BCH 312
Experiment (2)

Preparation and Dilution of Solutions

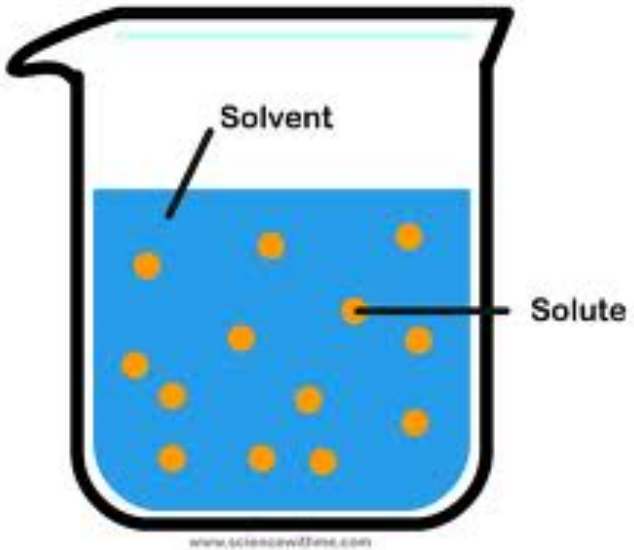
Objectives

1) To learn how to prepare solutions.

2) To get familiar with solution dilutions.

Solution, solute and solvent

- **Solution**: It is composed of one or more substance (the solute) dissolved in another substance (the solvent) forming a homogenous mixture .



A. Preparation of biological solutions

- **There are many expressions for concentration:**

1. Molarity
2. W/V %
3. W/W %

Molarity

- **It is the number of moles of solute dissolved in 1Lof solution.**

Example:

- **Prepare 100 ml 0f 2 M NaCL .**
- **First, we must calculate number of moles so we can calculate the weight in grams.**
- **Molarity= Number of moles / Volume in liters**
- **Number of moles=Molarity x volume**
- **=2 x 0.1 = 0.2 moles**
- **Now, we need to calculate grams of NaCl:**
- **Weight= mole x molecular weight**

=0.2 x (23 + 35.5)=11.7 grams

We dissolve 11.7 grams of NaCl and make up the volume to 100 ml

Molarity

Practically,

1. Place a beaker in a balance and zero the balance.
2. Weight 11.7 grams of NaCl , in the beaker and dissolve in a very small volume of water ,once the solid is dissolved, the volume is transferred to 100 ml volumetric flask.
3. Wash the beaker at least 2 times with small amount of distilled water and transfer it to the volumetric flask, to make sure all the solute is dissolved and there is no left overs.
4. Bring up to a final volume 100 ml.

w/v %

It is the number of grams of solute dissolved in 100 mL of solution.

- For example, 3% of NaOH, means 3 grams of NaOH is dissolved in 100 ml of the solution

Example

- **Prepare 50 ml of 4% NaOH**
- 4g → 100 ml
- ? → 50 ml
- Weight = 2 g

To prepare the solution, 2 grams of NaOH is dissolved in little water and the volume made up to 50 ml

W/W%

It is the number of grams of solute dissolved in 100 gram of solution

- The concentrations of many commercial acids are giving in terms of w/w%.
- In order to calculate the volume of the stock solution required for a given preparation the density (specific gravity) of stock solution should be provided.

Example

Prepare 100ml of 0.4 M HCl solutions starting with the concentrated HCl solution you are provided with. (w/w% = 36% , S.Gr = 1.15).

- Weight(g)= volume(ml) x SGr x w/w% as decimal
- **Important Note!!!**: the volume in this formula is not the required volume in the question, it is the volume of the concentrated HCl that you must add.
- First we must calculate the weight by the following:
- Mole=Molarity x volume in liter

  = 0.4 x 0.1=0.04 mole
- Weight= mole x MWt

  =0.04 x 36.5= 1.46 g
- 1.46=volume x 1.15 x 0.36 → Volume= 3.53 ml

To prepare the solution 3.53 ml of stock (i.e. concentrated HCl) solution is needed and the volume made up to 100 ml by the addition of water.

B. Solution dilution

1) Volume to volume dilutions :

- This type of dilutions describes the ratio of the solute to the final volume of the dilute solution

Example:

Prepare 30 ml of a 1:50 dilution of the 0.07M NaOH solution

- 1ml---------→50 ml
- ?----------→30 ml
- (1 x 30)/50=0.6 ml

0.6 ml of the starting solution (0.07M NaOH) is needed and volume made up to a final volume of 30 ml.

2)Preparing dilutions by using the $V_{1X}C_1=V_{2X}C_2$ formula

- Where:

V_1= Volume of starting solution needed to make the diluted solution.

C_1= Concentration of starting solution.

V_2= Final volume of diluted solution.

C_2= Final concentration of diluted solution.

Example:

Prepare 50 ml of a 2.5x10-3M from prepared 0.4M HCl.

- C1 x V1 = C2 x V2
- 0.4 x V1 = 2.5x10-3 x 50
- V1=0.337 ml

0.337 ml of the starting solution is taken and final volume made up to 50 ml by the addition of water.

3) Serial Dilutions

It is a step wise dilution of a solution, where the dilution factor is constant at each step. The source of dilution material for each step comes from the diluted material of the previous step

Example:

Starting with a 2.0 *M* stock solution of hydrochloric acid, prepare four standard solutions by serial dilution of the following Molarity respectively 1 M, 0.5 M, 0.25 M, 0.125 M.

Dilution factor (D.F) = 2/1 = 2 → 1:2

To prepare standard solution 1, 1 ml of the stock 2.0M solution is needed and volume made up to 2 ml with distilled water (never forget to mix properly).

To prepare standard solutions 2-4, 1 ml of the previously diluted solution is taken and volume is made up to a final volume of 2 ml by the addition of distilled water .