

# UNIT 1 CHEMISTRY

## BOOK 1

### How Can the Diversity of Materials Be Explained?

AOS 1: How Can the Knowledge of Elements Explain the Properties of Matter?

AOS 2: How Can the Versatility of Non-Metals Be Explained?

AOS 3: Research Investigation

## AOS 1: HOW CAN KNOWLEDGE OF ELEMENTS EXPLAIN THE PROPERTIES OF MATTER?

### Section 1: Atomic Structure

States of Matter

Physical Classification of Matter

Chemical Classification of Matter

### Relative and Absolute Sizes of Particles

#### Atoms and their Structure

#### Elements and Compounds

Elements

Atomic Elements

Molecular Elements

Elemental Lattices

Compounds

Molecular Compounds

Macromolecules

Ionic Compounds

#### Defining Atoms

Atomic Nuclei

Electron Arrangement

Atomic Number

Mass Number

Isotopic Symbols

Isotopes

#### Electron Configuration

Electronic Energy Levels

Shells

Subshells

Orbitals

Shapes of Orbitals

Filling Orbitals

Electron Configuration of Atoms

Electron Configuration – Exceptions

#### Evidence for Energy Levels

Emission Spectra

Electron Configurations of Atoms in Excited States

Ionisation Energies

## **Section 2: The Modern Periodic Table**

### **The Modern Periodic Table**

#### **A Periodic Table of the Elements**

Groups  
Periods  
Blocks

#### **Trends in the Periodic Table**

The Shielding Effect  
Effective Nuclear Charge  
Trends in Atomic Radii  
Trends in Metallic Nature  
Trends in Electronegativity  
Trends in First Ionisation Energies  
Other Trends in the Periodic Table  
Trends in Reactivity  
Patterns in Compounds  
Patterns in Oxides  
Patterns in Hydrides  
Summary of Trends

#### **Development of the Periodic Table**

#### **Chemical Bonding**

### **Section 3: Metals**

#### **Metals**

Properties of Metals  
Metallic Structure  
Metallic Bonding Model  
Explaining Metal Properties  
Electrical Conductivity  
Heat Conductivity  
Lustre  
Melting Points and Boiling Points  
Malleability and Ductility  
Hardness  
Density

#### **Comparing Metal Properties**

Properties of the s-Block Metals  
Properties of the p-Block Metals  
Transition Metals (d-Block Metals)  
Properties of the d-Block Metals

#### **Limitation of the Metallic Bonding Model**

#### **Modifying Metals to Make Them More Useful**

Alloying  
Work Hardening  
Heat Treatment  
Metallic Coatings

#### **Metal Fatigue**

#### **Reactivity of Metals**

Reactions of the Metals

### **Extraction of Metals**

Extraction of Iron  
Environmental Impacts  
Economic Impacts

### **Nanometals**

Applications  
Unique Nanometal Properties

## **Section 4: Ionic Compounds**

### **Ionic Bonding**

Forming Positively Charged Ions (Cations)  
s and p Block Metals (Monovalent Cations)  
d Block Metals (Transition Metals)  
Forming Negatively Charged Ions (Anions)  
Simple Anions

### **Polyatomic Ions**

### **Forming an Ionic Bond**

### **Writing Formulas for Ionic Compounds**

### **Naming Ionic Compounds**

### **Predicting the Structure of Ionic Compounds From its Properties**

### **The Ionic Bonding Model (Lattice Model)**

Using the Ionic Bonding Model to Explain the Properties of Ionic Compounds  
Limitations of the Ionic Bonding Model

### **Uses of Common Ionic Compounds**

### **Growing Ionic Crystals**

## **Section 5: Quantifying Atoms and Compounds**

Significant Figures  
Mathematics Operations  
Standard Form

### **Masses of Particles**

### **The Mass Spectrometer**

The Mass Spectrum

### **The Mole**

Calculating the Number of Particles or Amount of Substance  
Molar Mass (M)  
Molar Mass (M) and Mole

### **Determining Formulae of Compounds**

Percentage Composition  
Empirical Formulae  
Molecular Formulae

## **BOOK 2**

### **AOS 2: HOW CAN THE VERSATILITY OF NON-METALS BE EXPLAINED?**

#### **Section 1: Materials from Molecules**

##### **Covalent Bonding**

How Do Covalent Bonds Form?

Molecules

Multiple Covalent Bonds

##### **Naming Covalent Molecules**

Electron Dot Formulae (Lewis Structures)

##### **Shapes of Molecules**

Predicting Molecular Shape

Less Common Shapes

Summary of Common Molecular Shapes

Shapes of Complex Molecules

##### **Polar Bonds**

##### **Polar and Non-Polar Molecules**

Non-Polar Molecules

Polar Molecules

Identifying Polar Molecules

##### **Intermolecular Forces**

Dispersion Forces

Dipole – Dipole attraction

Ion-Dipole Bonding (An Interparticle Bond – Not Intermolecular)

Hydrogen Bonding

Summary of Bonding in Covalent Molecular Substances

Interparticle Bonding Summary

##### **The Properties of Molecular Substances**

Physical State

Melting and Boiling Points

Softness

Electrical Conductivity

Solubility

Trends in Molecular Properties

Properties of Water

## **Section 2: Carbon Lattices and Carbon Nanomaterials**

Diamond

### **Allotropes of Carbon**

Fullerenes

**Summary: Allotropes of Carbon**

**Summary: Covalent Bonding**

**Describing Atomic/Molecular Dimensions**

**Mixed Bonding Questions**

## **Section 3: Organic Compounds**

Organic Chemistry

Hydrocarbons

Molecular Formulae of Common Hydrocarbons

Representations of Hydrocarbons

Properties of Hydrocarbons

Alkanes

Alkenes

Alkynes

Branched Hydrocarbons

Structural Isomers

Naming Hydrocarbon Molecules

Cyclic Hydrocarbons

Aromatic Hydrocarbons

Functional Groups

Naming Organic Molecules with One Functional Group

Naming Organic Molecules with Multiple Functional Groups

Alcohols

Carboxylic Acids

Esters

Organic Reactions

Reactions Involving Alkanes

Reactions Involving Alkenes

A Summary of Addition Reactions Involving Ethene

Reaction of Alkynes

Reactions Involving Carboxylic Acids

Esterification

## **Section 4: Polymers**

Polymers

Addition Polymerisation

Properties of Addition Polymers

Isotactic, Syndiotactic and Atactic Polymers

Copolymers

Polymer Properties

Thermoplastic Polymers

Polyethene

Polystyrene

Polyvinyl Chloride (PVC)

Polytetrafluoroethene (Teflon)

Thermosetting Polymers

Condensation Polymerisation

Advantages and Disadvantages of Polymer Materials