**Year 9 Chemistry – Programme of study**

The topics we shall cover this year will be as follows:

**9/0 How Science Works**

- Designing an investigation – independent, dependent and control variables
- Making measurements
  - accuracy and precision
  - continuous, discrete, categoric and ordered variables
- Presenting data – tables and graphs
- Using data to draw conclusions - reliability

**9/1 States of matter**

- Solids, liquids and gases
  - Definitions and descriptions in terms of particles
  - Energy changes on change of state and temperature/time graphs
- Evidence for particles – diffusion and dilution experiments

**9/2 Materials**

- Elements, compounds and mixtures
  - Definitions and descriptions in terms of particles
- Separation of mixtures
  - Dissolving, filtration, evaporation, crystallisation
  - Distillation
  - Fractional distillation
  - Separating funnel
  - Chromatography
- Industrial methods of separation
  - Fractional distillation of crude oil, chromatography

**9/3 Aqueous chemistry**

- The water cycle
- Tests for water
  - Anhydrous copper(II) sulphate, cobalt(II) chloride
  - Melting and boiling points of pure water
- Solubility
  - Definitions of solvent, solute, solution, saturated, crystallisation
  - Solubility curves (for solid and gaseous solutes)
  - Temperature dependence of solubility
- Hard and soft water
  - Causes of hardness
  - Temporary and permanent hardness
  - Experiment to determine degree of hardness
  - Methods of removing hardness
  - Benefits and drawbacks of hard (and soft) water
- 'Dissolving' investigation

**9/4 Atomic structure**

- History of the discovery of atomic structure
- Protons, neutrons, the nucleus, electrons
  - relative size, mass, charge
- Atomic number (Z), mass number (A), isotopes
- Electron shells (energy levels) – maximum number in each shell
- Electronic structure (configuration) of elements up to Z=20 (i.e. Ca)

**9/5 The periodic table**

- History of the development of ideas relating to patterns in properties
- Relationship of the structure of the periodic table to electronic structure
- Patterns seen in periods (horizontal) and groups (vertical)
- Trends in reactivity of metals and non-metals
- Reactions of group 1 and group 7 elements

**9/6 Representing reactions – formulae and equations**

- Formulae of ionic compounds (given charges on anion and cation)
- Formulae of covalent molecules (e.g. $H_2$, $O_2$, $N_2$, $CO_2$, $NH_3$, $CH_4$)
- Interpret formulae as atom ratios
- Word equations and balanced symbol equations with state symbols

**9/7 Acids, bases and salts**

- Definitions of: acid, alkali, base
- Tests for acids and alkalis – the pH scale
- Neutralisation
- Preparation of salts

**9/8 Bonding, structure and related properties**

- Ionic, covalent and metallic bonding + intermolecular forces
  - Dot and cross diagrams for ionic and covalent compounds
- Giant and molecular structures
- Dependence of properties on bonding and structure
  - Melting and boiling points
  - Hardness and brittleness, malleability and ductility
  - Electrical and thermal conductivity
  - Solubility in polar and non-polar solvents