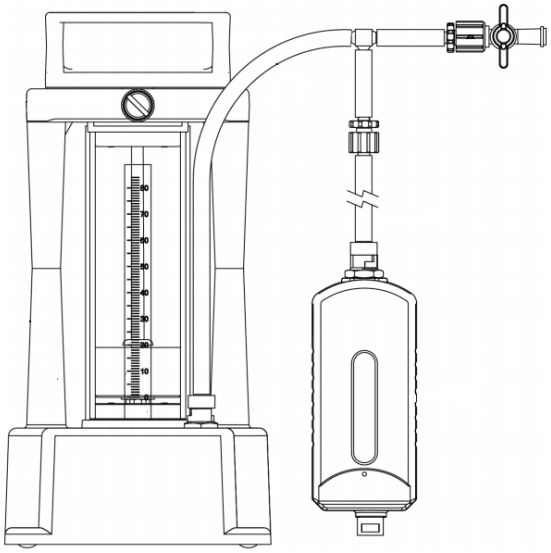
Name: Adeel Rehman | Group Members: Adeel, Steven, Anthony, Ben

Lab 3 – Ideal Gasses

Part 1: Boyle's Law

What is the relationship between Pressure and Volume of an ideal gas? It is important that while attempting to answer such a question, all other variables remain unchanged.



Equipment Needed

Heat Engine, Pressure Sensor, Tubing, Valve

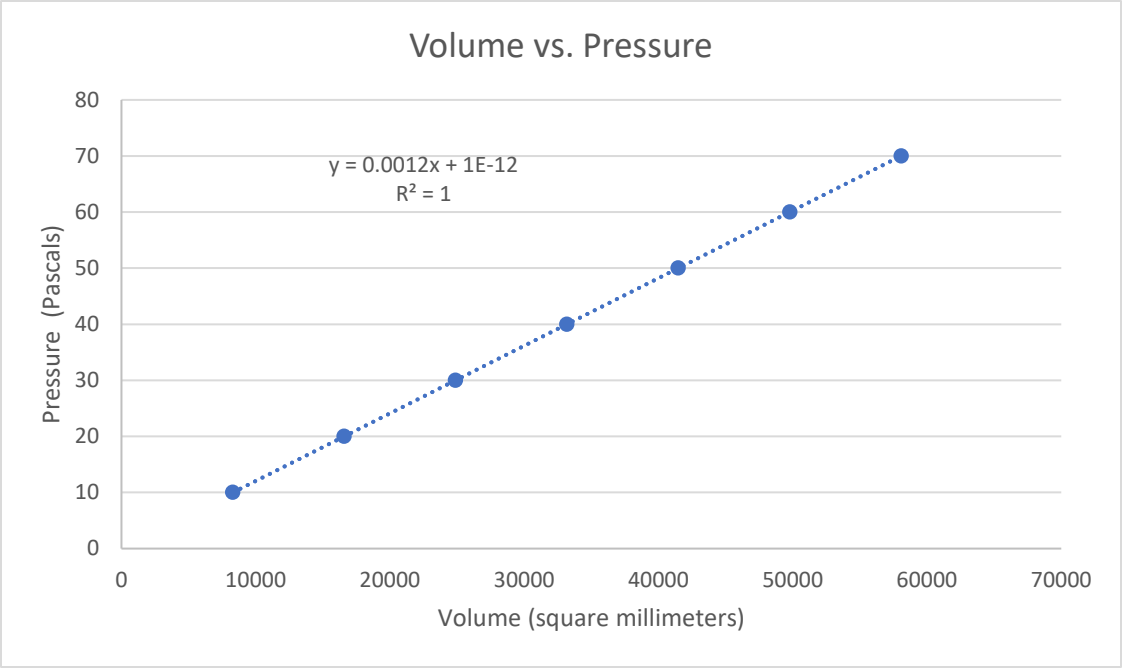
Experimental Design

1. Orient your lab equipment in the method shown.

2. Turn the valve's handle to a position parallel to the tubing to allow air flow (UNLOCKED position). While unlocked, raise the heat engine's piston position to some value of your choosing. Be sure to make room for compressing and expanding the air inside the piston. Once you have established this position, LOCK the valve by orienting the handle to be perpendicular to the tubing.

