Simulation: Gas Law Variables

FOR THE TEACHER

Summary
In this simulation, students investigate variables of a gas. From the computer models, they can see how pressure, temperature, and volume effect gas behavior.

Grade Level
Middle or high school

Objectives
By the end of this lesson, students should be able to

- Understand that pressure is a measure of force exerted by particles.
- Recognize that temperature is proportional to the average kinetic energy of particles.
- Know that the volume of a gas is dependent on the size of the container it occupies.

Chemistry Topics
This lesson supports students’ understanding of

- Gas properties
- Pressure
- Temperature
- Volume

Time
Teacher Preparation: 15 minutes
Lesson: 30 minutes

Materials
- Odyssey software

Safety
There are no specific safety concerns involved with this activity.

Teacher Notes
- To complete this activity, you must have access to Odyssey software. If you’re using version 5.1, this pairs with labs 40, 43, and 37. If you’re using version 5.0, this goes with labs 46, 48, and 52.
- There is a lesson built into the software, this lesson is not the same. The software assignment collects students’ responses; this lesson is designed for students to have a pencil-and-paper experience.
- This activity could be done individually, in small groups, or as an entire class, depending on the resources available to the teacher.
- There are quite a few labs about gases, and before I do anything with the gas laws I like to give kids some time to get adjusted to how the variables (pressure, temperature, and volume) are measured. When I do this with students, I have them do some conversions for the “units” box. I just put those sample problems on the board.
For pressure, to complete the definition/explanation section, students can investigate the individual helium atom and a group of helium atoms. Click on the “Compare” menu item, and select “Side-by-Side.” One image should be “Helium Atom: Confined to a Box” and one “Helium: Gas.”

For temperature, there is a bar that allows you to change the temperature of argon between -186 °C and 727 °C. By altering the temperature, students can infer that temperature is proportional to the kinetic energy of the particles.

For volume, there is a bar that allows you to change the volume of the container from 163 nm³ to 6,501 nm³. By altering the volume, students can infer that gas particles take up the size of their container.

The last two columns are up to student research or teacher supplied information. Pressure is measured in atm, kPa, mmHg, torr). Temperature is measured in °C or K. Volume is measured in mL or L. STP = 1 atm, 0 °C, and one mole of gas at those conditions occupies 22.4 L of space.

**FOR THE STUDENT**

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<th>Definition/Explanation</th>
<th>Units for measuring</th>
<th>Standard Conditions (STP)</th>
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<td>Pressure: Gas Pressure</td>
<td>What is gas pressure? What causes it? What factors influence it?</td>
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<td>Temperature: Kinetic Energy and Temperature</td>
<td>What does temperature measure? What is the lowest possible temperature?</td>
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<td>Volume: Characteristics of Gases</td>
<td>How does the volume of a gas differ from the volume of a liquid or a solid?</td>
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<td>There is no “standard volume” but the volume of one mole of any gas at STP is...</td>
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