



**Chemistry - Home Teacher Program**  
**ACADEMIC INSTRUCTIONAL LIBRARY**



# 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.

## HOME TEACHER LABS

Labs for the Homeschool Plus program are those contained in the Ignitia Online Curriculum. No expensive equipment is required with only several requiring the purchase of small items or household items to conduct the experiments.

It is always advisable to be familiar with your surroundings and wear protective equipment when conducting any experiment. Never allow yourself to be distracted when completing an experiment.

## UNIT 1- MEASUREMENT AND ANALYSIS

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. **Project: Practice in Measuring Metric Volumes**
11. **Measuring Mass in the Chemistry Laboratory**
12. **Project: Measuring Length with Precision [*Demonstrate a proficiency using the metric ruler. Obtain a metric ruler. Examine it carefully to determine its smallest interval. In this activity you are going to make measurements using this ruler. Decide how many digits should be in the measurements you record. Remember, you need to estimate one digit beyond the graduations on the ruler. Measure at least ten objects around the room that are less than one meter in length. Before you begin, make a table in which to record your results. Include a column for the name of the item and a column for estimating each length before actually measuring it. Record your measurements in centimeters (cm).*]**
13. **Quiz 3: Measurement and Precision**
14. **Observation and Hypothesizing**
15. **Learning to Make Useful and Detailed Observations**
16. **Using Graphs to Analyze Data**
17. **Project: Tutorial for Making a Scatter Plot Using an Electronic Spreadsheet Program [*In this project, you will be designing a scatter plot (a type of line graph) based on the information given to you in a data table. You must organize the data into a graph and make it clear and understandable. The advantage of using the Microsoft® Excel® application over paper and pencil is that you will have a neat and professional graph that may be*]**

*saved electronically and shared with your instructor. The tutorial will guide you in using the Excel application, but other spreadsheet tools are available, and, generally, the steps are similar. Complete the assignment in the Excel spreadsheet and upload for grading. If you do not have access to Excel notify your instructor of what electronic application, you will be able complete this project.)*

18. Quiz 4: Measurement to Graphs
19. Doing Chemistry Your Way: Find Your Future
20. Quiz 5: Chapter Review
21. Test
22. Alternate Test
23. Reference

## **UNIT 2 – STARTING THE INVESTIGATION: HOW TO IDENTIFY ELEMENTS, COMPOUNDS, AND MIXTURES**

1. The Basic Ingredient: Chemical Elements
2. Quiz 1: Elements, Chemical and Physical Properties
3. Using Chemical and Physical Properties to Identify Substances
4. Experiment: Salt and Sand
5. Creating Compounds: Investigating Chemical Changes
6. Quiz 2: Elements to Compounds and Chemical Changes
7. Report - Density (*Determine the density of three pure solids on g/cm<sup>3</sup> (refer to the lesson in this unit titled Using Chemical and Physical Properties to Identify Substances for the formula for density as well as a chart for densities of common materials and substances). Choose objects of which you are sure of their identity, such as aluminum foil (crumpled or in a ball), copper wire, or iron nails. Then, test an object that you think might contain one of the materials you tested. Report as to whether your*

*data supports your hypothesis. Write a 200-word report including hypothesis, procedure, results, and conclusions. Discuss the question, "What factors cause differences in density?" Be specific.)*

8. Identifying Different Types of Mixtures
9. Experiment: Using the Tyndall Effect to Identify Colloids
10. Quiz 3: Chapter Review
11. Test
12. Alternate Test
13. Reference

### **UNIT 3 - EXPLORING LAWS FOR GASES AND CONSERVATION OF MASS**

1. Nothing Stays Put - The Basis for Diffusion and Pressure
2. Gases and Kinetic Molecular Theory
3. Project: Graphing Kinetic Energy (*Apply the principles of Kinetic Molecular Theory to graphs of molecular motion. Print out graph paper and sketch a curve that represents the distribution of molecules at a temperature below the one shown. Label it as T2. Describe both T and T2 in terms of their average kinetic energy. Be specific and detailed.*)
4. Quiz 1: Diffusion and Kinetic Molecular Theory
5. Pressure-Volume Relationships in Gases (Boyle's Law)
6. Quiz 2: Diffusion to P-V Relationships in Gases
7. Temperature-Volume Relationships in Gases (Charles' Law)
8. *Experiment* – Charles's Law and a Metal Can
9. Quiz 3: Diffusion to V-T Relationships in Gases
10. Combined Gas Law
11. Quiz 4: Diffusion to Combined Gas Law

12. **Counting Gas Particles: The Measure of the Mole**
13. **How Big is a Mole? Avogadro's Number**
14. **Demonstrating Conservation of Mass with Balanced Equations**
15. **Essay: Biography (*Research and describe the important contribution that one of the following investigators of science has contributed to the knowledge of science: Robert Boyle, Lord Kelvin (William Thomson), and James Maxwell. Your report should be a minimum of 500 words with appropriate citing using MLA.*)**
16. **Quiz 5: Chapter Review**
17. **Test**
18. **Alternate Test**
19. **Reference**