3. Begin recording various volumes and associated pressures by either manually moving the piston or adding controlled weights. Keep in mind that the side of the piston reads length in MILLIMETERS and not volume. The piston is a cylinder with an inner diameter of 32.5 mm.

4. Below, please paste your data. This should include a data table and a Pressure vs. Volume graph. Please fit both side-by-side on the 1st page. Do not worry about linearizing your data.

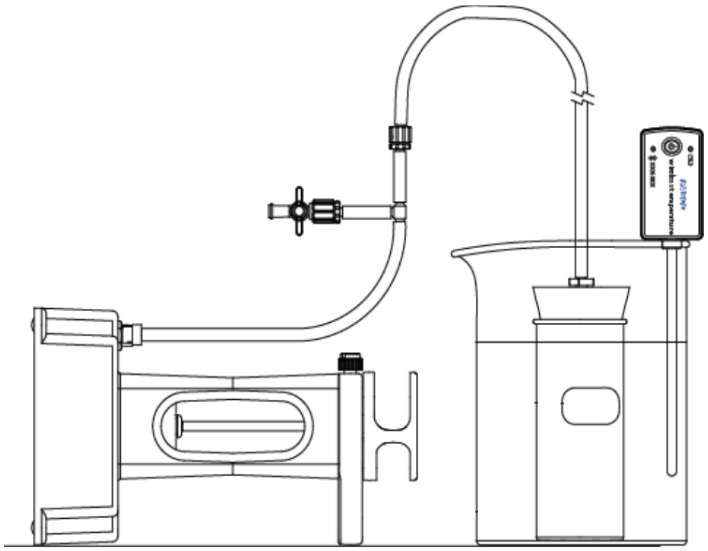


Part 2: Charles' Law

What is the relationship between Volume and Temperature of an ideal gas? It is important that while attempting to answer such a question, that all other variables remain unchanged.

Equipment Needed

Heat Engine, Beaker, Temperature Sensor, Hot Plate, Tubing, Aluminum Air Canister, Microwave, Valve



Experimental Design

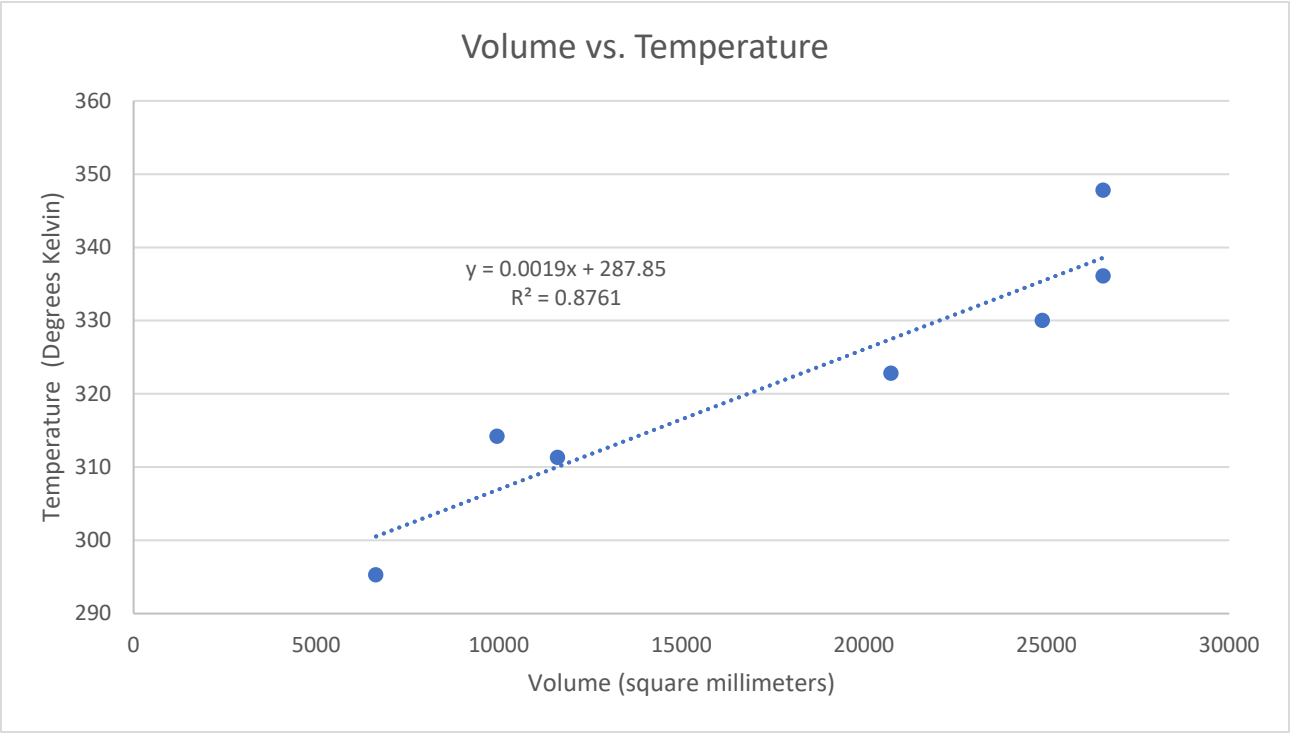
1. Orient your lab equipment in the method shown. Do not submerge the canister in the beaker yet, though.

