

Q. 1. Sample of NaOH weighing 5.0 g is dissolved in 45 g of water. (1 g water is \approx 1 ml) calculate wt % of NaOH in solution.

Ans.
$$p = \frac{5.0}{5.0 + 45} \times 100 = 10\%$$

Q. 2. Concentrated HCl (MW = 36.5) has a density of 1.19 g/ml and 37% by wt of HCl. How many ml of Conc. HCl should be dilute to 1 lit. with H₂O to prepare a 0.100 M.

Ans. gm of HCl needed = $\frac{V}{M} \times \frac{MW}{1000}$

$$= 3.65 \text{ g}$$

gm of HCl/ml = 1.19 g/ml \times 0.37 = 0.44 g/ml

Volume of HCl required = $\frac{\text{gm of HCl needed}}{\text{gm of HCL/ml}} = \frac{3.65}{0.44}$

$$= 8.3\text{ml}$$

$$\text{No of ml. of HCl} = \frac{V \times M \times Mw \times 100}{u \times \% \text{ purity}}$$

For very dilute solutions

$$PPm = \frac{W}{W + W_0} \times 10^6 \text{ since } w \text{ is usually very small compared to } W_0. \text{ 1 mg}$$

solution 1 lit of water of as 1 ppm

$$\therefore PPm = \frac{W}{W_0} \times 10^6$$

Q. 3. If drinking water contains 1.5 ppm of NaF. How many lit of water can be fluoridated with 1.0 lb (454 g) of NaF

Ans. Let V be the lit of water to fluoridated

Since 1 ppm = 1 mg/lit of H₂O

$$1.5 = \frac{454 \times 10^3 \text{ mg NaF}}{V(L)} \qquad V = 3.0 \times 10^5 \text{ lit}$$

For even more dilute solutions the system ppb is employed

$$PPb = \frac{W}{W_0} \times 10^9$$

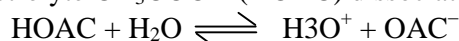
Q. 4. What do you mean by stoichiometric calculations.

Ans. When a solution is prepared and its concentration is determined accurately and it can be employed as titrant in determining purity of an unknown sample. The calculations involved are called stoichiometric and are based on the mole and mass relations between the elements and compounds.

Q. 5. What is formality of formal solution.

Ans. Many compounds undergo dissociation or complex formation when dissolved in certain solutions.

Eg. Weak electrolyte CH₃COOH (HOAc) dissociates into its ions when dissolved in water



If 0.100 mole of HOAc dissolved in 0.100 lit. of solution and dissociates to extent of 1.3% the solution is not 0.100 M in HOAc molecules. But a solution is 0.0987 M HOAc and 0.0013M of OAc⁻. In such case many chemists use the term F or analytical conc (Cx). Which indicates total concentration of species arising from HOAc.

Eg. F = Cx = [HoAc] + [OAc⁻] = 0.0987 + 0.0013

$$F = N_f/v$$

N_f = no. of formula wt. of solute and V is volume of solution in lit.

g = no. of gm of solute and F_w = Formula wt.

$N_f = g/F_w$ or $F = g/F_w \times V$

Q. 6. What do mean by primary standard. what are ideal characteristics of a primary standard.

Ans. A standard solution can sometimes be prepared by dissolving an accurately weighed sample of desired solute in an accurately measured weight of solution. But it is not applicable because very few chemicals can be obtained in sufficiently pure form to meet analyst's demand of accuracy. Few substances, which are adequate in this connection are called primary standards.

Characteristics of primary standards:

1. It should be readily available in pure form or in a state of known purity at reasonable cost.
2. The total amount of impurities should not exceed from 0.01 to 0.02%
3. It should be possible to test for purities by qualitative test of known sensitivity.
4. Substance should be stable.
5. It should be easy to dry.
6. It should not be so hygroscopic that it takes up water during weighing.
7. It should not lose its weight on exposure to air.
8. Primary standards have normally high equivalent weight to minimize the consequences of errors during weighing.

Eg. For standardization of base:

Potassium hydrogen Phthalate $KHC_8H_4O_4$

Sulfamic Acid HSO_3NH_2

Potassium hydrogen Iodate $[KH(IO_3)_2]$

For standardization of acids:

Sodium carbonate Na_2CO_3

Tris (hydroxymethyl) aminomethane $(CH_2OH)_3 CNH_2$ known as TRIS and THAM.

Secondary standards:

For acids and bases titration, generally solutions of acid and base of approximate desired concentration are taken and then standardize one of the solutions against primary standard. Solution thus standardized is called secondary standard and is used to obtain concentration of other solution.

Other examples of primary standards:

Many of primary standards are available as redox reagents

Eg. As_2O_3 , $Na_2C_2O_4$, Fe, $K_2Cr_2O_7$

Crystalline oxalic acid, anhydrous Na_2CO_3 , NaCl, KCl, $AgNO_3$, $FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$

Eg. Of Secondary standards:- HCl, H_2SO_4 , HNO_3 , NaOH, KOH, $KMnO_4$ etc.

Q. 7. What is indicator? What are the types of indicators?

Ans. It indicates the end point generally by a change of colour of solution. It indicates the physico-chemical reaction of a chemical reaction.

3 Types:

(a) **Internal Indicator:-** These are the substance that are added to titration mixture in conical flask.

Eg.: Phenolphthalein, Methyl Orange

- (b) **External Indicator:-** It is not added to titration mixture is conical flask eg: Potassium ferrocyanide in titration of $K_2Cr_2O_7$, $FeSO_4(NH_4)$, SO_4 , Starch etc.
- (c) **Self Indicator:-** If reagent is strongly colored and is decolorized by substance that is being determined or it is converted into slightly colored compound at the end point Eg. $KMnO_4$.

Internal indicators are classified into

- Acid Base indicators
- Redox indicators
- Precipitation Indicators
- Adsorption Indicators