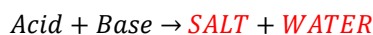




7) What are the products of acid/base reactions?



8) What is the equivalence point of a titration?

The point at which the amount (mol) of acid (H<sup>+</sup>) is equal to the amount (mol) of base (OH<sup>-</sup>)

9) What is the end point of a titration?

The point at which the solution changes color

10) What is the formula for calculating titrations?

$$M_a V_a i_a = M_b V_b i_b \text{ or } N_a V_a = N_b V_b$$

11) What is the normality of the following acids and bases?

a. 2.0 M NaOH

$$2.0 \text{ M NaOH} \left| \frac{1 \text{ mol OH}^-}{1 \text{ mol NaOH}} \right| = 2.0 \text{ N NaOH}$$

c. .5 M Ca(OH)<sub>2</sub>

$$0.5 \text{ M Ca(OH)}_2 \left| \frac{2 \text{ mol OH}^-}{1 \text{ mol Ca(OH)}_2} \right| = 1.0 \text{ N Ca(OH)}_2$$

b. 1.0 M H<sub>3</sub>PO<sub>4</sub>

$$1.0 \text{ M H}_3\text{PO}_4 \left| \frac{3 \text{ mol H}^+}{1 \text{ mol H}_3\text{PO}_4} \right| = 3.0 \text{ N H}_3\text{PO}_4$$

d. 1.5 M H<sub>2</sub>SO<sub>4</sub>

$$1.5 \text{ M H}_2\text{SO}_4 \left| \frac{2 \text{ mol H}^+}{1 \text{ mol H}_2\text{SO}_4} \right| = 3.0 \text{ N H}_2\text{SO}_4$$

12) Calculate the missing part of each of the following titrations:

a. 25 mL of 1.0 M H<sub>2</sub>SO<sub>4</sub> is titrated with 40 mL of NaOH. What is the concentration of the NaOH?

$$\begin{aligned} M_a V_a i_a &= M_b V_b i_b \\ (1.0)(25)(2) &= M_b (40)(1) \\ 1.2 \text{ M NaOH} &= M_b \end{aligned}$$

b. 3.0 L of sulfuric acid titrates with 1.0 L of 1.0 M Al(OH)<sub>3</sub>. What is the concentration of the acid?

$$\begin{aligned} M_a V_a i_a &= M_b V_b i_b \\ M_a (3.0)(2) &= (1.0)(1.0)(3.0) \\ M_a &= 2.0 \text{ M H}_2\text{SO}_4 \end{aligned}$$

c. 10. mL of 0.50 M HCl titrates 50. mL of an Al(OH)<sub>3</sub> solution. What molarity is the base?

$$\begin{aligned} M_a V_a i_a &= M_b V_b i_b \\ (0.5)(10)(1) &= (M_b)(50)(3) \\ M_b &= 0.03 \text{ M Al(OH)}_3 \end{aligned}$$

d. 7.5 L of 1.0 M tetra-protic acid is titrated with a 3.0 M KOH solution. What volume is needed?

$$\begin{aligned} M_a V_a i_a &= M_b V_b i_b \\ (1.0)(7.5)(4) &= (3.0)V_b(1) \\ 10. \text{ L NaOH} &= V_b \end{aligned}$$

13) In some instances, adding a salt to water will turn the solution into an acid or a base. There are 4 basic rules for predicting the acidity, basicity, or neutrality of a solution when a salt is added... what are they?

a. Strong Acid + Strong Base = Neutral Solution

b. Weak Acid + Weak Base = Neutral Solution

c. Strong Acid + Weak Base = Acidic Solution

d. Weak Acid + Strong Base = Basic Solution

14) If the  $K_a$  of ethanoic acid ( $\text{CH}_3\text{COOH}$ ) is  $6.40 \times 10^{-5}$ , what would be the concentration of hydrogen ion in a 0.300 M solution of ethanoic acid?

a. Write the equation for the dissociation of ethanoic acid:



b. Calculate the initial concentration, change in concentration, and final concentration of all three parts of the dissociation equation:

Reaction	Ethanoic Acid	Ethanoate	Hydrogen Ion
Initial	0.300	0	0
Change	-x	+x	+x
Final	$0.300 - x$	x	x

c. Write the formula for  $K_a$ , substitute in your final concentrations from part b, and then solve for your unknown amount... You are gonna need the quadratic formula for this one!

$$K_a = \frac{[\text{H}^+][\text{CH}_3\text{COO}^-]}{[\text{CH}_3\text{COOH}]}$$

$$6.40 \times 10^{-5} = \frac{[x][x]}{[0.300 - x]}$$

$$6.40 \times 10^{-5} = \frac{[x][x]}{[0.300 - x]}$$

$$1.92 \times 10^{-6} - 6.4 \times 10^{-5}x = x^2$$

$$0 = -1.92 \times 10^{-6} + 6.4 \times 10^{-5}x + x^2$$

Quadratic Equation

$$x = 1.35 \times 10^{-3}$$

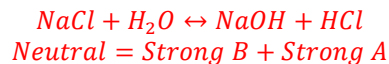
$$[\text{Ethanoic Acid}] = 0.299 \text{ M}$$

$$[\text{Ethanoate}] = 1.35 \times 10^{-3} \text{ M}$$

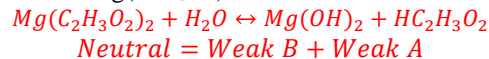
$$[\text{H}^+] = 1.35 \times 10^{-3} \text{ M}$$

15) Determine which acids and bases the following salts hydrolyze into and then determine whether the resulting solution will be acidic, basic, or neutral:

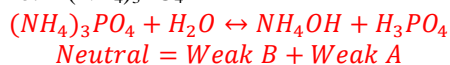
a. NaCl



c.  $\text{Mg}(\text{C}_2\text{H}_3\text{O}_2)_2$



b.  $(\text{NH}_4)_3\text{PO}_4$



d.  $\text{K}_2\text{CO}_3$

