

## **Investigating the relationship between pressure and volume in a gas**

### **Introduction**

In this experiment you will be taking measurements relating to the behaviour of gases. There are alternative methods of carrying out the experiments, but the aim is the same.

### **Aim**

- To determine the relationship between pressure and volume of a gas.

### **Intended class time**

- 45 to 60 minutes

### **A) Variation in volume – Boyles Law apparatus**

#### **Equipment**

- Boyle's Law apparatus
- a mercury in glass thermometer
- barometer
- suitable eye protection

#### **Procedure**

1. The apparatus is prepared for you with a means of increasing the pressure within the sealed column of air. You should ensure that you know how to operate the means of increasing the pressure.
2. Record the length of the column of air above the oil for a range of pressures.
3. Plot a graph of the volume of gas against its pressure.
4. Identify the type of relationship and substantiate this either graphically or by calculation.
5. Record the ambient temperature and pressure at which you carried out your experiment.

### **B) Variation in load on an enclosed quantity of gas**

#### **Equipment**

- plastic syringe or gas syringe with the outlet sealed or clamped
- a number of masses to act as the load on the system
- clamp stand, boss and clamp
- micrometer or vernier calipers
- mercury in glass thermometer
- barometer

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### Health and Safety

Care should be taken to avoid falling masses, bubble wrap in a small box placed under the apparatus will cushion the fall sufficiently.

### Procedure

1. The apparatus is set up with the cylinder arranged vertically.  
The masses are applied to the handle of the syringe to vary the pressure on the gas. This may be achieved by placing the masses on the handle, or by using string to hang the masses from the handle.
2. Record the force on the piston and the volume of gas for a suitable range of values.
3. Use the micrometer or vernier calipers to measure the diameter of the piston. If the syringes are sealed, your teacher should have an identical piston available for measurement.
4. Use your measurements to calculate the pressure and volume for the gas in the syringe.
5. Plot a graph of volume against pressure for the gas.
6. Identify the type of relationship, and substantiate this either graphically or by calculation.
7. Record the ambient temperature and pressure at which you carried out your experiment.

### Evaluation for both A) and B)

1. Does your data support the accepted theory?
2. Comment on uncertainty in measurements and your final conclusion.
3. What is the effect of atmospheric pressure on this experiment?

### Recording

As evidence for the Practical Endorsement you should have data collected from your group and additionally any class data required to allow graphical representation. All work should be clearly dated.

In addition, in preparation for the assessment of practical work in the written examinations, you should have used the data collected to support your hypothesis and should be able to comment on uncertainty in measurements.