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CANTERBURY SCHOOL

Unit 1 Overview: Chapters 1 – 4

Chapter 1: *Chemical Foundations* ***(Week 1)***

1.1 Chemistry: An Overview
1.2 The Scientific Method
1.3 Units of Measurement
1.4 Uncertainty in Measurement
1.5 Significant Figures and Calculations
1.6 Learning to Solve Problems Systematically
1.7 Dimensional Analysis
1.8 Temperature
1.9 Density
1.10 Classification of Matter

AP Learning Objectives:

- **LO 2.7** The student is able to explain how solutes can be separated by chromatography based on intermolecular interactions. *(Sec 1.10)*
- **LO 2.10** The student can design and/or interpret the results of a separation experiment (filtration, paper chromatography, column chromatography, or distillation) in terms of the relative strength of interactions among and between the components. *(Sec 1.10)*
- **LO 3.10** The student is able to evaluate the classification of a process as a physical change, chemical change, or ambiguous change based on both macroscopic observations and the distinction between rearrangement of covalent interactions and noncovalent interactions. *(Sec 1.10)*

Key Terms:

- Scientific Method
- Measurement
- Hypothesis
- Theory
- Model
- Natural Law
- Law of Conservation of Mass
- SI System
- Mass
- Weight
- Uncertainty
- Significant Figures

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- Accuracy
- Precision
- Random Error
- Systematic Error
- Exponential Error
- Unit Factor Method
- Dimensional Analysis
- Density
- Matter
- States of Matter
- Homogenous Mixture
- Heterogeneous Mixture
- Solution
- Pure Substance
- Physical Change
- Distillation
- Filtration
- Chromatography
- Paper Chromatography
- Compound
- Chemical Change
- Element

Homework & Practice

End of Chapter Problems (pgs. 33 – 41):

Required*: All AP multiple choice: 1 - 10

Recommended: 17, 20, 23, 26, 28, 30, 35, 36, 37, 39, 43, 47, 51, 59, 65, 69, 73, 75, 81, 83; *111 - 118*

Chapter 2: *Atoms, Molecules, and Ions* ***(Week 2)***

2.1 The Early History of Chemistry
2.2 Fundamental Chemical Laws
2.3 Dalton's Atomic Theory
2.4 Early Experiments to Characterize the Atom
2.5 The Modern View of Atomic Structure: An Introduction
2.6 Molecules and Ions

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2.7 An Introduction to the Periodic Table
2.8 Naming Simple Compounds

AP Learning Objectives:

- **LO 1.1** The student can justify the observation that the ratio of the masses of the constituent elements in any pure sample of that compound is always identical on the basis of the atomic molecular theory. *(Sec 2.2)*
- **LO 1.17** The student is able to express the law of conservation of mass quantitatively and qualitatively using symbolic representations and particulate drawings. *(Sec 2.2, 2.3)*
- **LO 2.17** The student can predict the type of bonding present between two atoms in a binary compound based on position in the periodic table and the electronegativity of the elements. *(Sec 2.6, 2.7)*
- **LO 3.5** The student is able to design a plan in order to collect data on the synthesis or decomposition of a compound to confirm the conservation of matter and the law of definite proportions. *(Sec 2.2)*
- **LO 3.6** The student is able to use data from synthesis or decomposition of a compound to confirm the conservation of matter and the law of definite proportions. *(Sec 2.2)*

Key Terms:

- Law of Conservation of Mass
- Law of Definite Proportion
- Law of Multiple Proportions
- Atomic Masses
- Atomic Weights
- Avogadro's Hypothesis
- Cathode-Ray Tubes
- Electrons
- Radioactivity
- Nuclear Atom
- Nucleus
- Proton
- Neutron
- Isotopes
- Atomic Number
- Mass Number
- Chemical Bond
- Covalent Bond
- Molecule
- Chemical Formula
- Structural Formula
- Space-filling model
- Ball-and-stick model
- Ion

