Homework - Worksheet

1 Asparagus

pOH = 5.6
pH = ?
$[H^+_{(aq)}]$ = ?
$[OH^-_{(aq)}]$ = ?

$[OH^-_{(aq)}] = 10^{-pOH}$
$[OH^-_{(aq)}] = 10^{-5.6}$
$\boxed{[OH^-_{(aq)}] = 3 \times 10^{-6} M}$

$K_w = [H^+_{(aq)}][OH^-_{(aq)}]$
$[H^+_{(aq)}] = \frac{1.0 \times 10^{-14}}{3 \times 10^{-6} M}$
$\boxed{[H^+_{(aq)}] = 4 \times 10^{-9} M}$

$pH = -\log[H^+_{(aq)}]$
$pH = -\log[4 \times 10^{-9}]$
$\boxed{pH = 8.4}$

pH + pOH = 14.00

3 $NaOH_{(aq)} \longrightarrow Na^+_{(aq)} + OH^-_{(aq)}$

m = 26g
v = 150mL
4.33 mol/L

4.33 mol/L

$26g\ NaOH \times \frac{1\ mol\ NaOH}{40.00g\ NaOH} = 0.65\ mol\ NaOH$

$C = \frac{n}{V} = \frac{0.65\ mol}{0.150\ L} = 4.33\ mol/L$

$pOH = -\log[OH^-_{(aq)}]$
$pOH = -\log[4.33]$
$\boxed{pOH = -0.637}$

pH + pOH = 14.000
pH = 14.000 − (−0.637)
$\boxed{pH = 14.637}$

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

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

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

can't use mole ratio

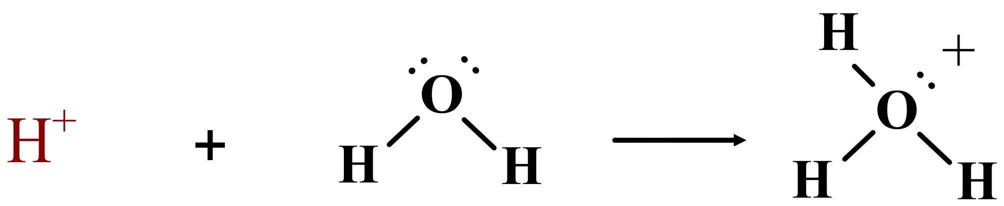
$$\overbrace{CH_3COOH_{(aq)} + H_2O_{(l)}}^{H^+} \longleftrightarrow H_3O^+_{(aq)} + CH_3COO^-_{(aq)}$$

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

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

$$K_a = \frac{[H_3O^+_{(aq)}][CH_3COO^-_{(aq)}]}{[CH_3COOH_{(aq)}]}, \quad [H_3O^+_{(aq)}] = [CH_3COO^-_{(aq)}]$$

$$K_a = \frac{[H_3O^+_{(aq)}]^2}{[CH_3COOH_{(aq)}]}$$



Ex. Predict the hydronium ion concentration, and 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

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

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

$$7.2\times10^{-4} = \frac{[H_3O_{(aq)}^{+}]^2}{1.0\ \text{mol/L}}$$

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

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

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

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

$$\boxed{pH = 1.57}$$

Homework

#22, 23 p. 610

Calculate the pH of a 0.410 mol/L solution of phosphoric acid.

What is the pH of a 0.150 mol/L hypochlorous acid solution at equilibrium?