

# CURRICULUM OVERVIEW

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## Chemistry



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## Chemistry Course Overview

Chemistry is intended to provide a more in-depth study of matter and its interactions. 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 in chemistry, 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 4: The Discovery of Atoms: Nature's Building Blocks |                                                                |                                                                                           |
|----------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Chemistry                                                | Assignments                                                    |                                                                                           |
|                                                          | 1. The Golden Years of Chemistry                               | 11. Charging Up: Ionization of Atoms                                                      |
|                                                          | 2. Experiment: Physical Properties of Elements*                | 12. Quiz 4: Golden Years to Ionization                                                    |
|                                                          | 3. Experiment: Chemical Properties of Some Metals*             | 13. A Closer Look Inside: Nuclear Reactions                                               |
|                                                          | 4. Masters of Classic Atomic Theory                            | 14. Report: Fission Reactors*                                                             |
|                                                          | 5. Quiz 1: Golden Years to Masters                             | 15. Quiz 5: Chapter Review                                                                |
|                                                          | 6. Designing an Organizational Map: The Periodic Table         | 16. Special Project*                                                                      |
|                                                          | 7. Quiz 2: Golden Years to Periodic Table                      | 17. Project: Types of Energy                                                              |
|                                                          | 8. Electron Configuration                                      | 18. Test                                                                                  |
|                                                          | 9. Light Spectra and Excited States                            | 19. Alternate Test*                                                                       |
|                                                          | 10. Quiz 3: Golden Years to Bohr Model                         | 20. Glossary and Credits                                                                  |
| Unit 5: Molecular Structure                              |                                                                |                                                                                           |
| Chemistry                                                | Assignments                                                    |                                                                                           |
|                                                          | 1. Chemical Accounting: Stoichiometry                          | 10. Intermolecular Bonding                                                                |
|                                                          | 2. Valence Structure                                           | 11. Project: Bonding of Water                                                             |
|                                                          | 3. Quiz 1: Stoichiometry to Valences                           | 12. Bonding Energy                                                                        |
|                                                          | 4. Determining Chemical Formulas                               | 13. Experiment: Demonstrating Polar Properties                                            |
|                                                          | 5. Balancing Equations                                         | 14. Quiz 3: Chapter Review                                                                |
|                                                          | 6. Electron Availability: Prelude to Bonding                   | 15. Special Project*                                                                      |
|                                                          | 7. Quiz 2: Stoichiometry to Prelude to Bonding                 | 16. Test                                                                                  |
|                                                          | 8. Types of Chemical Bonds                                     | 17. Alternate Test*                                                                       |
|                                                          | 9. Polar Covalent Molecules and Dot Structures                 | 18. Glossary and Credits                                                                  |
| Unit 6: Semester Review and Exam                         |                                                                |                                                                                           |
| Chemistry                                                | Assignments                                                    |                                                                                           |
|                                                          | 1. Review                                                      | 3. Alternate Exam- Form A*                                                                |
|                                                          | 2. Exam                                                        | 4. Alternate Exam- Form B*                                                                |
|                                                          |                                                                |                                                                                           |
| Unit 7: Chemical Reactions, Rates, and Equilibrium       |                                                                |                                                                                           |
| Chemistry                                                | Assignments                                                    |                                                                                           |
|                                                          | 1. Evidence for Chemical Change                                | 15. Experiment: Effect of Solution Concentration on Reaction Rate                         |
|                                                          | 2. Experiment: Observing Chemical Changes                      | 16. Factors that Affect Reaction Rate: Temperature, Catalysts, Concentration of Reactants |
|                                                          | 3. Reaction Types (1) Combination and Decomposition            | 17. Quiz 3: Chemical Change to Reaction Rate                                              |
|                                                          | 4. Reaction Types (2) Single and Double Displacement           | 18. Reaction Equilibria and Equilibrium Constants                                         |
|                                                          | 5. Reaction Types (3) Combustion and Neutralization            | 19. Activity: Exploring Factors that Affect Equilibrium                                   |
|                                                          | 6. Experiment: Chemical Reactions*                             | 20. Conditions Affecting Equilibrium                                                      |
|                                                          | 7. Experiment: Ammonium Nitrate*                               | 21. Project: Research a Chemist                                                           |
|                                                          | 8. Quiz 1: Chemical Reactions                                  | 22. Quiz 4: Chapter Review                                                                |
|                                                          | 9. Enthalpy of Reaction                                        | 23. Special Project*                                                                      |
|                                                          | 10. Heat Transfer                                              | 24. Test                                                                                  |
|                                                          | 11. Calorimetry                                                | 25. Alternate Test*                                                                       |
|                                                          | 12. Using Gibbs Free Energy to Predict Spontaneous Reactions   | 26. Glossary and Credits                                                                  |
|                                                          | 13. Quiz 2: Chemical Change to Entropy and Gibbs Free          |                                                                                           |
|                                                          | 14. Factors that Affect Reaction Rates: Solution Concentration |                                                                                           |
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| Unit 8: Equilibrium Systems |                                            |                                                       |
|-----------------------------|--------------------------------------------|-------------------------------------------------------|
| Chemistry                   | Assignments                                |                                                       |
|                             | 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. Glossary and Credits                              |

