# Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_ Score: \_\_\_\_\_\_\_\_\_

# MC900410905[1] qrcode.acid base salt theory.png

**Normality** is the number of equivalents of H+ or OH- per LITER. It is used as a concentration for acids or bases. The number of equivalents is determined by how many H+ or OH- per mole of acid (or base).

 1 mole HCl = 1 equiv. H+

 1 mole H2SO4 = 2 equiv. H+

 1 mole H3PO4 = 3 equiv. H+

 1 mole NaOH = 1 equiv. OH-

 1 mole Ca(OH)2 = 2 equiv. OH-

*Since* ***molarity*** *is moles per liter and* ***normality*** *is equiv. per liter*, you can convert between the 2 concentrations by doing the following:

 **M = N x mol/equiv.**

  **Moles equiv. moles**

 **--------------- = -------------- x ------------**

 **Liter Liter equiv.**

1. **Determine the mass** of 1.00 equivalent of HNO3.

2. **Determine the mass** of 1.00 equivalent of H2CO3.

3. **Determine the normality** of a 0.3 M H3PO4 solution.

4. **Determine the molarity** of a 0.45 N HCl solution.

For any aqueous solution of acid or base, the (equilibrium) product constant for water is **Kw = [H3O+] [OH-] = 1.0 x 10-14** at 25oC. So if either concentration is known, the other concentration could be calculated using that formula.

On the **pH scale,** a *pH of 0 to 7 is acidic, 7 to 14 is basic and 7.00 is neutral*.

To calculate a pH use the formula **pH = - log [H3O+]**

To calculate a pOH use the formula **pOH = - log [OH-]**

The relationship between  pH and pOH: **pH + pOH = 14.00**

To go backwards and solve for a concentration:

 **[H3O+] = 10-pH** and **[OH-] = 10-pOH**

5. **Determine the [H3O+] and [OH-]** for a solution which is 0.001 M HNO3.

 HNO3 + H2O 🡪 H3O+ + NO3-

6. **What is the pH** of a solution whose [H3O+] = 3.4 x 10-5 M?

7. The pH of an aqueous solution is measured to be 1.50. **Calculate [H3O+] and**

 **[OH-].**

In a titration, you carefully add a KNOWN volume of a KNOWN concentration of either an acid or base to the other (base added to acid or acid added to base) until the equivalence point is reached. That other substance you know the VOLUME of but not the concentration.

For molarity titrations use the following:

**Liters KNOWN mol KNOWN mol UNKNOWN 1**

**-------------------- x ------------------ x ----------------------- x --------------------------**

 **1 1.00 Liters mol KNOWN Liters UNKNOWN**

{vol known} x {M known} x mole ratio x {1/vol unknown}

 (from balanced reaction)

Once this calculation is finished you get units of MOL/L of unknown which is the MOLARITY of the unknown!!

8. By titration, 17.6 ml of aqueous sulfuric acid just neutralized 27.4 ml of 2.00 M

 LiOH solution. **What is the molarity of the acid solution**?

For a normality titration it is NOT necessary to show a balanced reaction since the number of equivalents is already accounted for in the N concentrations!!

The formula for normality titrations is:

 **NACID VACID = NBASE VBASE**

9. **Determine the normality of a NaOH solution** when 45.1 ml of a 0.100 N HCl

 solution was used in titrating 31.0 ml of the base.

10. **What volume** of 0.250 N NaOH would be needed to neutralize 30.0 ml of

 0.450 N H2SO4?