

## COURSE OVERVIEW

Chemistry is intended to expose students to the designs and patterns in the world that God has created. In preceding years, students should have developed an understanding for the macroscopic properties of substances and been introduced to the microstructure of substances. This chemistry course will expand upon that knowledge, further develop the microstructure of substances, and teach the symbolic and mathematical world of formulas, equations, and symbols. The major concepts covered are measurement, atomic structure, chemical formulas and bonding, chemical reactions, stoichiometry, gases, chemical equilibrium, and organic chemistry.

Students at this level should show development in their ability and understanding of scientific inquiry. The units contain experiments and projects that seek to develop a deeper conceptual meaning for the student and actively engage the student. The continued exposure of science concepts and scientific inquiry will serve to improve the student's skill and understanding.

Chemistry should be preceded by an Algebra I course and preceded or accompanied by an Algebra II course

Upon completion of the course, students should be able to do the following:

- Calculate and convert units using scientific notation and significant figures.
- Explain the differences between elements, compounds, and mixtures.
- Use Avogadro's number and the gas laws to calculate different variables in chemistry examples.
- Explain and use the periodic table.
- Recognize symbols for common elements.
- Differentiate between the different types of bonds.
- Predict how different elements will react.
- Describe acid-base reactions and redox reactions.
- Demonstrate an understanding of organic chemistry and carbon compounds.

UNIT 1: MEASUREMENT AND ANALYSIS				
Assignment Titles				
CHEMISTRY	1.	Course Overview	13.	Experiment: Masses
	2.	An Introduction to Chemistry and Metric Measurement	14.	Quiz 3: Measurement and Precision
	3.	Report: Metric System*	15.	Observation and Hypothesizing
	4.	Quiz 1: Metric Conversions	16.	Learning to Make Useful and Detailed Observations
	5.	Showing Precision in Measurements	17.	Using Graphs to Analyze Data
	6.	Using Significant Figures to Show the Reliability of Data	18.	Project: Tutorial for Making a Scatter Plot Using an Electronic Spreadsheet Program*
	7.	Using Scientific Notation with Significant Figures	19.	Quiz 4: Measurement to Graphs
	8.	Quiz 2: Precision, Significant Figures, and Scientific Notation	20.	Doing Chemistry Your Way: Find Your Future
	9.	Measuring Volume in the Chemistry Laboratory	21.	Quiz 5: Chapter Review
	10.	Practice in Measuring Metric Volumes	22.	Special Project*
	11.	Measuring Mass in the Chemistry Laboratory	23.	Test
	12.	Project: Measuring Length with Precision*	24.	Alternate Test*
		25.	Reference	

**UNIT 2: STARTING THE INVESTIGATION: HOW TO IDENTIFY ELEMENTS, COMPOUNDS, AND MIXTURES**

CHEMISTRY

**Assignment Titles**

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|--|---|
| 1. The Basic Ingredient: Chemical Elements                       | 8. Report: Density*   |
| 2. Quiz 1: Elements, Chemical and Physical Properties            | 9. Identifying Different Types of Mixtures                    |
| 3. Using Chemical and Physical Properties to Identify Substances | 10. Experiment: Using the Tyndall Effect to Identify Colloids |
| 4. Experiment: Observations of a Phase Change                    | 11. Quiz 3: Chapter Review                                    |
| 5. Experiment: Salt and Sand*                                    | 12. Special Project*  |
| 6. Creating Compounds: Investigating Chemical Changes            | 13. Test  |
| 7. Quiz 2: Elements to Compounds and Chemical Changes            | 14. Alternate Test*   |
|  | 15. Reference   |