2. UNLOCK the valve and assure the black rubber stopper is firmly fit into the canister. Adjust the piston to the zero position. LOCK the valve after this.

3. Fill the beaker about half way with room temperature water. Use the microwave to heat the water to *almost* boiling. If the water is too hot, the stopper will pop off and the experiment will have to be repeated. Place the aluminum canister inside the beaker so the entire canister is submerged. One person will have to hold this steady by the STOPPER. Do not touch the aluminum. Another person will need to hold the temperature sensor steady as well, and not let it touch the bottom of the beaker.

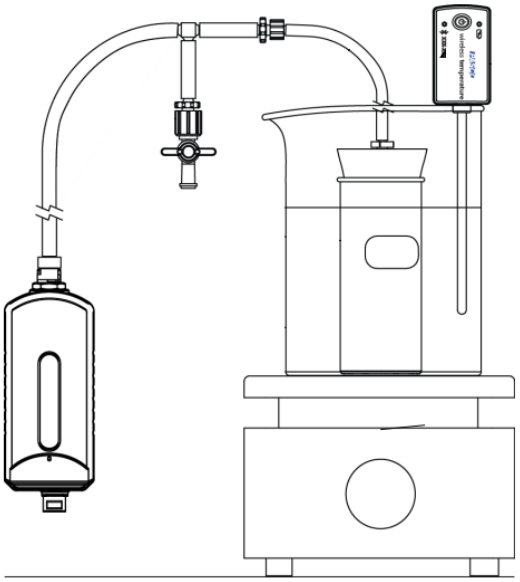
4. When the air stops expanding, record the maximum volume and temperature (Kelvin). Slowly reduce the temperature by adding ice in slow intervals. Record volumes and temperatures at intervals of your choosing

5. Below, please paste your data. This should include a data table and a Volume vs. Temperature graph. Please fit both side-by-side on the 2nd page.



Part 3: Gay-Lussac's Law (Goggles and Apron Required)

What is the relationship between Pressure and Temperature of an ideal gas? It is important that while attempting to answer such a question, that all other variables remain unchanged.



