



monarch

Curriculum Catalog

Chemistry

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Chemistry 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.

- **Measurement and Analysis:** Students will explore different types of laboratory measurements.
- **Starting the Investigation:** How to Identify Elements, Compounds, and Mixtures: Students will explore the chemical and physical properties of elements, compounds, and mixtures.
- **Exploring Laws for Gases and Conservation of Mass:** Students will explore the kinetic molecular theory, the gas laws and the conservation of mass.
- **The Discovery of Atoms:** Nature's Building Blocks: Students will describe the history and current atomic theory.
- **Molecular Structure:** Students will explore stoichiometry, chemical bonding, and polar properties.
- **Chemical Reactions, Rates and Equilibrium:** Students will observe chemical changes, reaction rates, and factors that affect equilibrium.
- **Equilibrium Systems:** Students will explore solutions and equilibrium systems.
- **Carbon Chemistry: Hydrocarbons:** Students will describe organic compounds and saturated and unsaturated hydrocarbons.
- **Carbon Chemistry: Functional Groups:** Students will explore and describe the functional groups in hydrocarbons.

Unit 1: Measurement and Analysis				
Assignments				
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
Assignments

Chemistry	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
Assignments

Chemistry	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
Assignments

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

Unit 5: Molecular Structure**Assignments**

Chemistry

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|--|---|
| 1. Chemical Accounting: Stoichiometry | 8. Charging Up: Ionization of Atoms |
| 2. Valence Structure | 9. Quiz 4: Golden Years to Ionization |
| 3. Quiz 1: Stoichiometry to Valence | 10. A Closer Look Inside: Nuclear Reactions |
| 4. Determining Chemical Formulas | 11. Report: Fission Reactors |
| 5. Electron Availability: Prelude to Bonding | 12. Quiz 5: Chapter Review |
| 6. Quiz 2: Stoichiometry to Prelude to Bonding | 13. Special Project |
| 7. Types of Chemical Bonds | 14. Test |

Unit 6: Semester Review and Test**Assignments**

Chemistry

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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**Assignments**

Chemistry

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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**Assignments**

Chemistry

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

Unit 9: Carbon Chemistry: Hydrocarbons		
Assignments		
Chemistry	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		
Assignments		
Chemistry	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		
Assignments		
Chemistry	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		
Assignments		
Chemistry	1. Review	3. Alternate Exam—Form A*
	2. Exam	4. Alternate Exam—Form B*

Unit 13: Final Exam		
Assignments		
Chemistry	1. Exam	3. Alternate Exam—Form B*
	2. Alternate Exam—Form A*	

(*) Indicates alternative assignment