



2017-2018 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

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	
Assignments	
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

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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**Assignments**

Chemistry

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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**Assignments**

Chemistry

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

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

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

Unit 12: Semester Review and Test	
Assignments	
Chemistry	1. Review
	2. Exam
	3. Alternate Exam—Form A*
	4. Alternate Exam—Form B*

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

(*) Indicates alternative assignment