2019-20

# CALVERT HOMESCHOOL ™

# CURRICULUM CATALOG

## 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.

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## Unit 1: Measurement and Analysis

**Assignments**

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

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## Unit 2: Scientific Method

**Assignments**

1. The Basic Ingredient: Chemical Elements
2. Project: Researching Branches of Chemistry
3. Quiz 1: Elements- Chemical and Physical Properties
4. Using Chemical and Physical Properties to Identify Substances
5. Phase Changes
6. Experiment: Observation of a Phase Change
7. Experiment: Salt and Sand*
8. Inorganic Nomenclature
9. Creating Compounds: Investigating Chemical Changes
10. Quiz 2: Elements - Compounds and Chemical Changes
11. Report: Density*
12. Identifying Different Types of Mixtures
13. Experiment: Using the Tyndall Effect to Identify Colloids
14. Quiz 3: Chapter Review
15. Special Project*
16. Test
17. Alternate Test*
18. Glossary and Credits

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## Unit 3: Exploring Laws for Gases and Conservation of Mass

**Assignments**

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

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## Unit 4: The Discovery of Atoms: Nature's Building Blocks

**Assignments**

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

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## Unit 5: Molecular Structure

**Assignments**

1. Chemical Accounting: Stoichiometry
2. Valence Structure
3. Quiz 1: Stoichiometry to Valences
4. Determining Chemical Formulas
5. Balancing Equations
6. Electron Availability: Prelude to Bonding
7. Quiz 2: Stoichiometry to Prelude to Bonding
8. Types of Chemical Bonds
9. Polar Covalent Molecules and Dot Structures
10. Intermolecular Bonding
11. Project: Bonding of Water
12. Bonding Energy
13. Experiment: Demonstrating Polar Properties
14. Quiz 3: Chapter Review
15. Special Project*
16. Test
17. Alternate Test*
18. Glossary and Credits

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## Unit 6: Semester Review and Exam

**Assignments**

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

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## Unit 7: Chemical Reactions, Rates, and Equilibrium

**Assignments**

1. Evidence for Chemical Change
2. Experiment: Observing Chemical Changes
3. Reaction Types (1) Combination and Decomposition
4. Reaction Types (2) Single and Double Displacement
5. Reaction Types (3) Combustion and Neutralization
6. Experiment: Chemical Reactions*
7. Experiment: Ammonium Nitrate*
8. Quiz 1: Chemical Reactions
9. Enthalpy of Reaction
10. Heat Transfer
11. Calorimetry
12. Using Gibbs Free Energy to Predict Spontaneous Reactions
13. Quiz 2: Chemical Change to Entropy and Gibbs Free
14. Factors that Affect Reaction Rates: Solution Concentration
15. Experiment: Effect of Solution Concentration on Reaction Rate
16. Factors that Affect Reaction Rate: Temperature, Catalysts, Concentration of Reactants
17. Quiz 3: Chemical Change to Reaction Rate
18. Reaction Equilibria and Equilibrium Constants
19. Activity: Exploring Factors that Affect Equilibrium
20. Conditions Affecting Equilibrium
21. Project: Research a Chemist
22. Quiz 4: Chapter Review
23. Special Project*
24. Test
25. Alternate Test*
26. Glossary and Credits

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## Unit 8: Equilibrium Systems

**Assignments**

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

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## Unit 9: Carbon Chemistry: Hydrocarbons

**Assignments**

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

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## Unit 10: Carbon Chemistry: Functional Groups

**Assignments**

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. Project: Carbon Allotropes
8. Quiz 2: Reactions of Saturated and Unsaturated Hydrocarbons to Esters
9. Nitrogen Functional Groups
10. Proteins and Amino Acids
11. Application of Organic Chemistry
12. Experiment: Preparation of a Polymer
13. Quiz 3: Chapter Review
14. Special Project*
15. Test
16. Alternate Test*
17. Glossary and Credits

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**Unit 11: Chemistry Review**

**Assignments**

1. Measurement and Analysis
2. Scientific Analysis and Significant Figures
3. Elements, Compounds, and Mixtures
4. Gases and Moles
5. Quiz 1: Measurement to Gasses 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. Glossary and Credits

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**Unit 12: Semester Review and Exam**

**Assignments**

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

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**Unit 13: Final Exam**

**Assignments**

1. Exam
2. Alternate Exam- Form A*
3. Alternate Exam- Form B*

(*) Indicates alternative assignment