Equipment Needed

Beaker, Temperature Sensor, Pressure Sensor, Hot Plate, Tubing, Aluminum Air Canister, Valve

Experimental Design

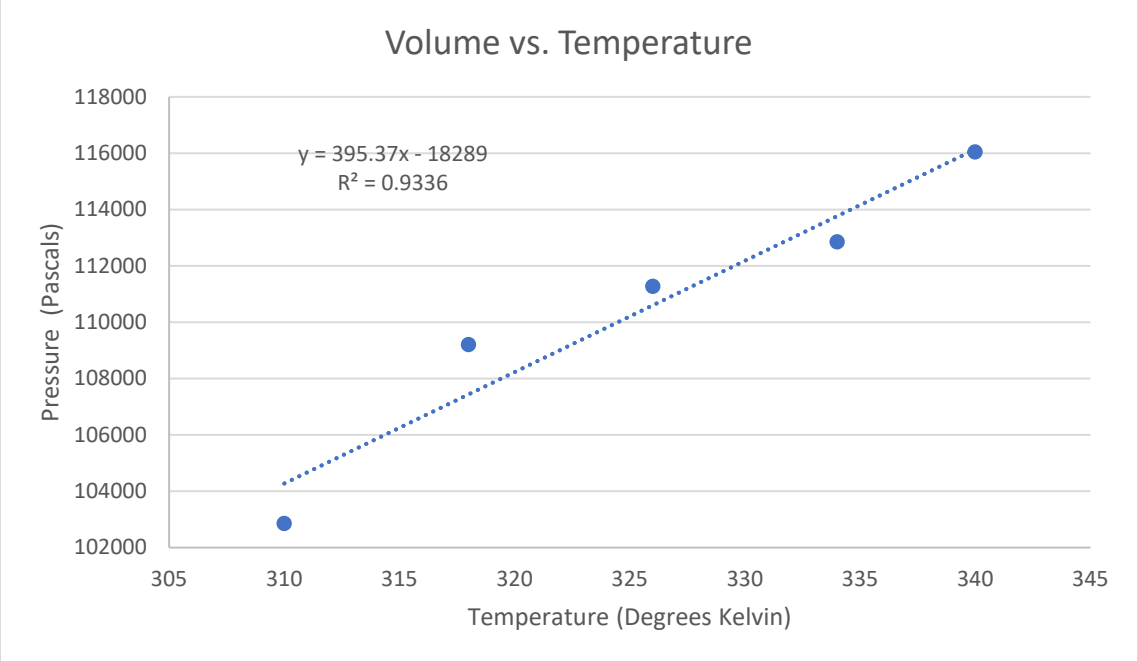
1. Orient your lab equipment in the method shown. Do not submerge the canister in the beaker yet, though.

2. UNLOCK the valve and assure the black rubber stopper is firmly fit into the canister. LOCK the valve after you have done so.

3. Fill the beaker about half way with room temperature water. Place aluminum canister inside, but do not let it touch the bottom. One person will have to hold this steady by the STOPPER. Do not touch the aluminum. One other person will need to hold the temperature sensor steady, and not let it touch the bottom of the beaker.

4. Place the beaker on a hot plate and turn it on. Begin recording pressures and temperatures (Kelvin) at intervals of your choosing. When the temperature reaches 80° C, or when the stopper pops off, stop recording and unplug the hot plate.

5. Below, please paste your data. This should include a data table and a Pressure vs. Temperature graph. Please fit both side-by-side on the 3rd page.



Questions

1. What is the relationship between Pressure and Volume? Include your regression equation from Part 1.

   We found the relationship between Pressure and Volume to be linear, with an equation of y = 0.0012x + 1E-12, where y is pressure, and x is volume.

2. What is the relationship between Volume and Temperature? Include your regression equation from Part 2.

   The relationship between Volume and Temperature is also linear. If y is temperature, and x is pressure, our equation relating the two is y = 0.0019x + 287.85

3. What is the relationship between Pressure and Temperature? Include your regression equation from Part 3.

   Pressure and Temperature also share a linear relationship. Using Temperature as x, and pressure as y, our equation is y = 395.37x - 18289

4. What are some sources of error that might have occurred during your laboratory experiment?

   Our heat engine had a leak in it, which would cause the pressure in it to return to atmospheric pressure after some time. To minimize this, we tightened all our pipes, and restored it to atmospheric pressure every time we moved the piston manually. In addition, there was a delay between when two measurements were read. Because the measurements were always changing, this would cause a small error in our measurements. Lastly, the thermometer was being held in the beaker by hand, and therefore always moving throughout the water, causing small deviations in the temperature recorded.