# Topic 3 – Practical 5

## *Gas laws – Simulation experiments*

### Safety

There are no safety issues concerning this experiment.

### Apparatus and materials

* laptop with internet access

### Introduction

In this simulation experiment you will verify the gas laws.

**Boyle’s law:** for a given mass of gas kept at constant temperature

**Charles’ law:** for a given mass of gas under constant pressure

**Pressure law:** for a given mass and volume of gas

### Procedure

1. Go to the phet website and download the ‘Gas properties’ simulation (<http://phet.colorado.edu/en/simulation/gas-properties>)
2. On the right-hand menu click the ‘Measurement Tools >>’ control box and tick the ‘Ruler’. Align the movable edge of the vessel to the 1 nm mark on the ruler. Use the ruler to measure the dimensions of the container and calculate its volume.
3. Pump some gas into the vessel (push the full length of the handle of the pump only once) and wait a few seconds.

**Boyle’s law**

1. On the right-hand menu on the top check the ‘Temperature’ option to keep it constant. Record the values of the volume and pressure.
2. Decrease the volume of the vessel by moving the movable edge by 1 nm. Wait for a few seconds and measure the pressure. Calculate the new volume of the container. Record your measurements in a suitable table.
3. Repeat step **5** four more times.
4. Plot a graph of pressure against volume. Answer question **1**.

**Charles’ law**

1. First check the ‘None’ option on the right-hand menu on the top and then press ‘Reset’. Pump the handle to insert some gas in the vessel and wait a few seconds.
2. On the right-hand menu on the top check the ‘Pressure’ option to keep it constant. Record the values of the volume and temperature.
3. Increase the temperature by approximately 10 K. Wait for a few seconds and measure the volume of the vessel. Record the exact value of the temperature and your measurements of the volume in a suitable table.
4. Repeat step **10** four more times.
5. Plot a graph of volume against temperature. Answer question **2**.

**Pressure law**

1. Press ‘Reset’ and pump the handle to insert some gas in the vessel and wait a few seconds.
2. On the right-hand menu on the top check the ‘Volume’ option to keep it constant. Record the values of the pressure and temperature.
3. Increase the temperature by 10 K. Wait for a few seconds and measure the pressure. Record your measurements in a suitable table.
4. Repeat step **15** four more times.
5. Plot a graph of pressure against temperature. Answer question **c**.

### Questions

* 1. Questions on Boyle’s law simulation experiment:
     1. What is the shape of the line and what relationship does it represent?

Does this confirm Boyle’s law?

* + 1. What axes should you use to get a linear graph?
    2. What happens if you try to reduce the volume further?
  1. Question on Charles’ law simulation experiment:

What is the shape of the line and what relationship does it represent?

Does this confirm Charles’ law?

* 1. Questions on Pressure law simulation experiment:
     1. What is the shape of the line? What relationship does it represent?

Does this confirm the Pressure law?

* + 1. If you extrapolate the line until pressure is zero, what is this value of temperature?