

## Properties of Gases

The objective of this experiment is to determine the relationships between the pressure, volume, temperature and number of particles.

### Part One: Pressure (P) and Volume (V)

The objective of this experiment is to determine the relationship between the pressure and volume of a confined gas. The gas we use will be air, and it will be confined in a syringe connected to a Gas Pressure Sensor. The volume of the syringe is changed by moving the piston, a change occurs in the pressure exerted by the confined gas. This pressure change will be monitored using a Gas Pressure Sensor. **It is assumed that temperature and number of particles will be constant throughout this experiment.** Pressure and volume data pairs will be collected during this experiment and then analyzed. From the data and graph, determine what kind of mathematical relationship exists between the pressure and volume of the confined gas. Historically, this relationship was first established by Robert Boyle in 1662 and has since been known as Boyle's law.

**It is assumed that temperature and volume will be constant throughout this experiment.**

### PROCESSING THE DATA

1. If the volume is *doubled* from 4.0 mL to 8.0 mL, what does your data show happens to the pressure? Show the pressure values in your answer.
2. If the volume is *halved* from 12.0 mL to 6.0 mL, what does your data show happens to the pressure? Show the pressure values in your answer.
3. If the volume is *tripled* from 4.0 mL to 12.0 mL, what does your data show happened to the pressure? Show the pressure values in your answer.
4. From your answers to the first three questions *and* the shape of the curve in the plot of pressure versus volume, do you think the relationship between the pressure and volume of a confined gas is direct or inverse? Explain how you know.
5. Using  $P$ ,  $V$ , and  $k$ , write an equation representing relating the relationship of pressure to volume. Write a verbal statement that correctly expresses this relationship.

## **Part Two: Pressure (P) and Number of Particles (n)**

### **PROCESSING THE DATA**

The objective of this experiment is to determine the relationship between the pressure and the number of particles in a confined gas. The gas we use will be air, and it will be confined in a syringe connected to a Gas Pressure Sensor. The number of particles is changed by moving the piston, a change occurs in the pressure exerted by the confined gas. This pressure change will be monitored using a Gas Pressure Sensor. **It is assumed that temperature and volume will be constant throughout this experiment.** Pressure and number of particle data pairs will be collected during this experiment and then analyzed. From the data and graph, determine what kind of mathematical relationship exists between the pressure and volume of the confined gas.

1. What happens to the number of particles if pressure is doubled? Show the pressure values in your answer.
2. What happens to the pressure if the amount of particles is halved? Show the pressure values in your answer.
3. What happens to the number of particles if pressure is tripled? Show the pressure values in your answer.
4. What happens to the pressure if the amount of particles is reduced by 3 (divided by 3)? Show the pressure values in your answer.
5. Using  $P$ ,  $n$ ,  $m$  and  $b$  write an equation representing the relationship of pressure to number of particles. Write a verbal statement that correctly the relationship of number of particles to pressure