**Name: Period: Seat#:**

**Worksheet #13**

**Directions:**

* Show your work!
* Some answers are provided at the end of the problem. They are underlined.

1. How many mL of a 0.10 M Ca(OH)2 solution are required to neutralize 25.0 mL of 0.50 M HNO3?

1. If it takes 50 mL of 0.5 M KOH solution to completely neutralize 125 mL of sulfuric acid solution (H2SO4), what is the concentration of the acid solution? Assume we are only removing one H+ from H2SO4 *0.2 M*

1. It takes 26.23 mL of a 1.008 M NaOH solution to neutralize a solution of 5g of an unknown monoprotic acid in 150.2 mL of solution. What is the molecular weight of the unknown? *192.3 g/mol*

1. What volume of 1.015 mol/L magnesium hydroxide is needed to neutralize 40.0 mL of 1.60 mol/L HCl? *31.5 mL*

1. In a titration experiment, 25.0 mL of an aqueous solution of sodium hydroxide was required to neutralize 50.0 mL of a 0.010 M hydrochloric acid. What is the concentration of the sodium hydroxide solution? *0.020 M*
2. What volume of 0.150 M HCl is needed to neutralize each solution listed below?
   1. 25.0 mL of 0.135 M NaOH *22.5 mL*

* 1. 20.0 mL of 0.185 M NH4OH *24.7 mL*

* 1. 80.0 mL of 0.0045 M Ca(OH)2 *4.8 mL*

1. What concentration of sodium hydroxide is required for each neutralization reaction?
   1. 37.82 mL of NaOH neutralizes 15.00 mL of 0.250 M HF *0.0991 M*

* 1. 21.56 mL of NaOH neutralizes 20.00 mL of 0.145 M H2SO4. Assume we are only removing one H+ from H2SO4 *0.135 M*

* 1. 14.27 mL of NaOH neutralizes 25.00 mL of 0.105 M H3PO4 Assume we are only removing one H+ from H3PO4 *0.184 M*

1. A 25.0 mL sample of sulfuric acid is completely neutralized by adding 32.8 mL of 0.116 M ammonia solution. Ammonium sulphate is formed. What is the concentration of the sulfuric acid? *7.6 x 10-2 M  
   \*HINT\* - use the balanced equation. You are removing both H+ this time according to the equation!*
2. Lactic acid, a chemical responsible for muscle fatigue, is a monoprotic acid. When 0.578 g of lactic acid is titrated with 0.206 M NaOH, a volume of 31.11 mL of NaOH is used. What is the molar mass of lactic acid?   
   HA + NaOH 🡪 NaA + H2O
3. A volume of 25.0 mL of nitric acid, HNO3 is titrated with 0.12 M NaOH. To completely neutralize the acid 10 mL of NaOH must be added. Find the concentration (mol/L) of the nitric acid. HNO3 + NaOH 🡪 NaNO3 + H2O
4. Malonic acid is a diprotic acid used in the production of pharmaceuticals. A 0.965 g sample of malonic acid requires 45.91 mL of 0.404 M LiOH to be neutralized. Determine the molar mass (g/mol) for malonic acid.   
   H2A + 2 LiOH 🡪 Li2A + 2 H2O
5. To find the molarity of sulfuric acid, H2SO4 it is titrated with 0.75 M KOH. It requires 328.4 mL of KOH to neutralize a 40.00 mL sample of sulfuric acid. Calculate the concentration (mol/L) of the sulfuric acid.   
   H2SO4 + 2 KOH 🡪 K2SO4 + 2 H2O
6. Boric acid is a triprotic acid that is used as an ant and roach killer. A 1.42-g sample of boric acid is neutralized by 157 mL of 0.4388 M NaOH. Determine the molar mass (g/mol) for boric acid. H3A + 3 NaOH 🡪 Na3A + 3 H2O
7. Tartaric acid, H2C4H4O6 is neutralized with NaOH. A sample of 3.0 g of tartaric acid reacts with 45 mL of base. How concentrated is the base? H2C4H4O6 + 2 NaOH 🡪 Na2C4H4O6 + 2 H2O
8. Using the following graph, determine the concentration of the unknown titrand.

**Titration of 25 mL HCl of Unknown Concentration   
 with 0.10 M Sodium Hydroxide as Titrant**

