

GAS PRESSURE AND TEMPERATURE RELATIONSHIPS

Name _____ Section _____

Log on to the Internet. Type the following address into the location-input line of your browser:

<http://dbpoc.com/pearson/chemsims/gold/kmtgold/KMT.php>

The simulation will open to an image of a volume of gas at a particular temperature and pressure in a container on a hotplate, which is quickly replaced with a new screen with an Overview page. You are welcome to read the Overview Page, and by clicking on the Learning Outcomes tab near the top of the display, you may read the Learning Outcomes Page. After reviewing these two pages click on the Experiment tab. When the screen changes the page will show two buttons: Run Demonstration button and Run Experiment button. You are welcome to click on the Run Demonstration button, but the instructions below are for the Run Experiment button. After clicking on the Run Experimental button the screen will look like Figure I.

Chemistry Simulations : Kinetic Molecular Theory of Gases

Overview Learning Outcomes Experiment Run Experiment Step 1

The main components of the macroscopic view in the simulation:

- Piston, glass container, and hotplate
- Controls to change the conditions of the experiment (pressure, volume, temperature, and number of moles of the gas) and to record each change
- Signify the responding variable by moving the Rspd button beside it. You then manipulate the controlling variables by sliding the slider bars.
- Ability to plot recorded data in graphical representations to view different relationships

Macroscopic Submicroscopic

#	P	V	T	n
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Pressure (atm)

Export Data Graph Data Temperature (K)

Properties

Rspd

P (atm): 0.50 Record

V (L): 2.45 Reset

T (K): 298.00

Gases

n (mol He): 0.05 Track

n (mol Ne): 0.00

n (mol Ar): 0.00 Pause

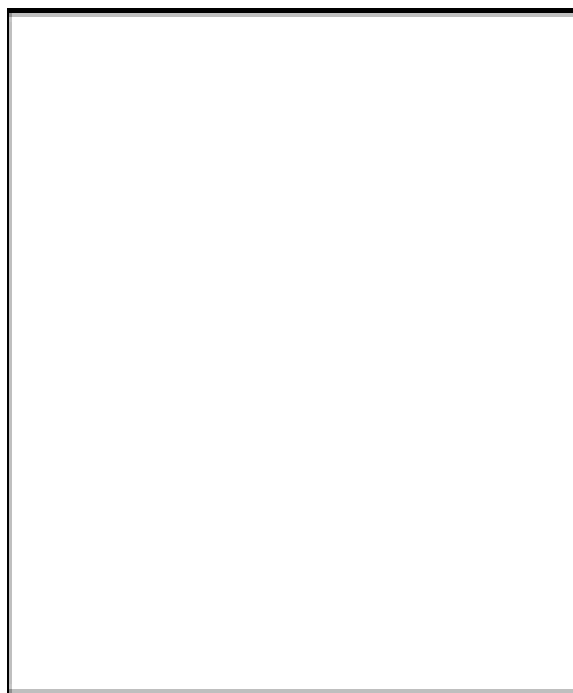
Figure I.

Problem Statement: How are the pressure and temperature of a gas sample related?

I. Data Collection:

A. Open the Gas Law Simulation program and observe and describe, in the space below, the activity in the Gas Sample window. Consider using some or all of the following terms in your description: particles, atoms, molecules, collisions, speed, energy, force.

B. One of the objects in the window is colored differently than the others. Enable the tracking function and trace the path of a particle from one side of the screen to the other in the space below. Explain any changes in speed or direction that you observe.



C. Record the values for pressure, volume and temperature on the digital read-outs of the Controls window.

D. Observe the action in the Speed Distribution window. Relate what you see with the behavior of the objects in the Gas Sample window.

Click the Pause button and sketch and label the graph in the space below.

- E. Using the controls in the Control Bar window, fix Pressure as a dependent variable by clicking on its radio button. Change the temperature of the container using the temperature slider bar and observe what happens to the pressure of the system as the number of moles of gas and volume of the gas are held constant.
- i) Describe your observation about the relationship of pressure and temperature. Also describe the behavior of the particles in the container as you change the temperature sliderbar.
- ii) While changing the temperature sliderbar how is the average speed of the particles in the container affected? (Answer in a complete sentence.)
- iii) Provide an explanation, in terms of the particles and their behavior, that explains why the pressure changes as a result of changing the temperature of the container.

F. Collect five additional observations of pressure/temperature relationships and record all of your data in the following table.

Data Table

Pressure	Temperature
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

II. Data Analysis:

What patterns are shown in these data? It might be helpful to graph the data. Try to come up with an algebraic equation that expresses the pattern you found.

III. Interpretation and Conclusions:

A. How are the pressure and temperature of a gas sample related?

B. Mental Model - Draw a picture(s) that explains how the pressure and temperature of a gas sample are related at the level of atoms and molecules, and that illustrates the observations you made in the experiment. In words, explain how your picture(s) illustrate(s) this relationship.

C. Using your data, predict the pressure of a gas sample at a temperature of 10 Kelvins. Show how you made your prediction.