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- Cation
- Anion
- Ionic Bond
- Ionic Solid
- Polyatomic Ion
- Periodic Table
- Metal
- Nonmetal
- Group (family)
- Alkali Metals
- Alkaline Earth Metals
- Halogens
- Noble Gases
- Period
- Binary compounds
- Binary ionic compounds
- Oxyanions
- Binary covalent compounds
- Acid

Homework & Practice

End of Chapter Problems (pgs. 72 - 81):

Required*: All AP multiple choice: 1 - 16

Recommended: 17, 19, 21, 22, 23, 29, 33, 34, 36, 41, 44, 47, 53, 55, 57, 61, 67, 72, 74, 76, 80; *87, 88, 98, 101, 103, 105*

Chapter 3: *Stoichiometry **(Week 3)***

3.1 Counting by Weighing
3.2 Atomic Masses
3.3 The Mole
3.4 Molar Mass
3.5 Learning to Solve Problems
3.6 Percent Composition of Compounds
3.7 Determining the Formula of a Compound
3.8 Chemical Equations
3.9 Balancing Chemical Equations

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3.10 Stoichiometry Calculations: Amounts of Reactants and Products
3.11 The Concept of Limiting Reactant

AP Learning Objectives:

- **LO 1.2:** The student is able to select and apply mathematical routines to mass data to identify or infer the composition of pure substances and/or mixtures. *(Sec 3.7)*
- **LO 1.3:** The student is able to select and apply mathematical relationships to mass data in order to justify a claim regarding the identity and/or estimated purity of a substance. *(Sec 3.6)*
- **LO 1.4:** The student is able to connect the number of particles, moles, mass, and volume of substances to one another, both qualitatively and quantitatively. *(Sec 3.3-3.4)*
- **LO 1.14:** The student is able to use data from mass spectrometry to identify the elements and the masses of individual atoms of a specific element. *(Sec 3.2)*
- **LO 1.17:** The student is able to express the law of conservation of mass quantitatively and qualitatively using symbolic representations and particular drawings. *(Sec 3.9-3.11)*
- **LO 1.18:** The student is able to apply conservation of atoms to the rearrangements of atoms in various processes. *(Sec 3.8-3.9)*
- **LO 1.19:** The student can design, and/or interpret data from, an experiment that uses gravimetric analysis to determine the concentration of an analyte in a solution. *(Sec 3.10)*
- **LO 3.1:** Students can translate among macroscopic observations of change, chemical equations and particle views. *(Sec 3.8)*
- **LO 3.3:** The student is able to use stoichiometric calculations to predict the results of performing a reaction in the laboratory and/or to analyze deviations from the expected results. *(Sec 3.11)*
- **LO 3.4:** The student is able to relate quantities (measured mass of substances, volumes of solutions, or volumes and pressures of gases) to identify stoichiometric relationships for a reaction, including situations involving limiting reactants and situations in which the reaction has not gone to completion. *(Sec 3.11)*
- **LO 3.6:** The student is able to use data from synthesis or decomposition of a compound to confirm the conservation of matter and the law of definite proportions. *(Sec 3.7)*

Key Terms:

- Chemical Stoichiometry
- Mass Spectrometer
- Average Atomic Mass
- Mole
- Avogadro's Number
- Molar Mass
- Conceptual Problem Solving
- Mass Percent

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- Empirical Formula
- Molecular Formula
- Chemical Equation
- Reactants
- Products
- Balancing a chemical equation
- Mole ratio
- Stoichiometric mixture
- Limiting reactant
- Theoretical yield
- Percent yield

Homework & Practice

End of Chapter Problems (pgs. 127 - 137):

Required*: All AP multiple choice: 1 - 17

Recommended: 27, 31, 32, 37, 39, 41, 48 , 65, 68, 71, 73, 78, 79, 81, 83, 95, 97, 99, 101, 105, 110, 115, 119, 137, 38, 44, 47, 49, 51, 52, 55, 75, 85, 87, 91, 96, 100, 109, 124

Chapter 4: *Types of Chemical Reactions and Solution Stoichiometry* ***(Week 4)***

