Topic 2: Analytical Techniques

Chemists perform a wide variety of monitoring roles, including analysing for drug residues and measuring the concentrations of pollutants such as pesticides in the environment. Chemists are also employed to analyse materials used in or produced by many branches of industry, including pharmaceuticals, polymers, metal production, and food preparation. In this topic students consider some of the more common means of analysis and undertake practical activities in measurement.

2.1 Volumetric Analysis

Key Ideas	Intended Student Learning
Concentrations of solutes in solutions can be described by using a number of standard conventions.	Convert concentrations from one unit to another (e.g. mol L^{-1}, g L^{-1}, %w/v, ppm, and ppb).
Knowledge of the mole ratios of reactants can be used in quantitative calculations.	Perform stoichiometric calculations when given the reaction equation and the necessary data.
A titration can be used to determine the reacting volumes of two solutions.	Describe the correct use of a volumetric flask, a pipette, and a burette.
Analysis of a variety of chemicals depends on an understanding of quantitative aspects of chemical reactions, including acid–base and redox reactions.	Describe and explain the procedure involved in carrying out a titration, particularly rinsing glassware and determining the end-point.
A titration can be used to determine the concentration of a solution of a reactant in a chemical reaction.	Determine the concentration of a solution of a reactant in a chemical reaction by using the results of a titration.

2.2 Chromatography

Key Ideas	Intended Student Learning
Adsorption chromatography involves the use of a stationary phase and a mobile phase to separate the components of a mixture.	Identify the stationary and mobile phases in an adsorption chromatography process.
The strength of attraction between two substances depends on their relative polarities.	Predict the relative strengths of attraction of components for the stationary phase and the mobile phase on the basis of their polarities.
The rate of movement of any component along a stationary phase is determined by the structure or relative polarity of the component and the relative polarities of the stationary phase and the mobile phase.	Predict the relative rates of movement of components along a stationary phase, given the structural formulae or relative polarities of the components and the two phases.
The rate of movement of a component along a stationary phase is compared with a known standard in order to identify the component.	Describe and apply R_F values and retention times in the identification of components in a mixture.

2.3 Atomic Spectroscopy

Key Ideas	Intended Student Learning
Electrons move to a higher or lower energy level when atoms or ions absorb or emit radiation.	State the effect of the absorption or emission of radiation on the energy levels of electrons in atoms or ions.
The wavelengths of radiation emitted and absorbed by an element are unique to that element.	State that the wavelengths of radiation emitted and absorbed by an element are unique to that element.
The wavelengths of radiation absorbed by an element can be used to identify its presence in a sample.	Explain the principles of atomic absorption spectroscopy in identifying elements in a sample.
Atomic absorption spectroscopy is used for quantitative analysis.	Describe the construction and use of calibration graphs in determining the concentration of an element in a sample.