**UNIT 3: EXPLORING LAWS FOR GASES AND CONSERVATION OF MASS**

CHEMISTRY

**Assignment Titles**

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|---|---|
| 1. Nothing Stays Put - The Basis for Diffusion and Pressure | 12. Combined Gas Law  |
| 2. Gases and Kinetic Molecular Theory                       | 13. Quiz 4: Diffusion to Combined Gas Law                       |
| 3. Project: Graphing Kinetic Energy*                        | 14. Counting Gas Particles: The Measure of the Mole             |
| 4. Quiz 1: Diffusion and Kinetic Molecular Theory           | 15. How Big is a Mole? Avogadro's Number                        |
| 5. Pressure-Volume Relationships in Gases (Boyle's Law)     | 16. Demonstrating Conservation of Mass with Balanced Equations  |
| 6. Quiz 2: Diffusion to P-V Relationships in Gases          | 17. Essay: Biography*   |
| 7. Temperature-Volume Relationships in Gases (Charles' Law) | 18. Project: Examining the Use of Certain Gases as Propellants* |
| 8. Experiment: Finding Absolute Zero Experimentally         | 19. Quiz 5: Chapter Review                                      |
| 9. Experiment: Charles' Law and a Metal Can*                | 20. Special Project*  |
| 10. Project: Absolute Zero: Real or Theoretical?*           | 21. Test  |
| 11. Quiz 3: Diffusion to V-T Relationships in Gases         | 22. Alternate Test*   |
|   | 23. Reference   |

**UNIT 4: THE DISCOVERY OF ATOMS: NATURE'S BUILDING BLOCKS**

CHEMISTRY

**Assignment Titles**

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|--|---|
| 1. The Golden Years of Chemistry                       | 9. Quiz 3: Golden Years to Bohr Model       |
| 2. Experiment: Physical Properties of Elements         | 10. Charging Up: Ionization of Atoms        |
| 3. Experiment: Chemical Properties of Some Metals      | 11. Quiz 4: Golden Years to Ionization      |
| 4. Masters of Classic Atomic Theory                    | 12. A Closer Look Inside: Nuclear Reactions |
| 5. Quiz 1: Golden Years to Masters                     | 13. Report: Fission Reactors                |
| 6. Designing an Organizational Map: The Periodic Table | 14. Quiz 5: Chapter Review                  |
| 7. Quiz 2: Golden Years to Periodic Table              | 15. Special Project                         |
| 8. The Bohr Model Revisited                            | 16. Test                                    |
|  | 17. Alternate Test                          |
|  | 18. Reference                               |

**UNIT 5: MOLECULAR STRUCTURE**

CHEMISTRY

**Assignment Titles**

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|--|--|
| 1. Chemical Accounting: Stoichiometry          | 8. Polar Covalent Molecules and Dot Structures |
| 2. Valence Structure                           | 9. Experiment: Demonstrating Polar Properties  |
| 3. Quiz 1: Stoichiometry to Valence            | 10. Quiz 3: Chapter Review                     |
| 4. Determining Chemical Formulas               | 11. Special Project*                           |
| 5. Electron Availability: Prelude to Bonding   | 12. Test                                       |
| 6. Quiz 2: Stoichiometry to Prelude to Bonding | 13. Alternate Test*                            |
| 7. Types of Chemical Bonds                     | 14. Reference                                  |

## UNIT 6: SEMESTER REVIEW AND TEST

## Assignment Titles

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|-----------|----------------------------|
| 1. Review | 3.. Alternate Exam—Form A* |
| 2. Exam   | 4. Alternate Exam—Form B*  |

## UNIT 7: CHEMICAL REACTIONS, RATES AND EQUILIBRIUM

## Assignment Titles

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|--|---|
| 1. Evidence for Chemical Change                                  | 10. Factors that Affect Reaction Rate: Temperature, Catalysts, Concentration of Reactants |
| 2. Experiment: Observing Chemical Changes                        | 11. Quiz 2: Chemical Change to Reaction Rate  |
| 3. Experiment: Chemical Reactions*                               | 12. Reaction Equilibria and Equilibrium Constants   |
| 4. Experiment: Ammonium Nitrate*                                 | 13. Activity: Exploring Factors that Affect Equilibrium                                   |
| 5. Enthalpy of Reaction  | 14. Conditions Affecting Equilibrium  |
| 6. Using Gibbs Free Energy to Predict Spontaneous Reactions      | 15. Quiz 3: Chapter Review  |
| 7. Quiz 1: Chemical Change to Enotropy and Gibbs Free Energy     | 16. Special Project*  |
| 8. Factors that Affect Reaction Rates: Solution Concentration    | 17. Test  |
| 9. Experiment: Effect of Solution Concentration on Reaction Rate | 18. Alternate Test*   |
|  | 19. Reference   |

