

# Acid-Base Titrations

## Concentration of Solutions

Molarity = moles per litre of solution ( $\text{mol l}^{-1}$ )

$$\text{molarity} = \frac{\text{mass per litre}}{M_r (\text{g mol}^{-1})}$$

grams of solute per litre ( $\text{g l}^{-1}$ )

parts per million (ppm) =  $\text{mg l}^{-1}$  ( $1\text{g} = 1000\text{mg}$ )

$$\text{moles} = \frac{\text{volume (cm}^3\text{)} \times \text{concentration (M)}}{1000}$$

$$\text{moles} = \frac{\text{mass (g)}}{M_r (\text{g mol}^{-1})}$$

can be expressed as percentages:

$$\% \text{ w/v} = \text{g}/100\text{cm}^3$$

$$\% \text{ w/w} = \text{g}/100\text{g}$$

$$\% \text{ v/v} = \text{cm}^3/100\text{cm}^3$$

diluted solutions:  $\text{moles}_{\text{dil}} = \text{moles}_{\text{conc}}$

$$V_{\text{dilute}} \times M_{\text{dilute}} = V_{\text{conc}} \times M_{\text{conc}}$$

## Preparation of Standard Solutions and Titration Procedure

A standard solution is a solution of accurately known concentration (made using a primary standard solute which is 100% pure, stable and soluble).

A primary standard solute is a pure compound with a high molecular mass, from which solutions of a known concentration can be made. It must be 100% pure, stable and soluble.

Preparation:

- Weigh the solute accurately

- Transfer the solute to a clean beaker and add a small volume of pure water (less than 100cm<sup>3</sup>)
- Rinse the clock glass using the wash bottle filled with pure water and add the rinsings to the beaker
- Stir the mixture until the solute is dissolved completely
- Rinse the stirring rod into the beaker using the wash bottle
- Using a funnel, transfer the solution from the beaker into the volumetric flask
- Rinse the beaker several times with the wash bottle and add all of the rinsings to the volumetric flask
- Rinse and remove the funnel
- Fill the volumetric flask with pure water to within 1cm of the calibration mark
- Add pure water dropwise until the bottom of the meniscus rests on the calibration mark when read at eye level
- Seal the flask and invert 20+ times to ensure a homogeneous solution

#### Sources of Error:

- Volumetric flask must be used as when filled to the calibration mark at the temperature stated on the flask it contains a specific known volume
- Analytical balance must be used to measure masses of solute as it is extremely accurate
- Ensure no solution is lost when the solid is being dissolved in a beaker or when the solution is transferred from the beaker to the volumetric flask by using a wash bottle to transfer all rinsings