Activity: Understanding Gas Laws

Summary
In this activity, students use an online program to investigate gas laws.

Resource Type: Activity  
Grade Level: High school

Objectives
By the end of this lesson, students should be able to
- explain the relationship between pressure and temperature for an ideal gas.
- explain the relationship between temperature and volume for an ideal gas.
- explain the relationship between volume and pressure for an ideal gas.

Chemistry Topics
This lesson supports students’ understanding of
- Gas laws

Time
Teacher Preparation: 5 minutes  
Lesson: 50 minutes

Materials
- Computer with internet access

Safety
There are no special safety considerations for this activity.

Teacher Notes
- Before beginning this activity, make sure students know the school’s policy on internet usage.
- It may be helpful to walk around the room as students work.

FOR THE STUDENT

Student Activity Sheet: Understanding Gas Laws

Lesson
Draw diagrams of what you think ten gas particles would look like if you could zoom really close in to see them. Use ● for particles, → to show their movement. Bigger arrows mean more velocity. The box is the container.

Low temperature | High temperature
Students also draw high pressure vs. low pressure and high volume vs. low volume


Part I: Kinetic Molecular Theory
1. Use the pump to put one pump of gas into the box.
   a. What happens to the clump of particles?
To answer the following questions, keep your eye on one particle and notice how it moves.
   b. How do the particles move? (straight line, circular, random, etc.)
   c. Do the particles stay at a constant speed?
   d. If not, what causes the speed to change?
   e. Do they always move in the same direction?
   f. If not, what causes their direction to change?
2. Using the settings on the right side of the screen, put 100 “heavy species” in the container. Allow the pressure to stabilize.
   a. Record the pressure (the number will jump around, determine a reasonable average value).
   b. Reset the number of “heavy species” to zero, and the “light species” to 100. Record the pressure.
   c. Does the mass of the particles significantly affect the pressure of the container? Explain.

Part II: Partial Pressures
3. Put 100 of “heavy species” and no “light species.”
   a. Record the pressure.
   b. Put 50 of the “light species” and no “heavy species”. Record the pressure.
   c. Put 50 “light species” AND 100 “heavy species” together. Record the pressure.
   d. How does this compare to the pressures from 3a and 3b? Explain.

Part III: Boyle’s Law
Since Boyle’s Law deals with pressure and volume, temperature must be constant.
4. On the constant parameter box in the top right, select temperature to be constant. Place 200 “heavy species” in your container.
5. Use the little man to change the volume of the container.
   a. What happens to the pressure as the volume changes?
   b. As the volume goes____________ the pressure goes_____________.
   c. This is a(n) ______________________ relationship.
6. Play around with the number of species, volume and pressure. What combination do you need to blow the top off?
7. Diagram the particles in the boxes that would model Boyle’s Law. (Include arrows.) Label the variables below each box.

Part IV: Charles’ law
Since Charles’ Law deals with temperature and volume, _________________ must be constant.

8. Place 200 “heavy species” in your container. On the constant parameter box in the top right, select the appropriate constant.

9. Use the flame at the bottom to heat up the container.
   a. What happens to the volume as the changes?
   b. As the temperature goes_______________ the volume goes___________________.
   c. This is a(n) ______________________ relationship.

10. Play around with the temperature and volume. What combination do you need to blow the top off?

11. Diagram the particles in the boxes that would model Charles’ Law. (Include arrows.) Label the variables below each box.

Part V: Gay-Lussac’s Law
Since Gay-Lussac’s Law deals with pressure and temperature, _________________ must be constant.

12. On the constant parameter box in the top right, select the appropriate constant. Place 200 “heavy species” in your container.

13. Use the flame to change the temperature of the container.
   a. What happens to the pressure as the temperature changes?
   b. As the temperature goes_______________ the pressure goes___________________.
   c. This is a(n) ______________________ relationship.

14. Play around with the number of species, temperature and pressure. What combination do you need to blow the top off?

15. Diagram the particles in the boxes that would model Gay-Lussac’s Law. (Include arrows.) Label the variables below each box.