4.1 Water, the Common Solvent
4.2 The Nature of Aqueous Solutions: Strong and Weak Electrolytes
4.3 The Composition of Solutions
4.4 Types of Chemical Reactions
4.5 Precipitation Reactions
4.6 Describing Reactions in Solution
4.7 Stoichiometry of Precipitation Reactions
4.8 Acid-Base Reactions
4.9 Oxidation-Reduction Reactions
4.10 Balancing Oxidation-Reduction Reactions

AP Learning Objectives:

- **LO 1.4:** The student is able to connect the number of particles, moles, mass, and volume of substances to one another, both qualitatively and quantitatively. *(Sec 4.3)*
- **LO 1.17:** The student is able to express the law of conservation of mass quantitatively and qualitatively using symbolic representations and particulate drawings. *(Sec 4.5)*

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- **LO 1.18:** The student is able to apply conservation of atoms to the rearrangement of atoms in various processes. *(Sec 4.9)*
- **LO 2.8:** The student can draw and/or interpret representations of solutions that show the interactions between the solute and solvent. *(Sec 4.1-4.3)*
- **LO 2.9:** The student is able to create or interpret representations that link the concept of molarity with particle views of solutions. *(Sec 4.1-4.3)*
- **LO 2.14:** The student is able to apply Coulomb's Law qualitatively (including using representations) to describe the interactions of ions, and the attractions between ions and solvents to explain the factors that contribute to the solubility of ionic compounds. *(Sec 4.1)*
- **LO 3.1:** Students can translate among macroscopic observations of change, chemical equations, and particle views. *(Sec 4.4-4.9)*
- **LO 3.2:** The student can translate an observed chemical change into a balanced chemical equation and justify the choice of equation type (molecular, ionic, or net ionic) in terms of utility for the given circumstances. *(Sec 4.5-4.9)*
- **LO 3.3:** The student is able to use stoichiometric calculations to predict the results of performing a reaction in the laboratory and/or to analyze deviations from the expected results. *(Sec 4.8)*
- **LO 3.4:** The student is able to relate quantities (measured mass of substances, volumes of solutions, or volumes and pressures of gases) to identify stoichiometric relationships for a reaction, including situations involving limiting reactants and situations in which the reaction has not gone to completion. *(Sec 4.8)*
- **LO 3.8:** The student is able to identify redox reactions and justify the identification in terms of electron transfer. *(Sec 4.9)*
- **LO 3.9:** The student is able to design and/or interpret the results of an experiment involving a redox titration. *(Sec 4.9-4.10)*
- **LO 3.10:** The student is able to evaluate the classification of a process as a physical change, chemical change, or ambiguous change based on both macroscopic observations and the distinction between rearrangement of covalent interactions and noncovalent interactions. *(Sec 4.1-4.10)*

Key Terms:

- Aqueous Solution
- Polar Molecule
- Hydration
- Solubility
- Solute
- Solvent
- Electrical Conductivity
- Strong Electrolyte
- Weak Electrolyte
- Nonelectrolyte

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- Acid
- Strong Acid
- Strong Base
- Weak Acid
- Weak Base
- Molarity
- Standard Solution
- Dilution
- Precipitation Reaction
- Precipitate
- Formula Equation
- Complete Ionic Equation
- Spectator Ions
- Net Ionic Equation
- Acid
- Base
- Neutralization Reaction
- Volumetric Analysis
- Titration
- Stoichiometric (Equivalence) Point
- Indicator
- Endpoint
- Oxidation-Reduction Reaction
- Oxidation State
- Oxidation
- Reduction
- Oxidizing Agent (Electron Acceptor)
- Reducing Agent (Electron Donor)

Homework & Practice

End of Chapter Problems (pgs. 180 - 188):

Required*: All AP multiple choice: 1 - 15

Recommended: 15, 16, 21, 23, 27, 31, 35, 43, 45, 49, 61, 65, 73, 75, 81, 87, 90, 91, 109, 19, 24, 29, 39, 51, 67, 82, 119, 133, 139

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