

Worksheet #4

KOH

$$\text{pH} = 11.5$$

$$V = 500. \text{ mL}$$

$$m = ?$$

$$\text{pH} + \text{pOH} = 14.0$$

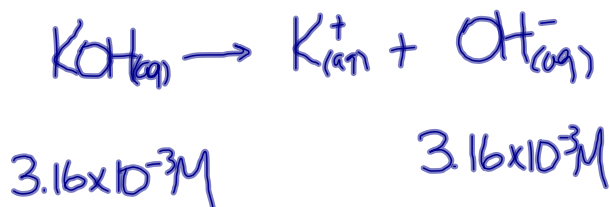
$$\text{pOH} = 14.0 - 11.5$$

$$\text{pOH} = 2.5$$

$$[\text{OH}^-] = 10^{-\text{pOH}}$$

$$[\text{OH}^-] = 10^{-2.5}$$

$$[\text{OH}^-] = 3.16 \times 10^{-3} \text{ M}$$



KOH

$$C = 3.16 \times 10^{-3} \text{ M}$$

$$V = 500. \text{ mL}$$

$$m = ?$$

$$C = \frac{n}{V}$$

$$n = (3.16 \times 10^{-3} \text{ mol/L})(0.500 \text{ L})$$

$$n = 1.58 \times 10^{-3} \text{ mol}$$

$$1.58 \times 10^{-3} \text{ mol KOH} \times \frac{56.11 \text{ g KOH}}{1 \text{ mol KOH}} = \boxed{0.09 \text{ g KOH}}$$

Ionization Constants for Acids

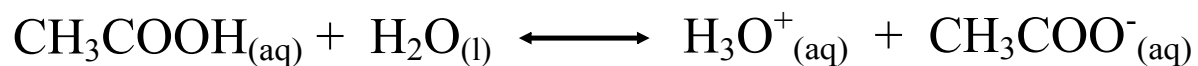
Strong acids - ionizes **quantitatively** in water to form hydronium ions



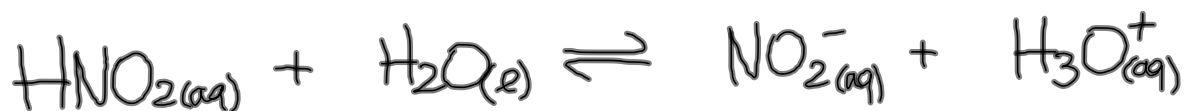
Weak acids - ionizes **partially** in water to form hydronium ions



To describe the equilibrium of acids in water, the equilibrium law is used to calculate the acid ionization constant, K_a .



Ex. Predict the hydronium ion concentration, and pH of a 1.0 mol/L **nitrous acid** solution at equilibrium.



1.0 mol/L

$$K_a = \frac{[\text{NO}_2^-_{(aq)}][\text{H}_3\text{O}^+_{(aq)}]}{[\text{HNO}_{2(aq)}]}, \quad [\text{NO}_2^-_{(aq)}] = [\text{H}_3\text{O}^+_{(aq)}]$$

$$K_a = \frac{[\text{H}_3\text{O}^+_{(aq)}]^2}{[\text{HNO}_{2(aq)}]} \Rightarrow [\text{H}_3\text{O}^+_{(aq)}] = \sqrt{K_a [\text{HNO}_2]}$$

$$[\text{H}_3\text{O}^+_{(aq)}] = \sqrt{(7.2 \times 10^{-4}) [1.0]}$$

$$[\text{H}_3\text{O}^+_{(aq)}] = 0.027 \text{ M}$$

$$\text{pH} = -\log [\text{H}_3\text{O}^+_{(aq)}]$$

$$\text{pH} = -\log [0.027]$$

$$\boxed{\text{pH} = 1.57}$$

Weak Bases

Weak bases react with water to form the hydroxide ion and conjugate acid of the base.



0.221M

base dissociation constant

$$K_b = \frac{[\text{NH}_4^+_{(\text{aq})}][\text{OH}^-_{(\text{aq})}]}{[\text{NH}_{3(\text{aq})}]}, \quad [\text{NH}_4^+_{(\text{aq})}] = [\text{OH}^-_{(\text{aq})}]$$

$$K_b = \frac{[\text{OH}^-_{(\text{aq})}]^2}{[\text{NH}_{3(\text{aq})}]}$$

$$[\text{OH}^-_{(\text{aq})}] = \sqrt{(1.72 \times 10^{-5})(0.221)}$$

$$[\text{OH}^-_{(\text{aq})}] = 1.95 \times 10^{-3} \text{ M}$$

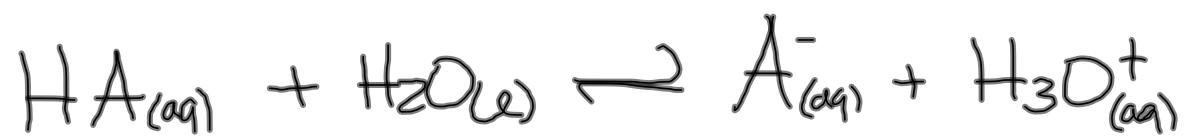
$$K_a K_b = K_w$$

$$K_b = \frac{K_w}{K_a}$$

$$K_b = \frac{1.0 \times 10^{-14}}{5.8 \times 10^{-10}}$$

$$K_b = 1.72 \times 10^{-5}$$

WEAK ACIDS



$$K_a K_b = K_w$$

$$K_b = \frac{K_w}{K_a}$$

Weak Acids Worksheet