Gravimetric Methods of Analysis

- Chapter 8 Gravimetric Analysis
  - Skoog Book
    - *Page 179-198 Do Problems: 1,2,4,9,10,11,14,16,21,27,30,33*

- Chapter 9 Electrolyte Effects Activities
  - Effective concentration and equilibrium
  - Please do problems: 1,2,3,6,7,8,12

- Exam II Feb. 13

Gravimetric Calcualations

Calculate the grams of anlyte per gram of precipitate for the following:

Analyte	**Precipitate**
K	Ag_3PO_4
K_2HPO_4	Ag_3PO_4
Bi_2S_3	$BaSO_4$

The Gravimeteric Factor

- Don't let this term bug you it is something you already know just never defined before.

- It is just a convenience equation of analytical chemists

$$\text{GF} = \frac{\text{f mass analyte}}{\text{f mass precipitate}} \times \frac{\text{mol analyte}}{\text{mol precipitate}} = \frac{\text{g analyte}}{\text{g precipitate}}$$

So imagine we want to know how much Cl_2 was in a sample that was converted to AgCl precipitate and the dried precipitate weighed 1.00 g AgCl. How much Cl_2 was there and what is the GF?

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The Gravimetric Factor

$$\text{g } Cl_2 = 1 \text{ g AgCl} \times \frac{1 \text{ mol AgCl}}{143.35 \text{ g AgCl}} \times \frac{1 \text{ mol Cl}}{1 \text{ mol AgCl}} \times \frac{2 \text{ mol } Cl_2}{1 \text{ mol Cl}} \times \frac{70.9 \text{ g } Cl_2}{1 \text{ mol } Cl_2}$$

Gravimetric Calculations

- Most of the time we are interested in the % analyte in an unknown sample.

$$\% \text{ A} = \frac{\text{mass analyte}}{\text{mass sample}} \times 100$$

g precipitate X GF

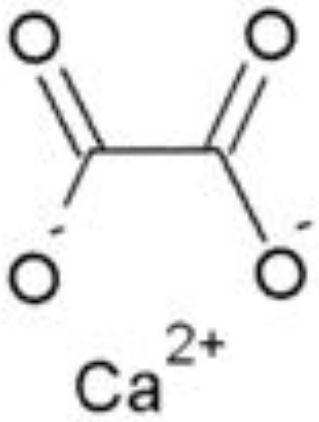
mass by difference in a crucible

Gravimetric Calculation

A 0.4500 g sample of impure potassium chloride was dissolved in water and treated with an excess of silver nitrate. A 0.8402 g of silver chloride was massed after digesting, collecting, washing and drying the precipitate. Calculate the percentage KCl in the original sample. (9712)

Gravimetric Calculation

The calcium in a 200.0-mL sample of a natural water was determined by precipitating the cation as CaC_2O_4. The precipitate was filtered, washed and ignited in a crucible with an empty mass of 26.6002 g. The mass of the crucible plus CaO (molar mass = 56.077g/mol) was 26.7134 g. Calculate the concentration of Ca (molar mass = 40.078 g/mol) in the water in units of grams per 100 mL.



calcium oxalate

Worked Example

- A 0.7406 g sample of impure $MgCO_3$ was decomposed with HCl, releasing 0.1881 g of carbon dioxide. Calculate the % Mg in the original sample. Remember that CO_3
- How much CaO (in grams) can be produced from 1.500 g of calcium carbonate?

Gravimetric Calcuation

An iron ore was analyzed by dissolving a 1.1324-g sample in concentrated HCl. The resulting solution was diluted with water, and the iron(III) was precipitated as the hydrous oxide $Fe_2O_3 \cdot xH_2O$ by the addition of NH_3. After filtration and washing, the residue was ignited at a high temperature to give 0.5394 g of pure Fe_2O_3 (molar mass =159.69 g/mol). Calculate (a) the %Fe (molar mass = 55.847 g/mol) and (b) the % Fe_3O_4 (231.54 g/mol) in the sample.

Worked Example

A 0.2356 g sample containing only NaCl (fwt 58.44 g/mol) and $BaCl_2$ (fwt 208.23 g/mol) yielded 0.4637 g of dried AgCl (fwt 143.32 g/mol). Calculate the percent of each halogen compound in the sample.

Worked Example

A certain barium halide exists as the hydrated salt $BaX_2.2H_2O$, where X is an unknown halogen. A sample of the halide hydrate (0.2650 g) was dissolved in water in 200 cm^3 and excess sulfuric acid added. The mixture was then digested and held at boiling for 45 minutes. The precipitate was filtered off, washed and dried. The mass of precipitate obtained = 0.2533 g. Determine the identity of X.