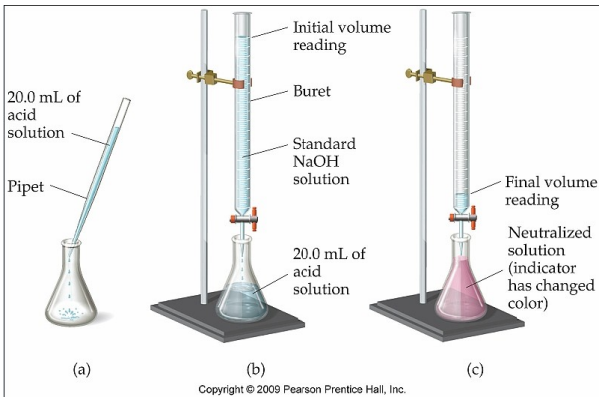
Titrations

Name: _____

Support Reading: p150 -152

Titrations are used to quantitatively determine the amount of a chemical species, the analyte, through a chemical reaction of known stoichiometry . There are several steps used during a titration that we will cover in this unit.



Analyte:
The chemical species that is to be determined

Titrant: Reactant of known concentration delivered by a precise volume

Primary Standard: A solid reactant we can make into solution with a high level of accuracy. Usually this is a solid that will not react or absorb any compounds from the air (oxygen, water, etc)

Equivalence Point: The moment when the analyte has been completely reacted.

Indicator: A spectator chemical species added to the reaction to show when the reaction has reached a chosen point. This point is called the **end point**. The end point may or may not be equal to the equivalence point of the reaction.

(e.g. **phenolphthalein**, **methyl orange**, **1% starch solution, etc**)

Pipet: A device to deliver liquid or aqueous solutions to a high level of accuracy and precision. It is calibrated to deliver a single (usually) volume of liquid.

Buret: A graduated tube of high precision that delivers the titrant to the analyte

Making Solutions

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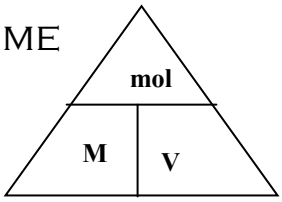
Concentration: is a term used to define the amount of solute dissolved in an given quantity of solvent or quantity of solution. Therefore, the more solute in solution the greater the concentration.

Molarity: Molarity (M, mol/L) is the number of moles of solute in a litre of solution (soln).

$$\text{Molarity} = \frac{\text{moles solute}}{\text{volume of solution in litres}}$$

Sample 1:
Calculate the Molarity of dissolving 35.0g of sodium chloride in 1.25L of water

Interconverting Molarity, Moles, and Volume



Looking at the formula from the previous page (of molarity) we can use a simple formula triangle to quickly rearrange that formula to solve for volume, moles, or concentration.

Sample 2:
(a) How many moles of silver nitrate is in 200.0ml of a 0.235 mol/L solution?

(b) If I want 0.20mol of Potassium Iodide from a 0.15 mol/L solution of KI, what volume of solution would I need?

(c) What is the molarity of a 15.5mol of $HCl_{(g)}$ in 10.0L of water?

Dilution

We frequently must alter the concentration of a solution by diluting it in the lab. We buy standardized (stock) solutions from a chemical supplier that is shipped to the school and these solutions are made to the desired solution for an experiment. We use the following expression:

$$M_{conc} \times V_{conc} = M_{dilute} \times V_{dilute}$$

- M_{conc}: Concentration of Stock (concentrated) solution in mol/L
- V_{conc}: Volume of Stock solution (in Litres)
- M_{dilute}: Concentration of Stock (concentrated) solution in mol/L
- V_{dilute}: Volume of Dilute solution (in Litres)

Sample 3:

What volume, in ml, of 12M HCl would I need to make a 500.0ml solution of 0.25M $HCl_{(aq)}$