Solutions

Definition of solution

1. It is a mixture of liquid where the minor component is solute and is dissolved in the major component is solvent.
2. This solute and solvent are uniformly distributed.

- These are the formulas for the preparation of various solutions

Concentrations of solution

A dilute solution is one that contains a small amount of solute.

A concentrated solution contains a large amount of solute.

Molar solution

1. It contains one mole as (molecular weight) of solute in a solution (solvent) making it equal to one liter.
2. Molar solution = Molecular weight in gram/liter in the solution.
3. Example:
4. I molar solution of sodium chloride (NaCl).

Sodium atomic weight = 23

Chloride atomic weight = 35.5

Total molecular weight = 58.5 gram/mol

Normal solution

- The normal solution is defined as the gram equivalent weight per liter of the solution (solvent).
    - Normal solution = gram equivalent weight of solute/liter of the solution (solvent) = Eq.wt/L.
- These solutions are expressed as N.
    - Gram equivalent weight = Gram molecular weight/valency.
- Example of Gram equivalent weight e.g NaCl
    - NaCl gram molecular weight = 58.5 g
    - Valency =1
    - 58.5/1 = 58.5 gram equivalent weight.

Example

To make a 1 N sodium chloride solution

- The molecular weight of NaCl is 58.5.
- Gram equivalent weight of NaCl = molecular weight/1 (valency).
    - So dissolve 58.5 grams of NaCl in distilled water and makeup to one liter.
    - **Dissolve 58.5 grams of NaCl in distilled water to make one liter.**

What is the difference between normal and molar solution?

One of the main differences between the normality and molarity of a solution is that

Normality describes the amount of gram equivalent of compound present in the solution while

Molarity describes the number of moles present in the solution.

What is the difference between 1M and 1N solution?

1M of hydrogen ions is equal to one equivalent of hydrogen ions. Therefore, **1M HCl is the same as 1N HCl**, but when we take sulphuric acid H_2SO_4, 1M of sulphuric acids gives 2M of hydrogen ions into the solution. Therefore, normality of hydrogen ions will be 2N for a sulphuric acid solution.

What is the relation between normal and molar?

The relation between normality and molarity is **N = M x n**

where N refers to normality,

M is molarity,

and n denotes the number of equivalents.

Molarity = Molarity (M) moles solute liters of solution

Molarity is defined as the amount of moles of a compound dissolved in an amount of solvent (usually water).It can be solved with the equation:

Molarity(M) =moles solute liters of solution

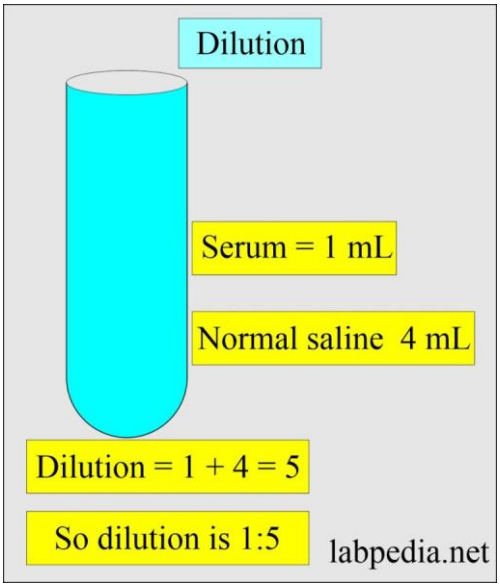
$$\text{Molarity}\,(M) = \frac{\text{moles of solute}}{\text{liters of solution}}$$

Percent solution

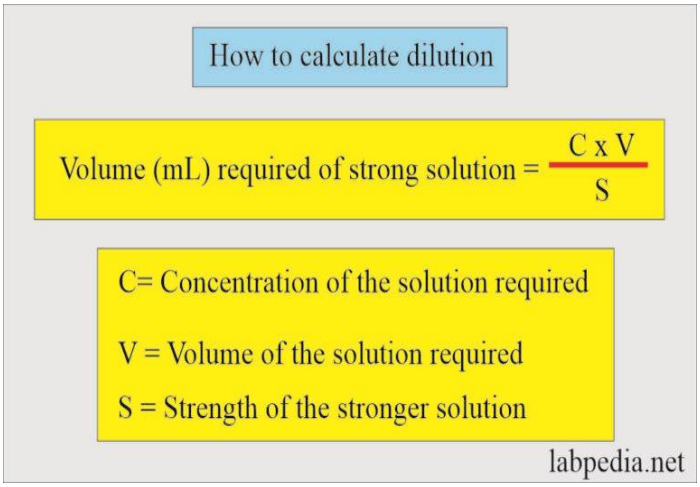
1. This is per hundred part of the total solution.
2. There are three possibilities for a percent solution.
3. **Weight/weight:**
    1. It is a percentage of solute in 100 grams of final solution equal to solute + solvent.
    2. e.g. For the 5% solution take 5 grams of NaCl dissolved in 95 grams of water which is around 95 mL.
4. **Weight/volume:**
    1. 5 grams of NaCl dissolved in water and the volume is made 100 ml is called a 5% solution of NaCl.
5. **Volume/volume:**
    1. It is composed of two solutions. e.g. if we take 5 mL of acid and dilute it to 100 mL of water will be a 5% solution of that acid.

Dilution

1. This procedure is very common to prepare the dilution of the serum where there is a high concentration of chemicals like urea in the blood if it is above 300 mg/dL.
2. If we make a dilution of serum like this:
    1. Serum = 1 ml
    2. Diluting fluid 4 mL
    3. This will be a dilution of 1:5 (1+4 =5).



3. This dilution can be made from the stronger solution by this formula:



Dilution of Solutions

- **Solution: a mixture of two or more substances that is identical throughout (homogeneous)**
- **can be physically separated**
- **composed of *solutes* and *solvents***

- Mixture: a combination of two or more substances that do not combine chemically, but remain the same individual substances; can be separated by physical means.
- Two types:
  - Heterogeneous
  - Homogeneous

Heterogeneous

- Hetero" means "different"
- Consists of visibly different substances or phases (solid, liquid, gas)
- Can be separated by filtering

Homogeneous

- Homo" means the same
- has the same uniform appearance and composition throughout; maintain one phase (solid, liquid, gas)
- Commonly referred to as **solutions**

1. **Example dilution of sodium hydroxide 1:**
    1. To make 250 mL of sodium hydroxide solution 0.25 mol/L from a solution of 0.4 mol/L solutions.
        1. C = o.25 mol/L
        2. V = 250 mL
        3. S = 0.4 mol/L
        4. Calculation = 0.25 x 250 / 0.4 = 156.25 mL
2. **Example dilution of HCL 2:**
    1. Make 500 ml of HCL acid , 0.01 mol/L from a 1 mol/L acid.
        1. C = 0.01
        2. V = 500
        3. S = 1
        4. Calculation = 0.01 x 500 / 1 = 5 mL of HCL acid.
3. **Example for dilution of the body fluids:**
    0. To make a 5 ml of 1 in 10 dilutions of the serum.
        1. C = 1:10
        2. Volume = 5 mL
        3. S = 1
        4. Calculations = 1/10 x 5 / 1 = 0.5 mL of the serum and 4.5 mL of the saline = 0.5 : 4.5 = 1:10 dilution

Question 1: What is the difference between the molar and normal solution?

Molar solution is gram molecular weight/L and the normal solution is gram equivalent weight/L.

Question 2: What is formula for the dilution of various fluids?

Volume mL of the strong fluid = C x V / S

Question 3: What are types of % solution?

There are possibilities of =

1. weight/weight
2. weight/volume
3. Volume /volume