Medical Chemistry

First stage

Collage of Dentistry

Lecture : 1

Concentration(preparation of solution)

by

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Concentration(preparation of solution)

The preparation of solution differ from each other by the amount of solute ,and can express on it by the weight or volume unite. There are several method to express about the concentration of solution is Molarity ,Normality and part per million (ppm), to prepare standard solution must be know the volume if the substance is liquid while we use sensitive balance if the substance is solid.

a- Preparation of solution from solid substance:-

To prepare solution from solid substance which have know concentration must be calculate the solid substance amount that dissolve in know volume of D.W

And to calculate the weight we using:-

$$Wt = \frac{M \times V(ml) \times M.Wt}{1000}$$ in case of Molarity

When :-

Wt: is the weight of solid substance in(gm).

M: is the Molarity in (mol / liter) unite.

V_{ml} : is the want volume in (milliliter).

M.Wt : is the molecular weight of solid substance that wanted to prepare.

While in case of Normality the equation become :-

$$Wt = \frac{N \times V(ml) \times eq.wt}{1000}$$

$$\text{eq.wt} = \frac{M.Wt}{no.of\ equivalent}$$

Q1/ prepare the solution of aluminum chloride NH_4CL in concentration (0.1) M in (1/2) liter of D.w. ? atomic weight for (Cl = 35.5 , N= 14).

Sol./

$$Wt = \frac{M \times V(ml) \times M.Wt}{1000}$$

M.Wt $_{(NH4Cl)}$ = (1x 14) + (4x1) + (1x35.5) = 53.49g/mol

V(ml) = 0.5 x 1000 = 500ml

Wt = $\frac{0.1\ x\ 500\ x\ 53.49}{1000}$ = 2.6745 g.

To prepare this solution we take 2.6745 g of NH_4Cl and then dissolve in a little amount of D.w. then its transfer to volumetric flask having the volume 500 ml.

Q2/ prepare the solution of Na_2CO_3 in concentration (0.05) N in (200) ml of D.W. ? M.Wt = 106 g/mol.

Sol./

$$Wt = \frac{N \times V(ml) \times eq.wt}{1000}$$

$$\text{eq.wt} = \frac{M.Wt}{no.of\ equivalent}$$

$$= \frac{106}{2} = 53 \text{ g/mol}$$

$$= \frac{0.05\ x\ 200\ x\ 53}{1000} = 0.53 \text{ g.}$$

To prepare this solution we take 0.53g of Na_2CO_3 and then dissolve in a little amount of D.w. then its transfer to volumetric flask having the volume 200 ml.

b- Preparation the solution from liquid substance :-

Prepare the standards solution in the laboratory is very important for more concentration solution such as acid and base and to prepare this solutions we use:

1- Calculate the Molarity or Normality of concentration solution about:

$$\boldsymbol{M = \frac{Sp.gr\ x\ \%\ x\ 1000}{M.Wt}}$$ in case of Molarity

When:-

M = the Molarity of concentration solution.

$Sp.\ gr$ = qualitative weight.

% = molar ratio

M.Wt = molecular weight.

$$\boldsymbol{N = \frac{Sp.gr\ x\ \%\ x\ 1000}{eq.wt}}$$ in case of Normality

2- using the dilution low:-

M_1 X V_1 = M_2 X V_2

Not:

The qualitative weight and molar ratio is found on the tube**.**

Q1/ Prepare the solution of H_2SO_4 in concentration (5)N and volume (50) ml ,the qualitative weight (1.84) ,molar ratio 98% and M.Wt (98.08) g/mol?

Sol./

$$N = \frac{Sp.gr\ x\ \%\ x\ 1000}{eq.wt}$$

$$\text{eq.wt} = \frac{M.Wt}{no.of\ equivalent} = \frac{98.08}{2} = 49.04 \text{ g/mol}$$

$$N = \frac{1.84\ x\ o.98\ x\ 1000}{49.04} = 36.769 \text{ N}$$

$N_1 \text{ X } V_1 = N_2 \text{ X } V_2$

$36.769 \text{ X } V_1 = 5 \text{ X } 50$

$V_1 = \frac{5\ X\ 50}{36.769} = 6.799$ ml.

Weight/weight percent:-

To determine the weight per cent of a solution, divide the mass of solute by mass of the solution (solute and solvent together) and multiply by 100 to obtain percent.

$$\text{concentration \%(w/w)} = \frac{\text{mass of solute}}{\text{mass of solution}} \text{ X } 100$$

Determine the % of a solution which has 25.0g of NaCl dissolved in100mL of De-ionized water.

Solution

Given,

Mass of solute (NaCl) = 25g

Mass of solvent (de-ionized water) = 100g (1 mL of de-ionized water roughly weighs 1g)

Therefore, mass of solution = mass of solute + mass of solvent = 100g + 25g = 125g

Mass % of NaCl in this solution = (25g/125g)*100% = 20%

Therefore, mass % of NaCl in the solution is 20%

Volume/volume percent:

Volume/volume percentage (v/v percent) is a measure of the concentration of a substance in a solution. It is expressed as the ratio of the volume of the solute to the total volume of the solution multiplied by 100.

Vsolution= Vsolut+ Vsolvent

$$\%\ \text{by volume} = \frac{\text{Volume of solute}}{\text{Volume of solution}} \times 100$$

Example: Calculate the percent by volume of alcohol in 95 mL of solution which contains 30 mL of alcohol.

Data:

Solute = 30 mL

Solution = 95 mL

% by volume = ?

$$\%\ \text{by volume} = \frac{\text{Volume of solute}}{\text{Volume of solution}} \times 100$$

$$= \frac{30\ \cancel{mL}}{95\ \cancel{mL}} \times 100$$

= 31.6 % of alcohol

Weight / Volume percentage concentration (w/v%), or mass/volume percentage concentration (m/v%):-

is a measure of the concentration of a solution. w/v% or m/v% is calculated by dividing the mass of the solute in grams by the volume of solution in millilitres then multiplying this by 100.

$$\text{w/v (\%)} = \%\text{(m/v)} = \frac{\text{mass of solute (g)}}{\text{volume of solution (mL)}} \times 100$$

Milligrams per 100ml (mg/dl):-

Milligrams per milliliter (mg/mL) is a measurement of a solution's concentration. In other words, it's the amount of one substance dissolved in a specific volume of a liquid.

1 Milligram per milliliter [mg/ml] = 100 Milligram per deciliter [mg/dl]

1 mg/mL = 100 mg/dL

2 mg/mL = 200 mg/dL

Parts per million and part per billion:-

PPM and PPB are units used in atmospheric chemistry to describe the concentration of gases. PPM stands for parts of gas per million parts of air, and PPB is parts per billion.

Parts per million and parts per billion may be converted from one to the other using this relationship: 1 part per million = 1,000 parts per billion.