Name: Date: Pd:

Gas Laws Simulation and Lab

In this virtual lab you will observe the behavior of gases when different variables are changed. The variables that we will be changing and measuring are temperature, pressure and volume. Follow the directions and write all information on your student sheet.

Getting to know the system:

1. Go to https://phet.colorado.edu/sims/html/gas-properties/latest/gas-properties_en.html. Open the "**Gas Properties (HTML5)"** simulation by clicking on the PLAY button (triangle) on the image. Select "IDEAL"
2. Spend a minute just playing with the controls to see what happens.

Activity #1

1. Reset the system and make sure the Constant Parameter button is set to None.
2. Click on the green plus beside "Particles" to open the drop down menu. Pump 50 heavy gas molecules and 50 light gas molecules in the gas container.
   - **How does the speed of the heavy molecules compare to those of the light gas molecules?**

3. Use the Heat Control to add energy. Notice that the thermometer shows an increasing temperature.
   - **What happens to the speeds of the gas molecules as energy is added?**

Activity #2

1. Reset the system.
2. Add 200 light molecules.
3. Set the Constant Parameter button to Volume. Select "Width" on the menu on the right.
4. Record the temperature and pressure of the system.

   Temperature: _____ K; **Pressure**: _____ Atm

5. Add heat to the system using the Heat Control.
6. **What happens to the temperature and pressure?**

7. Record the temperature and pressure of the system.

   Temperature: _____ K; **Pressure**: _____ Atm

   - Write the mathematical relationship (formula) between **temperature** and **pressure** and define as **direct** or **indirect/inverse.**

Activity #3

1. Reset the system.
2. Add 200 light molecules.
3. Set the Constant Parameter button to Pressure:V
4. Record the temperature and volume of the system.

   Temperature: _____ K ; **Volume = Width** A: _____ nm A

5. Add heat to the system using the Heat Control.
   - **What happens to the volume of the gas container?**

   - Write the mathematical relationship between **temperature** and **volume** and define as **direct** or **inverse/indirect**.

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Activity #4

1. Reset the system.
2. Add 200 light molecules.
3. Set the Constant Parameter button to Temperature.
4. Record the pressure and volume of the system.

   Pressure: _____ atm ; **Volume**: _____ nm A

7. Increase the volume of the container by dragging the side handle.
8. Record the new pressure and volume of the system.

   Pressure: _____ atm ; **Volume**: _____ nm A

- Write the mathematical relationship between **pressure** and **volume** and define as direct or **inverse/indirect**.

Activity #5

1. Reset the system using the Reset button. Set the constant parameter to None.
2. Add 100 heavy molecules to the gas container and watch the gas molecules move.

   Record the temperature: _____ K.

- **Do all the molecules move at the same speed?**

- **Explain why this relates to the fact that temperature is defined as "average kinetic energy of particles"**

Gas Variables Lab:

- In this activity, you will test the effect that the environment has on gases.

Procedure:

1. Ensure that the LabPro apparatus is set up with the Gas Pressure Sensor attached.
2. Ensure that the syringe is at 8 mL of gas and lay the gas pressure sensor down on the counter.
3. Fill your plastic bag about halfway full with ice.
4. Place the bag over the syringe portion of the sensor with about half of the bag hanging over each side.
5. Immediately begin recording pressure in the chamber every 5 seconds for 2 minutes.
6. Dump out ice water and set bag back at your station.

Analysis:

1. What two variables in gas laws were being tested in this mini-lab?

   Temperature and _____

2. Using your **INITIAL** values for these two variables, calculate what the **final value** for the dependent variable would be if your temperature reached 0°C ($\mathbf{T_2}$). (Be sure all values are in Kelvin!)

3. Provide **<u>two</u>** reasons **why** this may not be the **ACTUAL** value you would have at that temperature.
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