| Unit 9: Carbon Chemistry: Hydrocarbons |                                         |                                    |
|----------------------------------------|-----------------------------------------|------------------------------------|
| Chemistry                              | Assignments                             |                                    |
|                                        | 1. Organic Compounds                    | 9. Alkanes: Saturated Hydrocarbons |
|                                        | 2. Sources of Organic Compounds         | 10. Unsaturated Hydrocarbons       |
|                                        | 3. Experiment: Volatility*              | 11. Quiz 3: Hydrogen and Carbon    |
|                                        | 4. Quiz 1: Carbon Compounds             | 12. Special Project*               |
|                                        | 5. A Closer Look at the Carbon Atom     | 13. Test                           |
|                                        | 6. Bonding in Organic Compounds         | 14. Alternate Test*                |
|                                        | 7. Quiz 2: Organic Compounds to Bonding | 15. Glossary and Credits           |
|                                        | 8. Organic Nomenclature                 |                                    |
|                                        |                                         |                                    |

| Unit 10: Carbon Chemistry: Functional Groups |                                                                          |                                          |
|----------------------------------------------|--------------------------------------------------------------------------|------------------------------------------|
| Chemistry                                    | Assignments                                                              |                                          |
|                                              | 1. Common Reactions of Saturated Hydrocarbons                            | 9. Nitrogen Functional Groups            |
|                                              | 2. Reactions of Unsaturated Hydrocarbons                                 | 10. Proteins and Amino Acids             |
|                                              | 3. Quiz 1: Reactions of Saturated and Unsaturated Hydrocarbons           | 11. Application of Organic Chemistry     |
|                                              | 4. Alcohols                                                              | 12. Experiment: Preparation of a Polymer |
|                                              | 5. Aldehydes, Acids, and Ketones                                         | 13. Quiz 3: Chapter Review               |
|                                              | 6. Esters                                                                | 14. Special Project*                     |
|                                              | 7. Project: Carbon Allotropes                                            | 15. Test                                 |
|                                              | 8. Quiz 2: Reactions of Saturated and Unsaturated Hydrocarbons to Esters | 16. Alternate Test*                      |
|                                              |                                                                          | 17. Glossary and Credits                 |

| Unit 11: Chemistry Review         |                                                |                            |
|-----------------------------------|------------------------------------------------|----------------------------|
| Chemistry                         | Assignments                                    |                            |
|                                   | 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 Gasses 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. Glossary and Credits   |
|                                   | 11. Quiz 2: Measurement to Reaction Dynamics   |                            |
| Unit 12: Semester Review and Exam |                                                |                            |
| Chemistry                         | Assignments                                    |                            |
|                                   | 1. Review                                      | 3. Alternate Exam- Form A* |
|                                   | 2. Exam                                        | 4. Alternate Exam- Form B* |
| Unit 13: Final Exam               |                                                |                            |
| Chemistry                         | Assignments                                    |                            |
|                                   | 1. Exam                                        | 3. Alternate Exam- Form B* |
|                                   | 2. Alternate Exam- Form A*                     |                            |

(\*) Indicates alternative assignment