

## ACID-BASE TITRATIONS:

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To determine the concentration of an acid (or base), we can react it with a base (or acid) of known concentration until it is completely neutralized. This point of exact neutralization, known as the endpoint or equivalence point, is noted by the change in color of the indicator.

We use the following Titration formula from our Table T (Reference Tables):

$M_A$  = molarity of acid

$V_A$  = volume of acid

$$M_A V_A = M_B V_B$$

$M_B$  = molarity of base

$V_B$  = volume of base

Solve the following problems. SHOW ALL WORK!

1. A 25.0 mL sample of HCl was titrated to the endpoint with 15.0 mL of 2.0 M NaOH. What is the molarity of the HCl?
2. A 10.0 mL sample of  $H_2SO_4$  was exactly neutralized by 13.5 mL of 1.0 M KOH. What is the molarity of the  $H_2SO_4$ ?
3. How much 1.5 M NaOH is necessary to exactly neutralize 20.0 mL of 2.5 M  $H_3PO_4$ ?
4. How much of 0.5 M  $HNO_3$  is necessary to titrate 25.0 mL of 0.05 M  $Ca(OH)_2$  solution to the endpoint?
5. What is the molarity of a NaOH solution if 15.0 mL is exactly neutralized by 7.5 mL of a 0.02 M  $HC_2H_3O_2$  solution?

## Titration Practice:

A titration was set up and used to determine the unknown molar concentration of a solution of NaOH. A 1.2 M HCl solution was used as the titration standard. The following data were collected.

	Trial 1	Trial 2	Trial 3	Trial 4
Volume of 1.2 M HCl	10.0 mL	10.0 mL	10.0 mL	10.0 mL
Initial Reading of NaOH	0.0 mL	12.2 mL	23.2 mL	35.2 mL
Final Reading of NaOH	12.2 mL	23.2 mL	35.2 mL	47.7 mL
Volume of NaOH used (mL)				
Molarity of NaOH (M)				

- 1) Calculate the volume of NaOH used to neutralize the acid for each trial. Record in data table above. Show one sample calculation below.
- 2) Using the  $M_A V_A = M_B V_B$  formula calculate the molarity of the base for each trial. Record in data table above. Show one sample calculation below.
- 3) Calculate the average molarity of the NaOH using your results from question 2. Your answer must include the correct number of significant figures and the correct units.