Gas Law Simulation PART 3 (Volume vs. Pressure) Name:



Get Started

1. Click on this [link](https://phet.colorado.edu/sims/html/gases-intro/latest/gases-intro_en.html) to open the gas simulation
2. Choose the Laws option on the right. See picture

**The Relationship between Volume and Temperature - Constant Pressure**

1. Reset the simulator by selecting the reset button in the bottom right corner of the simulation.
2. Give one pump of gas into the chamber.
3. Choose to hold the Temperature constant by selecting that option in the upper right hand corner. See the picture.

What is the initial pressure in the chamber? \_\_\_\_\_\_\_\_\_

Record this value in the data chart.



In order for us to measure volume we need to know the size of the container.

1. Select the Width option. This will cause a ruler to appear. The rulers units are in nanometers (nm) but we are going to use the ruler to give us an estimated measurement of volume. You will use the ruler to measure the width of the box. We will then change the units of measurement to liters. For example: initially the box should have a width of 10.0 nm which will be recorded in your data table as 10.0 L (liters). When you are asked to change/measure the volume of the box, use the ruler to do so.

Record the initial Volume in the data table.

1. Use the handle on the left side of the simulator to change the volume

Fill in the following chart by selecting various volumes. Measure the pressure of the container and record in the Data table.

 Data Chart

|  |  |  |
| --- | --- | --- |
| Trials | Pressure (P) | Volume (V) |
| Trial 1 | 5.8 atm | 10.0 L |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |

Create a Graph of the P(vertical axis) vs. V(horizontal axis) below. LABEL EACH AXIS

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
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Is the relationship between these two variables a DIRECT or INDIRECT RELATIONSHIP (Circle One)

When a scientist discovers a relationship between variables, they can then create a mathematical law to relate these variables. This relation hip was first given credit to Robert Boyle.

**Deriving the law:** In order to create a mathematical law, we need to find out what is constant between the variables. We will do this by comparing the variables in two ways.

1. Multiply your Volume and Pressure values from each trial. Record in table below.
2. Divide your Volume by Pressure and record in table below.

|  |  |  |
| --- | --- | --- |
| Trials | Calculate *k1 =* (*VxP*) | Calculate *k2 =V/P* |
| Trial 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |

Which value remains consistent in the data table? k1 or k2

You just discovered that the relationship between the variables is constant!! This feeling you have is the same as Robert Boyle had himself. Explain how you feel..

This k-value is constant; the ratio between volume and temperature of any point on the graph will be the same. Pick any two points from the graph or table:

 Point #1 Point #2

 V1 = V2 =

 P1 = P2 =

Show the *k*-value calculation:

You can create an equation now:

**P1V1 = P2V2**

**THIS IS BOYLES’S LAW**!!!!

We can use this formula to predict the pressure (P2) or volume (V2) of any gas. Use this formula to complete the following calculation. Show your work.

1. If a gas has a volume of 1.25 L and a pressure of 1.75 atm, what will the pressure be if the volume is changed to 3.15 L?