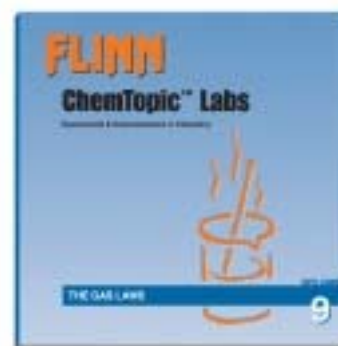


# The Gas Laws— Experiment Summaries and Concepts



## ***Boyle's Law in a Bottle—Pressure versus Volume***

More than 350 years ago, Robert Boyle used air trapped in a glass tube above a column of mercury to study the relationship between the volume and pressure of air. In this experiment, students carry out a modern version of Boyle's classic experiment using only a syringe and a special, "pressurized" soda bottle. Discover Boyle's law in a safe and environmentally friendly manner!

## ***Charles's Law and Absolute Zero—How Low Can You Go?***

Charles's law was inspired by the first sensational flight in the history of hot-air ballooning. A hot-air balloon works on the principle that the volume of a gas expands when it is heated. When a gas is heated, the kinetic energy of the particles increases and they move faster. What happens when a gas is cooled? Is there a lower limit to temperature at which the particles stop moving altogether? What would happen to the volume of a gas at this minimum temperature? Find out just how low you can go in this innovative Charles's law experiment.

## ***Molar Volume of Hydrogen—Combining the Gas Laws***

The volume occupied by one mole of a gas is called the molar volume. According to the ideal gas law, the molar volume of an ideal gas is equal to 22.4 L/mole at standard temperature and pressure and is independent of the identity of the gas. In this microscale experiment, students measure the volume corresponding to a known amount of hydrogen gas and then use the gas laws to calculate its molar volume at STP.



## ***Technology and the Forgotten Gas Law—Pressure versus Temperature***

Avogadro, Boyle, and Charles—together these scientists gave us the ABC's of gas laws. Their experiments and their stories are well known to students and teachers alike. But who was Guillaume Amontons and what is his gas law? The purpose of this technology-based experiment is to measure the pressure of a gas at different temperatures and thus rediscover the forgotten gas law relating the temperature and pressure of a gas.



## ***Life on Planet V—A Classroom Activity***

Imagine that you have been relocated to Planet V, a planet just like Earth but with no atmosphere at all. What would it be like to live in a vacuum? Which of our tools and toys—from vacuum cleaners to squirt guns—would still work the same? Which would not work at all? Use this "mental lab" activity to stimulate student discussion of the concepts of pressure and vacuum.



### **Concepts**

- Gas properties
- Pressure
- Boyle's law
- Kinetic-molecular theory
  
- Temperature
- Charles's law
- Absolute zero
- Kinetic-molecular theory
  
- Avogadro's law
- Dalton's law
- Ideal gas law
- Molar volume
  
- Boyle's law
- Amontons's law
- Absolute zero
- Kinetic-molecular theory
  
- Atmospheric pressure
- Vacuum