**11.2 Concentration of Solutions**

* The concentration of a solution describes the relative amounts of solute and solvent present.
* A solution with a high ratio is said to be **concentrated** and a solution with a low ratio is said to be **dilute.**
* The most commonly used units for concentrations are:
  + Mass of solute per litre of solution and
  + Amount, in mol, of solute per litre of solution

**Mass of Solute per litre of Solution.**

* Unit is expressed in terms of mass of solute present in 1 litre of solution.

**Worked example.**

**If a 250ml glass of mineral water contains 4.0 mg of sulphate ions, what is the concentration of the ions in the mineral water (mg L-1)**

**÷ 103**

**÷ 103**

**÷ 103**

microlitre

kilolitre

litre

millilitre

**x 103**

**x 103**

**x 103**

**Amount, in mol, of Solute per litre of Solution.**

* This measure of concentration is known as molarity or molar concentration.
* Molarity is defined as the number of moles of solute particles per litre of solution.
* A one molar (1 M) solution contains one mole of solute dissolved in each litre of a solution.
* A concentration of such a solution is said to be *one mole per litre, 1 mol L-1, or 1M.*
* The amount of solute is linked to the concentration (molarity) and volume by the relationship:

Concentration, mol L-1

Volume, L

Amount, mol

**n = c x V**

therefore and

and remember

and

Where: m= mass of substance, M = molar mass and n = amount of substance (mol)

**Worked Examples**

**1. Calculate the molar concentration of a solution that contains 0.125 mol of potassium nitrate dissolved in 200ml of solution.**

**(First convert the given volume to litres)**

**2. Calculate the amount, in moles, of ammonia in 25.0 mL of a .3277 M ammonia solution.**

**3. Calculate the concentration, in mol L-1, of a solution that contains 16.8mg of silver nitrate (AgNO3) dissolved in 150ml of solution.**

**Convert the given volume to litres and mass to grams**

**Calculate the amount, in moles, of AgNO3**

**Calculate he concentration**

**Dilution**

* The process of adding more solvent to a solution is known as dilution.
* The amount of solute remains the same but the spacing between the solute particles has increased.
* The dilution formula can be used to calculate unknown concentrations or volumes.

**The Dilution Formula**

Where c1 = initial concentration and V1 = initial volume and

c2 = final concentration and V2 = finial volume

**Worked Example 1**

**The concentration of a seaweed extract is 9.0 g L-1. If 10 mL of seaweed fertiliser is diluted with water to fill a 2.0 L container, what is the new concentration? (List all your known values and find the unknown) (As concentration is expressed in grams per litre, all volumes must be converted to litres)**

**2. How much water must be added to 40mL of a 2.5M solution of sodium hydroxide to dilute it to 1.0 M?**

**Text Questions: 9 – 12**

**Chapter Review: 14-16, 19-22, 24-33, 35-37**