

EXPERIMENT NO: 02

PREPARATION OF DIFFERENT TYPE OF SOLUTION

Theory

Preparing different types of solutions is a fundamental laboratory skill that is required in many scientific disciplines. In this practical we are going to learn about the principle and preparation of Molar solution, Normal solution, Molal Solution, Percentage solution and ppm solution.

Requirements

- I. Different chemical
- II. Distilled water
- III. Balance
- IV. Beaker
- V. Stirring rod
- VI. Funnel
- VII. Volumetric flask

Molar Solution:

Principle:

A molar solution is a solution in which the concentration of the solute is expressed in moles per liter (mol/L). The molarity of a solution is defined as the number of moles of solute present in one liter of solution.

Example: Prepare 1 liter of 0.1 Molar solution of sodium chloride.

Given: Molecular weight of sodium chloride = 58.44 g/mol, Volume of solution = 1 liter, Desired molarity = 0.1 M.

Procedure:

Weigh 5.84 grams of sodium chloride using a balance. Add the sodium chloride to a clean, dry beaker. Add a small amount of water to dissolve the sodium chloride. Stir the mixture until the solute is completely dissolved. Transfer the solution to a volumetric flask using a funnel. Add distilled water to the volumetric flask up to the 1-liter mark while stirring the mixture. Once the solution is completely mixed, adjust the volume to the mark on the flask with distilled water.

Mix the solution thoroughly by inverting the flask several times.

Normal Solution:

Principle:

A normal solution is a solution in which the concentration of the solute is expressed as the number of equivalents of solute present per liter of solution. The normality of a solution is the number of equivalents of solute in one liter of solution.

Example: Prepare 1 liter of 0.1 Normal solution of hydrochloric acid (HCl).

Given: Molecular weight of HCl = 36.46 g/mol, Volume of solution = 1 liter, Desired normality = 0.1 N, HCl is a monoprotic acid.

Procedure:

Weigh 3.646 grams of hydrochloric acid using a balance. Add the HCl to a clean, dry beaker. Add a small amount of water to dissolve the HCl. Stir the mixture until the solute is completely dissolved. Transfer the solution to a volumetric flask using a funnel. Add distilled water to the volumetric flask up to the 1-liter mark while stirring the mixture. Once the solution is completely mixed, adjust the volume to the mark on the flask with distilled water. Mix the solution thoroughly by inverting the flask several times.

Molal Solution:

Principle:

A molal solution is a solution in which the concentration of the solute is expressed as the number of moles of solute present per kilogram of solvent. The molality of a solution is the number of moles of solute in one kilogram of solvent.

Example: Prepare 500 mL of 0.1 Molal solution of glucose ($C_6H_{12}O_6$).

Given: Molecular weight of glucose = 180.16 g/mol, Mass of solvent = 500 g, Desired molality = 0.1 m.

Procedure:

Weigh 9.008 grams of glucose using a balance. Calculate the number of moles of glucose present in 9.008 grams of glucose by dividing the mass by its molecular weight. Number of moles of glucose = $9.008 \text{ g} / 180.16 \text{ g/mol} = 0.05 \text{ mol}$. Weigh 500 grams of solvent using a balance. Add the glucose to a clean, dry beaker. Add a small amount of solvent to dissolve the glucose. Stir the mixture until the solute is completely dissolved. Add distilled water to the beaker to make up the desired amount of solvent while stirring the mixture. Transfer the solution to a volumetric flask using a funnel. Mix the solution thoroughly by inverting the flask several times.

Percentage Solution:**Principle:**

A percentage solution is a solution in which the concentration of the solute is expressed as the percentage of the total solution. The percentage can be by weight, by volume, or by mass/volume.

Example: Prepare 250 mL of 5% w/v solution of sodium chloride (NaCl).

Given: Weight of NaCl = 5% of total weight, Total volume of solution = 250 mL.

Procedure:

Weigh 12.5 grams of NaCl using a balance. Add the NaCl to a clean, dry beaker. Add a small amount of distilled water to dissolve the NaCl. Stir the mixture until the solute is completely dissolved. Add distilled water to the beaker to make up the desired volume of solution while stirring the mixture. Transfer the solution to a volumetric flask using a funnel. Add distilled water to the volumetric flask up to the 250 mL mark while stirring the mixture. Once the solution is completely mixed, adjust the volume to the mark on the flask with distilled water. Mix the solution thoroughly by inverting the flask several times.

Parts per Million (ppm)

Principle:

Parts per million (ppm) is a unit of concentration that expresses the number of parts of a substance per million parts of solution or mixture. It is commonly used to express the concentration of small amounts of impurities or contaminants in a larger sample.

Example

Prepare a 1 liter solution of 100 ppm (parts per million) NaCl (sodium chloride):

Weigh out 0.1 g of NaCl using a precision balance. Transfer the weighed NaCl into the 1 liter volumetric flask. Add distilled or deionized water to the flask, filling it up to the mark on the neck of the flask. Close the volumetric flask with a stopper or a plastic cap, and mix the contents thoroughly by inverting the flask several times or using a magnetic stirrer. The resulting solution will be a 100 ppm NaCl solution.

Conclusion