



## Exploring Relationships Between Volume, Temperature, and Pressure of a Gas - Grade 8 Strand: Fluids

CRITICAL LEARNING: BIG IDEAS	
How do pressurized fluids affect our lives and the lives of other living things?	
FOCUS QUESTIONS	
What is the relationship between temperature, volume, and pressure in a gas?	
CURRICULUM EXPECTATIONS	
<p>2. Developing Investigation and Communication Skills</p> <p>2.8 use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes (e.g., using appropriate scientific and/or technological conventions, create a technical drawing of a pneumatic/hydraulic device; create a brochure or a multimedia presentation outlining safe and unsafe uses of the device that was modelled)</p> <p>2.7 use appropriate science and technology vocabulary, including viscosity, density, particle theory of matter, hydraulic, and pneumatic, in oral and written communication</p> <p>3. Understanding Basic Concepts</p> <p>3.6 explain in qualitative terms the relationship between pressure, volume, and temperature when a liquid (e.g., water) or a gas (e.g., air) is compressed or heated</p>	<p><b>LEARNING GOALS</b></p> <p>This investigation is designed to allow students to explain in qualitative terms the relationship between pressure, volume, and temperature on a gas when compressed or heated.</p>

MINDS ON...(ELICIT & ENGAGE)	ASSESSMENT & EVALUATION
<ul style="list-style-type: none"> <li>• Bring in a bicycle pump and a can of compressed air.</li> <li>• Ask students to predict what will happen to the temperature of the pump as it is pumped and the can as it is sprayed (Will the devices feel cooler or hotter as they are used?)</li> <li>• Have students give reasons for their predictions then check by operating the pump and the can (the pump will feel hotter and the can will feel cooler).</li> <li>• Ask students to explain why using each tool produced a different change in temperature.</li> </ul>	<p>The debriefing session serves as a formative assessment.</p>
ACTION! (EXPLORE & EXPLAIN)	ASSESSMENT & EVALUATION
<p><b>EXPLORE:</b> Give the students time to use the “Gas Particles in Motion” website to investigate the effect of temperature and volume on the pressure of a gas.</p> <p><u>Changing Volume Weblink:</u> <a href="http://outreach.physics.utah.edu/javalabs/java12/gaslaws/act1/lab.htm">http://outreach.physics.utah.edu/javalabs/java12/gaslaws/act1/lab.htm</a></p> <p><u>Changing Temperature Weblink:</u> <a href="http://outreach.physics.utah.edu/javalabs/java12/gaslaws/act2/lab.htm">http://outreach.physics.utah.edu/javalabs/java12/gaslaws/act2/lab.htm</a></p> <p><u>PURPOSE:</u> To determine the effect of volume and temperature on the pressure of a gas.</p> <p><u>HYPOTHESIS:</u> Create a table to predict: (A) Does increasing or decreasing the temperature of a gas increase or decrease its pressure? (B) Does increasing or decreasing the volume of a gas increase or decrease its pressure?</p> <p><u>PROCEDURE:</u></p> <p>(A) Changing Temperature</p> <ul style="list-style-type: none"> <li>• Use <b><u>Changing Temperature Weblink</u></b> above</li> <li>• Select the size of the gas container (keep it constant for this part of the investigation)</li> <li>• Choose a temperature by clicking the top of the thermometer</li> <li>• Click <b><u>Record</u></b> (located under the Data Table) when you are satisfied with your chosen temperature</li> </ul> <p>(B) Changing Volume</p> <ul style="list-style-type: none"> <li>• Use <b><u>Changing Volume Weblink</u></b> above</li> <li>• Select the temperature of the gas container (keep it constant for this part of the investigation)</li> <li>• Choose a volume by clicking the <b><u>Increase or Decrease Volume</u></b> buttons below the container</li> <li>• Click <b><u>Record</u></b> (located under the Data Table) when you are satisfied with your chosen volume</li> </ul>	<p>*See <u>Consolidation</u> Section</p>

<p><b><u>EXPLAIN:</u></b></p> <p><b><u>OBSERVATIONS:</u></b>  (A) Changing Temperature</p> <ul style="list-style-type: none"> <li>• Collect data for at least 5 different temperatures and pressures</li> <li>• Copy the data from the Data Table onto your lab sheet data table</li> <li>• Graph the data from your data table on your lab sheet</li> </ul> <p>(B) Changing Volume</p> <ul style="list-style-type: none"> <li>• Collect data for at least 5 different volumes and pressures</li> <li>• Copy the data from the Data Table onto your lab sheet data table</li> <li>• Graph the data from your data table on your lab sheet</li> </ul> <p><b><u>CONCLUSIONS:</u></b>  (A) Changing Temperature</p> <ul style="list-style-type: none"> <li>• Complete the following statements:</li> <li>• “As we increase the temperature of a gas, the pressure ...”</li> <li>• “As we decrease the temperature of a gas, the pressure ...”</li> </ul> <p>(B) Changing Volume</p> <ul style="list-style-type: none"> <li>• Complete the following statements:</li> <li>• “As we increase the volume of a gas, the pressure ...”</li> <li>• “As we decrease the volume of a gas, the pressure ..”</li> </ul>	
<p><b>CONSOLIDATION (<i>ELABORATE, EVALUATE, &amp; EXTEND</i>)</b></p>	<p><b>ASSESSMENT &amp; EVALUATION</b></p>
<p>Students work in groups to:</p> <ul style="list-style-type: none"> <li>• Identify examples of the effects of changing the temperature or volume of a gas.</li> <li>• Use the particle theory to explain why you cannot change the volume of a liquid.</li> <li>•</li> </ul>	<p>Have students create a chart that lists the results of the <i>Action!</i> investigation. Include responses to the <i>Consolidation</i> questions.</p>
<p><b>REFERENCES</b></p>	
<p><b><u>MINDS ON</u></b>  DiGiuseppe, Gibb, Hammill, Hayhoe, Pare. 2009. <i>Science &amp; Technology Perspectives 8 Teacher's Manual</i>. Nelson Education, Toronto. Page 117.</p> <p><b><u>EXPLORE &amp; CONSOLIDATION</u></b>  Aspire. <i>Gas Particles in Motion Activities 1 &amp; 2</i>  <a href="http://outreach.physics.utah.edu/javalabs/java12/gaslaws/index.htm">http://outreach.physics.utah.edu/javalabs/java12/gaslaws/index.htm</a></p>	