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GRAVIMETRY ANALYSIS

BASIC CONCEPT, PRINCIPLE

BY, LIPSA SAMAL

ASST. PROF (PA & QA), SPLS, CUTM



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- GRAVIMETRIC ANALYSIS OR QUANTITATIVE ANALYSIS** is the process of isolating and weighing an element or a definite compound of the element in as pure a form as possible.
- The element or compound is separated from a weighed portion of the substance being examined.
 - A large proportion of the determinations in gravimetric analysis is concerned with the transformation of the element or radical to be determined into a pure stable compound which can be readily converted into a form suitable for weighing.



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- **The weight of the element or radical may then be readily calculated from a knowledge of the formula of the compound and the relative atomic masses of the constituent elements.**
- **The separation of the element or of the compound in a number of ways, the most important of which are: (a) precipitation methods; (b) volatilisation or evolution methods; (c) electroanalytical methods; and (d) extraction and chromatographic methods.**



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- **The advantages offered by gravimetric analysis are:**
- **(a) it is accurate and precise when using modern analytical balances;(b) possible sources of error are readily checked, since filtrates can be tested for completeness of precipitation and precipitates may be examined for the presence of impurities;**
- **(c) it has the important advantage of being an absolute method, i.e. one involving direct measurement without any form of calibration being required;**
- **(d) determinations can be carried out with relatively inexpensive apparatus, the most expensive requirements being a muffle furnace and, in some cases, platinum crucibles.**



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THEORY & PRINCIPLE

The underlying principles and theories of gravimetric analysis are as stated below :

- **(i) Law of mass action and reversible reactions,**
- **(ii) Principle of solubility product, and**
- **(iii) Common ion effect.**



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THE LAW OF MASS ACTION advocates that the rate of a reaction is directly proportional to the product of the molecular concentrations of the reacting substances.

- For example : $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{HCl}$
- In the above reaction the rate of reaction is designated by the following expression :

Forward reaction :

- $\text{Rate} = [\text{BaCl}_2] \times [\text{H}_2\text{SO}_4] \times k \dots(a)$ where, k = a constant that corrects for all factors which affect the rate other than concentration.

Opposing reaction :

- $\text{Rate} = [\text{BaSO}_4] \times [\text{HCl}] \times k_1$



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THE PRINCIPLE OF SOLUBILITY PRODUCT may be stated as

follows : ‘The product of the concentration of the constituent ions in a saturated solution of a difficultly soluble salt for any given temperature is practically a constant, each concentration being raised to a power equal to the relative number of ions supplied by one molecule of the salt upon dissociating’. The principle of solubility product is applicable to :

- (i) difficultly soluble salts in their saturated solutions,**
- (ii) occurrence of precipitation,**
- (iii) prevention of precipitation,**



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COMMON ION EFFECT

The common-ion effect states that in a chemical solution in which several species reversibly associate with each other by an equilibrium process, increasing the concentration of any one of its dissociated components by adding another chemical that also contains it will cause an increased amount of association.



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