



# monarch

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

| Unit 7: Chemical Reactions, Rates and Equilibrium |  |   |
|---|--|---|
| Assignments                                       |  |   |
| Chemistry   | 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                   | 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