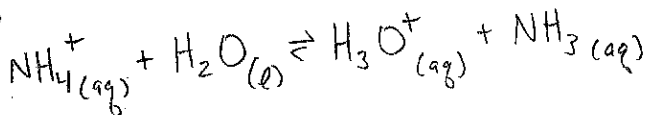
10. What is the equilibrium expression for the hydrolysis of NH_4Cl ?

a. $K = \frac{[HCl][OH^-]}{[Cl^-]}$

c. $K = \frac{[Cl^-]}{[HCl][OH^-]}$

(b.) $K = \frac{[NH_3][H_3O^+]}{[NH_4^+]}$

d. $K = \frac{[NH_4^+]}{[NH_3][H_3O^+]}$



11. The pH of a 0.10 M KOH solution is:

a. 0.10

b. 1.00

(c.) 13.00

d. 14.00

$$pOH = -\log(1E-1) = 1$$

$$pH = 14 - 1 = 13$$