Homework - Worksheet #2-4

(4) $KOH_{(aq)} \longrightarrow K^+_{(aq)} + OH^-_{(aq)}$

$3.16 \times 10^{-3} M$ $3.16 \times 10^{-3} M$

$m = ?$

$V = 500.mL$

$pH = 11.5$

$pH + pOH = 14.0$

$pOH = 14.0 - 11.5$

$pOH = 2.5$

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

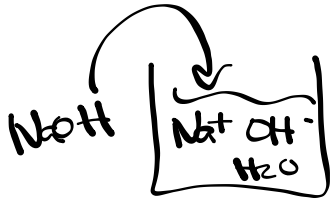
$[OH^-] = 10^{-2.5}$

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

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

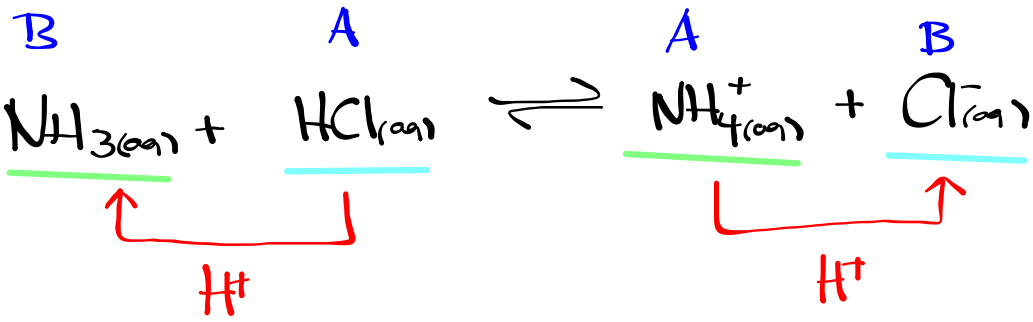
$n = (3.16 \times 10^{-3} mol/L)(0.500L)$

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



$$NaOH_{(aq)} \longrightarrow Na^{+}_{(aq)} + OH^{-}_{(aq)}$$

Conjugate Pairs



* substances that differ by a proton

Ionization Constants for Acids

Strong acids - ionizes quantitatively in water to form hydronium ions

$$HCl_{(aq)} + H_2O_{(l)} \longrightarrow H_3O^+_{(aq)} + Cl^-_{(aq)}$$

Weak acids - ionizes partially in water to form hydronium ions

$$CH_3COOH_{(aq)} + H_2O_{(l)} \longleftrightarrow H_3O^+_{(aq)} + CH_3COO^-_{(aq)}$$

H^+

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

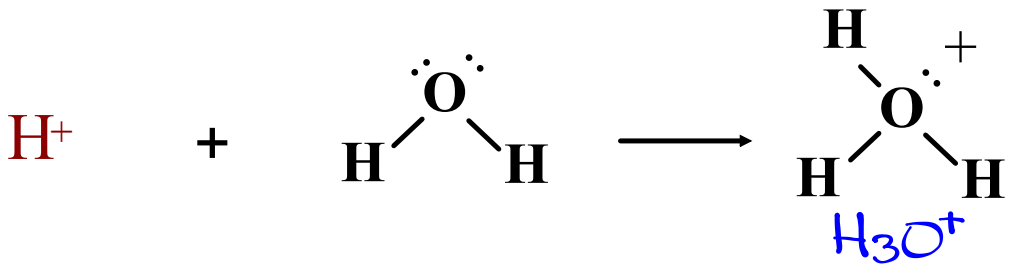
$$CH_3COOH_{(aq)} + H_2O_{(l)} \longleftrightarrow H_3O^+_{(aq)} + CH_3COO^-_{(aq)}$$

$$K = \frac{[H_3O^+_{(aq)}][CH_3COO^-_{(aq)}]}{[CH_3COOH_{(aq)}][H_2O_{(l)}]}$$

constant

$$K[H_2O_{(l)}] = \frac{[H_3O^+_{(aq)}][CH_3COO^-_{(aq)}]}{[CH_3COOH_{(aq)}]}$$

$$K_a = \frac{[H_3O^+_{(aq)}][CH_3COO^-_{(aq)}]}{[CH_3COOH_{(aq)}]} = 1.8 \times 10^{-5}$$



$$pH = -\log [H_3O^+]$$

$$[H_3O^+] = 10^{-pH}$$

$$[H_3O^+][OH^-] = 1.0 \times 10^{-14}$$

WEAK

Ex. Predict the pH of a 1.0 mol/L nitrous acid solution at equilibrium.

$$HNO_{2(aq)} + H_2O_{(l)} \rightleftharpoons NO_{2(aq)}^- + H_3O_{(aq)}^+$$

1.0 mol/L

$$K_a = \frac{[NO_{2(aq)}^-][H_3O_{(aq)}^+]}{[HNO_{2(aq)}]}, \quad [NO_{2(aq)}^-] = [H_3O_{(aq)}^+]$$

$$K_a = \frac{[H_3O_{(aq)}^+]^2}{[HNO_{2(aq)}]}$$

$$[H_3O_{(aq)}^+] = \sqrt{K_a[HNO_{2(aq)}]}$$

$$[H_3O_{(aq)}^+] = \sqrt{(7.2\times10^{-4})[1.0]}$$

$$[H_3O_{(aq)}^+] = 0.027\,M$$

$$pH = -\log[H_3O_{(aq)}^+]$$

$$pH = -\log[0.027]$$

$$pH = 1.57$$

$$HA_{(aq)} + H_2O_{(l)} \rightleftharpoons A^-_{(aq)} + H_3O^+_{(aq)}$$