## UNIT 8: EQUILIBRIUM SYSTEMS

## Assignment Titles

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|--|---|
| 1. Chemist's Toolbox                       | 14. Titration of Acids and Bases                      |
| 2. Solutions                               | 15. Quiz 3: Toolbox to Titration                      |
| 3. Solution Concentration: Molarity        | 16. Redox Equilibria                                  |
| 4. Electrical Nature of Solutions          | 17. Redox and Oxidation Potentials                    |
| 5. Solubility                              | 18. Activity: Solution Concentration vs. Conductivity |
| 6. Quiz 1: Toolbox TO Solubility           | 19. pH Calculations                                   |
| 7. The Dissolving Process                  | 20. Quiz 4: Chapter Review                            |
| 8. Experiment: Solubility Trends           | 21. Special Project*                                  |
| 9. The Solubility Constant                 | 22. Test  |
| 10. Quiz 2: Toolbox to Solubility Constant | 23. Alternate Test*                                   |
| 11. Acid-Base Equilibria                   | 24. Reference   |
| 12. Experiment: Acid Strength*             |   |
| 13. pH Scale                               |   |

## UNIT 9: CARBON CHEMISTRY: HYDROCARBONS

## Assignment Titles

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|--|------------------------------------|
| 1. Organic Compounds                           | 8. Alkanes: Saturated Hydrocarbons |
| 2. Sources of Organic Compounds                | 9. Unsaturated Hydrocarbons        |
| 3. Experiment: Volatility*                     | 10. Quiz 3: Chapter Review         |
| 4. Quiz 1: Organic Compounds and Their Sources | 11. Special Project*               |
| 5. A Closer Look at the Carbon Atom            | 12. Test                           |
| 6. Bonding in Organic Compounds                | 13.. Alternate Test*               |
| 7. Quiz 2: Organic Compounds to Bonding        | 14. Reference                      |

UNIT 10: CARBON CHEMISTRY: FUNCTIONAL GROUPS			
CHEMISTRY	Assignment Titles		
	1.	Common Reactions of Saturated Hydrocarbons	8 Nitrogen Functional Groups
	2.	Reactions of Unsaturated Hydrocarbons	9. Proteins and Amino Acids
	3.	Quiz 1: Reactions of Saturated and Unsaturated Hydrocarbons	10. Experiment: Preparation of a Polymer
	4.	Alcohols	11. Quiz 3: Chapter Review
	5.	Aldehydes, Acids, and Ketones	12. Special Project*
	6.	Esters	13. Test
	7.	Quiz 2: Reactions of Saturated and Unsaturated Hydrocarbons to Esters	14. Alternate Test*
			15. Reference

UNIT 11: CHEMISTRY REVIEW			
CHEMISTRY	Assignment Titles		
	1.	Measurement and Analysis	12. Solutions
	2.	Scientific Analysis and Significant Figures	13. Solubility Equilibrium
	3.	Elements, Compounds, and Mixtures	14. Neutralization
	4.	Gases and Moles	15. Organic Compounds
	5.	Quiz 1: Measurement to Gases and Moles	16. Hydrocarbon Chemistry
	6.	Atomic Structure and Nuclear Reactions	17. Quiz 3: Chapter Review
	7.	The Periodic Law	18. Special Project*
	8.	Molecular Structure	19. Test
	9.	Chemical Reactions, Rates, and Equilibrium	20. Alternate Test*
	10.	Reaction Dynamics	21. Reference
	11.	Quiz 2: Measurement to Reaction Dynamics	

UNIT 12: SEMESTER REVIEW AND TEST			
CHEMISTRY	Assignment Titles		
	1.	Review	3. Alternate Exam—Form A*
	2.	Exam	4. Alternate Exam—Form B*

UNIT 13: FINAL EXAM			
CHEMISTRY	Assignment Titles		
	1.	Exam	3. Alternate Exam—Form B*
	2.	Alternate Exam—Form A*	

(\*) Indicates alternate assignment