#### **UNIT 4 – THE DISCOVERY OF ATOMS: NATURE’S BUILDING BLOCKS**

1. **The Golden Years of Chemistry**
2. **Masters of Classic Atomic Theory**
3. **Quiz 1: Golden Years to Masters**
4. **Designing an Organizational Map: The Periodic Table**
5. **Quiz 2: Golden Years to Periodic Table**
6. **The Bohr Model Revisited**
7. **Quiz 3: Golden Years to Bohr Model**
8. **Charging Up: Ionization of Atoms**
9. **Quiz 4: Golden Years to Ionization**
10. **A Closer Look Inside: Nuclear Reactions**
11. **Report: Fission Reactors (*Describe in detail the process of energy production in a nuclear reactor. Document the use of nuclear reactors in***

***this country and world-wide. Evaluate the impact of this scientific advancement on societies and the environment. Prepare a 500-word report on fission reactors in use today. Include the mechanics of the reaction, safety procedures, control mechanisms, and potential as an energy source. Detail the hazards, pollution problems, and waste disposal problems.)***

12. **Quiz 5: Chapter Review**
13. **Test**
14. **Alternate Test**
15. **Reference**

#### **UNIT 5 – MOLECULAR STRUCTURE**

1. **Chemical Accounting: Stoichiometry**
2. **Valence Structure**
3. **Quiz 1: Stoichiometry to Valence**
4. **Determining Chemical Formulas**
5. **Electron Availability: Prelude to Bonding**
6. **Quiz 2: Determining Chemical Formulas to Prelude to Bonding**
7. **Types of Chemical Bonds**
8. **Polar Covalent Molecules and Dot Structures**
9. **Experiment: Demonstrating Polar Properties**
10. **Quiz 3: Chapter Review**
11. **Test**
12. **Alternate Test**
13. **Reference**

## UNIT 6 – SEMESTER REVIEW AND TEST

1. Review
2. Exam
3. Alternate Exam—Form A
4. Alternate Exam—Form B

## UNIT 7 - CHEMICAL REACTIONS, RATES AND EQUILIBRIUM

1. Evidence for Chemical Change
2. Enthalpy of Reaction
3. Using Gibbs Free Energy to Predict Spontaneous Reactions
4. Quiz 1: Chemical Change to Entropy and Gibbs Free Energy
5. Factors that Affect Reaction Rates: Solution Concentration
6. Factors that Affect Reaction Rate: Temperature, Catalysts, Concentration of Reactants
7. Quiz 2: Chemical Change to Reaction Rate
8. Reaction Equilibriums and Equilibrium Constants
9. Activity: Exploring Factors that Affect Equilibrium (*Evaluate experimental results showing equilibria shifts due to temperature change. Using this reversible reaction, answer:  $N_2O_4 \rightleftharpoons 2NO_2$  As the temperature increased, what happened to the  $[N_2O_4]$ ? Was the formation of reactants or products favored by the addition of heat? Which reaction is exothermic? If the change of enthalpy of this reaction when proceeding left to right is 14 kcal, which chemical equation is correct?  $N_2O_4 \rightleftharpoons 2NO_2 + 14 \text{ kcal}$ ,  $2NO_2 \rightleftharpoons N_2O_4$ ,  $HR = +14 \text{ kcal}$ ,  $N_2O_4 + 14 \text{ kcal} \rightleftharpoons 2NO_2$ ,  $N_2O_4 \rightleftharpoons 2NO_2$ ,  $HR = -14 \text{ kcal}$ . Complete the question as a part of this assignment.*)
10. Conditions Affecting Equilibrium
11. Quiz 3: Chapter Review



12. **Test**
13. **Alternate Test**
14. **Reference**

## **UNIT 8 – EQUILIBRIUM SYSTEMS**

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. **The Solubility Constant**
9. **Quiz 2: Toolbox to Solubility Constant**
10. **Acid-Base Equilibria**
11. **pH Scale**
12. **Titration of Acids and Bases**
13. **Quiz 3: Toolbox to Titration**
14. **Redox Equilibria**
15. **Redox and Oxidation Potentials**
16. **Activity: Solution Concentration vs. Conductivity (*Graph experimental data and interpret results for peer review. A chemistry student carried out an experiment with a conducting apparatus (ammeter) similar to the one below. This ammeter measures in milliamperes (mA). The following data was taken. Answer all questions related to his activity showing the graph*)**

17. **pH Calculations**
18. **Quiz 4: Chapter Review**
19. **Test**
20. **Alternate Test**
21. **Reference**

## **UNIT 9 – CARBON CHEMISTRY: HYDROCARBONS**

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

## **UNIT 10 – CARBON CHEMISTRY: FUNCTIONAL GROUPS**

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. **Test**
13. **Alternate Test**
14. **Reference**

#### **UNIT 11 - CHEMISTRY REVIEW**

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. **Test**
19. **Alternate Test**
20. **Reference**

#### **UNIT 12 - SEMESTER REVIEW AND TEST**

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

#### **UNIT 13 - FINAL EXAM**