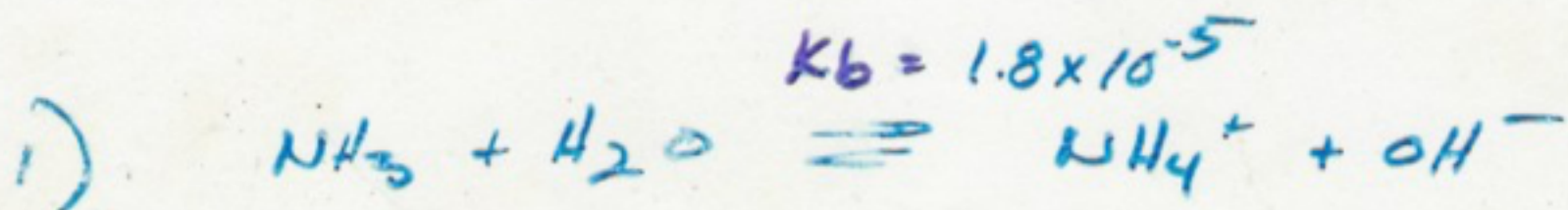


Acid / Base Equilibria work sheet

- 1) Calculate the pH in a 0.10 M solution of NH_3 , a weak base, whose $K_b = 1.8 \times 10^{-5}$.
- 2) Calculate $[\text{OH}^-]$ in a 1.0×10^{-3} M solution of the weak base methylamine (CH_3NH_2), whose $K_b = 4.4 \times 10^{-4}$. What percentage of the base has ionized?
- 3) Given that K_a for HF is 6.8×10^{-4} , calculate K_b for F^- .
- 4) Calculate the pH of a 0.15 M solution of KF. (K_a for HF = 6.8×10^{-4} ; K_b for $\text{F}^- = 1.5 \times 10^{-11}$.)
- 5) Aniline ($\text{C}_6\text{H}_5\text{NH}_2$), a weak base, forms a salt $\text{C}_6\text{H}_5\text{NH}_3^+\text{Cl}^-$ with HCl. Determine the pH of a 0.10 M solution of this salt.
- $\text{C}_6\text{H}_5\text{NH}_2$ $K_b = 4.27 \times 10^{-10}$
- 6) What is the pH of a 0.10 M solution of NH_4Br ? (K_b for $\text{NH}_3 = 1.8 \times 10^{-5}$.)



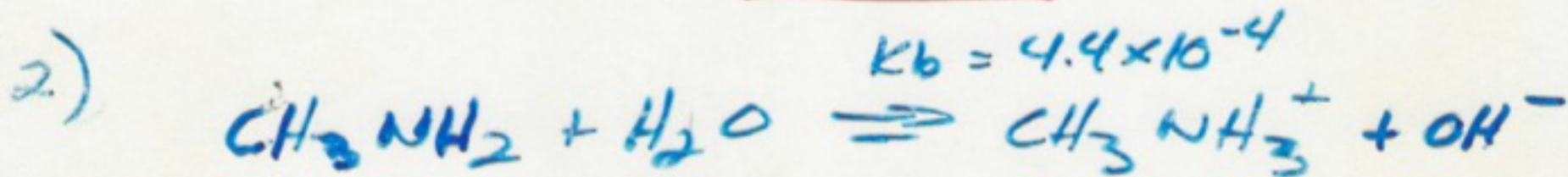
$$K_b = \frac{[\text{NH}_4^+][\text{OH}^-]}{[\text{NH}_3]} = \frac{x^2}{1-x} = 1.8 \times 10^{-5}$$

$$[\text{OH}^-] = x = 1.3 \times 10^{-3}$$

$$[\text{H}^+][\text{OH}^-] = 10^{-14}$$

$$[\text{H}^+] = \frac{10^{-14}}{1.3 \times 10^{-3}} = 7.69 \times 10^{-12}$$

$$\text{pH} = 11.1$$



$$4.4 \times 10^{-4} = \frac{x^2}{1.0 \times 10^{-3} - x}$$

$$x = 6.6 \times 10^{-4}$$

$$\frac{6.6 \times 10^{-4}}{1.0 \times 10^{-3}} \times 100 = 66\%$$

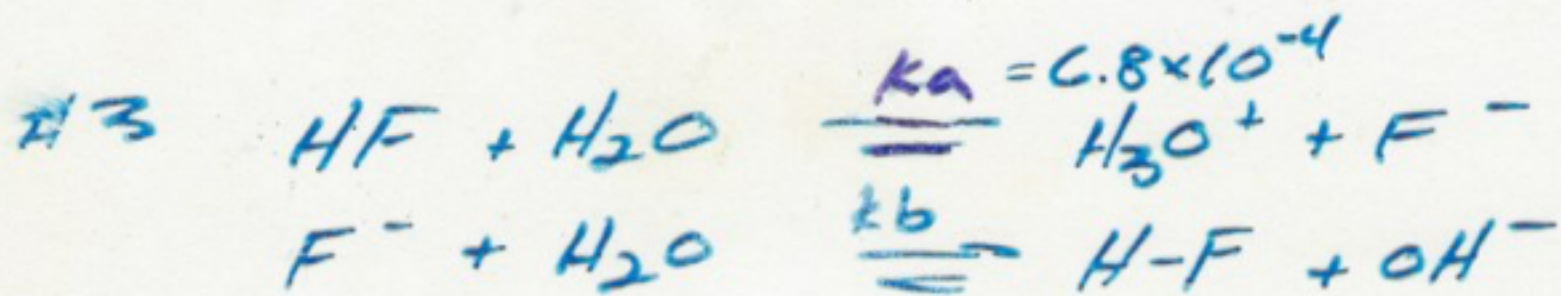
x is not negligible

$$x^2 + 4.4 \times 10^{-4}x - 4.4 \times 10^{-7} = 0$$

$$x = \frac{-4.4 \times 10^{-4} \pm \sqrt{(4.4 \times 10^{-4})^2 - 4(1)(-4.4 \times 10^{-7})}}{2(1)}$$

$$\frac{-4.4 \times 10^{-4} + 1.4 \times 10^{-3}}{2}$$

$$\frac{4.8 \times 10^{-4}}{1.0 \times 10^{-3}} \times 100 = 48\%$$



$$K_b K_a = K_w$$

$$K_b = \frac{10^{-14}}{6.8 \times 10^{-4}}$$

$$= \underline{\underline{1.5 \times 10^{-11}}}$$



$$1.5 \times 10^{-11} = \frac{x^2}{.15 - x}$$

$$[\text{OH}^-] = x = 1.5 \times 10^{-6} \qquad \text{pOH} = 5.82$$

$$\text{pH} = 14 - 5.82$$

$$= \underline{\underline{8.18}}$$

#5



$$K_a = \frac{10^{-14}}{4.27 \times 10^{-10}} = 2.34 \times 10^{-5}$$

$$\frac{x^2}{.1 - x} = 2.34 \times 10^{-5}$$

$$x = 1.5 \times 10^{-3}$$

$$\text{pH} = \underline{\underline{2.82}}$$

