

CURRICULUM CONTENT

1. Atomic structure

- The nucleus of the atom: neutrons and protons, isotopes, proton and nucleon numbers
- Electrons: electronic energy levels, ionization energies, atomic orbitals, extra nuclear structure

2. Atoms, molecules and stoichiometry

- Relative masses of atoms and molecules
- The mole, the Avogadro constant
- The determination of relative atomic masses, A_r , and relative molecular masses, M_r , from mass spectra
- The calculation of empirical and molecular formulae
- Reacting masses and volumes (of solutions and gases)
- The gaseous state: Ideal gas behaviour and deviations from it
- $pV = nRT$ and its use in determining a value for M_r

3. Chemical bonding

- Ionic (electrovalent) bonding
- Covalent bonding and coordinate (dative covalent) bonding
- The shapes of simple molecules
- Bond energies, bond lengths and bond polarities
- Intermolecular forces, including hydrogen bonding
- Metallic bonding
- Bonding and physical properties

4. Periodicity

- Periodicity of physical properties of the elements: variation with proton number across the third period (sodium to argon) of:
 - atomic radius and ionic radius
 - melting point
 - electrical conductivity
 - ionization energy
- Periodicity of chemical properties of the elements in the third period
- Reaction of the elements with oxygen, chlorine and water
- Variation in oxidation number of the oxides(sodium to sulfur only) and of the chlorides (sodium to phosphorus only)

5. Introduction to organic chemistry

- Molecular, structural and empirical formulae
- Functional groups and the naming of organic compounds
- Characteristic organic reactions
- Shapes of organic molecules; σ and π bonds V
- Isomerism: structural; cis-trans; optical

6. Alkanes

- Alkanes (exemplified by ethane)
- Free-radical reactions
- Crude oil and 'cracking

7. Energetics

- Enthalpy changes: ΔH of formation, combustion, hydration, solution, neutralisation and atomisation; bond energy; lattice energy; electron affinity
- Hess' Law, including Born-Haber cycles

8. Kinetics

- Simple rate equations; orders of reaction; rate constants
- Effect of temperature on rate constants; the concept of activation energy
- Homogeneous and heterogeneous catalysis

