

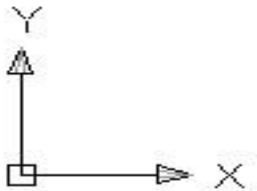
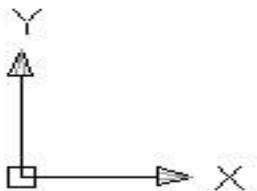
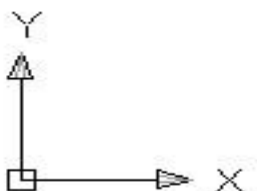
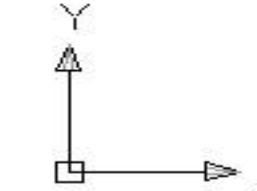
Student Directions for [Gas Properties](http://phet.colorado.edu/) Chemistry: Gas Laws

<http://phet.colorado.edu/>

Learning Goals:

- Design experiments to measure the relationships between pressure, volume, and temperature.
- Create graphs based on predictions and observations.
- Make qualitative statements about the relationships between pressure, volume and temperature using molecular models.

Predictions: Make a chart like the one below. Without using the simulation, sketch what you think the graphs would look like. **Note: Be sure to label your x and y axes.**

<p>I. Volume-Pressure graph</p> 	<p>Explain your reasoning for the graph's appearance</p>
<p>II. Volume-Temperature graph</p> 	<p>Explain your reasoning for the graph's appearance</p>
<p>III. Temperature-Pressure graph</p> 	<p>Explain your reasoning for the graph's appearance</p>
<p>IV. Number of particles – Volume</p> 	<p>Explain your reasoning for the graph's appearance</p>

Experiments:

1. For each case, I-IV. Write a short description of how to use the sim to collect data. Then make an Excel spreadsheet for each, graph and curve fit. Some helpful

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hints – if you set a parameter like temperature constant, then make a change, you may have to watch the temperature adjust and not record your data until the temperature is back to the original setting. These experiments would be difficult in a real situation because it is complicated to isolate parameters like you can in the sim.

2. After you have made your graphs in Excel, check your predictions, and see if any might need some corrections. If necessary, make corrections in a different color including corrections to your reasoning.

3. Complete this table:

Relationship	Direct or indirect?	Constant parameters	Whose Law?	Briefly, why according to particle model.
V vs P				
V vs T				
T vs P				
Moles vs V				

4. Using your results, explain each of the following scenarios. Make sure to refer to which graph can be used as evidence for your answer.
- Explain why bicycle tires seem more flat in the winter than in summer.
 - Explain why a can of soda pop explodes if left in the hot sun.
 - A rigid container filled with a gas is placed in ice (ex. nalgene bottle). What will happen to the pressure of the gas? What do you think will happen to the volume?
 - An infected tooth forms an abscess (area of infected tissue) that fills with gas. The abscess puts pressure on the nerve of the tooth, causing a toothache. While waiting to see a dentist, the person with the toothache tried to relieve the pain by treating the infected area with moist heat. Will this treatment help? Why or why not?