

# Chemistry of Gases—Preface

The historical foundation of modern chemistry was built on an understanding of the chemistry of gases. Studies of hydrogen and oxygen in the 18th century led to the modern definition of an element versus a compound and revealed what happens in a chemical reaction. From these historical roots, the study of gases continues to influence both science and society. As we learn more about the role of greenhouse gases in the chemistry of the atmosphere, the chemistry of gases remains a vital area of research in the 21st century as well. The purpose of *Chemistry of Gases, Volume 8* in the Flinn ChemTopic™ Labs series, is to provide high school chemistry teachers with laboratory activities that will help students investigate the preparation and properties of the common gases. Four experiments and six demonstrations illustrate a variety of techniques for the preparation of gases and reveal the unique physical and chemical properties of common gases.

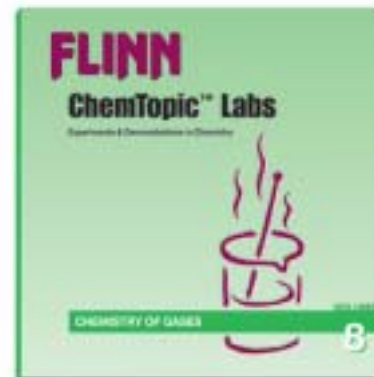
## Common Gases

Pure substances, whether solid, liquid or gas, have a constant composition and characteristic physical and chemical properties. In “Common Gases,” students prepare five common gases and study the properties that make them unique. Which gases are lighter than air? Which gases have an odor? Use this introductory level experiment to review physical and chemical properties of substances or to provide experience in writing and balancing chemical equations. This survey experiment is also well-suited for use in an applications-oriented chemistry course.

## Macroscale and Microscale Techniques

In “Collecting Gases by Water Displacement,” a demonstration procedure, students observe the principle of collecting a gas by water displacement. The large-scale procedure is reduced to a safer and more convenient level in the microscale experiment “Preparing and Testing Hydrogen Gas.” Students prepare hydrogen gas and study its density and combustion reaction with air. The microscale adaptation is fast and safe, making it possible for students to repeat the experiment several times as they study the variables that affect the combustion of hydrogen. Supplementary instructions are also provided for the preparation of oxygen gas. The innovative “gas in a syringe” method for preparing gases is featured in two additional microscale experiments. In “Oxygen, What a Flame,” students prepare oxygen gas and

investigate its role in combustion and oxidation–reduction reactions. In “Carbon Dioxide, What a Gas,” students perform classic tests to analyze this important gas and learn about its acid–base properties.



## Exciting Demonstrations

Five demonstrations allow the high school chemistry teacher to showcase in colorful and dramatic fashion the physical and chemical properties of a variety of gases. Acid–base indicators in “Solubility of Carbon Dioxide” and “Solubility of Ammonia” provide a rainbow of color changes to compare the solubility of these gases and to contrast their acidic and basic properties, respectively. The acidic nature of carbon dioxide is also featured in “The Collapsing Bottle” demonstration, where the exothermic reaction of carbon dioxide with sodium hydroxide in a soda bottle results in the bottle collapsing in on itself. “Underwater Fireworks” provides a rather spectacular demonstration of the energy released when bubbles of chlorine and acetylene gas collide under water and react. The density of hydrocarbon vapors and their flammability are illustrated in the “Flaming Vapor Ramp” demonstration. Use this demonstration to underscore the importance of fire safety rules, not only in the lab but in the home as well.

## Safety, Flexibility, and Choice

The overlapping selection of experiments and demonstrations in Chemistry of Gases gives you the ability to cover the topics you feel are important in the safest, most effective manner possible. Depend on Flinn Scientific to give you the information and resources to work safely with your students and to help them succeed. Your students will benefit as they learn to appreciate the historical role of the study of gases and to recognize its continuing role in the development of chemistry as the central science. All of the experiments and demonstrations in the Chemistry of Gases have been thoroughly tested and retested. You know they will work! Use the experiment summaries and concepts on the following pages to locate the concepts you want to teach and to choose activities that will help you meet your goals.

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