Gas Properties Simulation Activity Name ________________________________

https://phet.colorado.edu/en/simulations/gas-properties

If the direct link does not work, use Google, and use the search terms "Phet Gas properties". You can download the program on your home computer if you have Java, or you can run it online.

Introduction:

Tire pressures, sinus headaches, cabin pressure in airplanes, even hairspray bottles- all find their explanation in the properties and laws of gas molecules. Four important measurable quantities of gasses- pressure, temperature, volume, and amount (in moles) - are used to define the behaviors of gas molecules. Using the **Gas Properties** simulation from the PhET program, you will explore the Kinetic Molecular Theory of gasses, properties of gasses and the four measurable quantities of gasses.

Part 1: *PLAY!!*

Take about five minutes to explore the simulation. Note at least 3 relationships that you observe and find interesting. Also make note of at least 4 things you can change in the simulation.

1.

2.

3.

1.
2.
3.
4.

Part 2: *Exploring different variables.*

Scientists in the late 1800's noted relationships between many of the state variables related to gasses (pressure, volume, temperature), and the number of gas particles in the sample being studied. They knew that it was easier to study relationships if they varied only two parameters at a time and "fixed" (held constant) the others. Use the simulation to explore these relationships.

1. Using the "Constant Parameter" section to the right of the simulation. Hold volume constant. Adjust the amount of gas molecules and the temperature and observe what is happening to the pressure of the system. Record your observations. ____
____
2. Now hold the temperature constant. Adjust the amount of gas molecules and volume and observe what is happening to the pressure of the system. Record your observations.
____
____

3. Based on your observations, define the first property of gas molecules- ***pressure***.

4. Repeat steps 1-2, holding pressure and temperature constant and defining ***volume***.

5. Repeat Steps 1-2, holding pressure and volume constant and defining ***temperature***.

6. How does the amount of gas molecules present affect the three properties above (pressure, volume, temperature)?

7. Using your observations and the simulation, predict the relationship between temperature and pressure (direct proportion or an indirect proportion). **Hint**: A pair of variables is *directly proportional* when they vary in the same way (one increases and the other also increases). A pair of variables is *inversely proportional* when they vary in opposite ways (one increases and the other decreases).

8. Hold volume constant in the "constant parameter" section to the right.
9. Add heat to the system and record your new temperature and pressure in the chart below.
10. Repeat step nine three more times recording your new temperature and pressure each time.

Pressure (atm)	Temperature (K)

11. Using your observations and the simulation, predict the relationship between volume and pressure (direct proportion or an indirect proportion).
12. Now hold temperature constant.
13. Adjust the volume by moving the man. Calculate your new volume by clicking on the "Measuring Tools" and checking the "Ruler" and "Layering tool" box. (Assume the width of the box is 10 nm).
14. Record your new volume and pressure in the chart below.
15. Repeat steps 13-14 three more times.

Pressure (atm)	**Volume (nm^3)**

16. Using your observations and the simulation, predict the relationship between temperature and volume (direct proportion or an indirect proportion).
17. Now hold pressure constant.
18. Choose to either add or remove heat. Calculate the new volume and record the new temperature and volume in the chart below.
19. Repeat step 18 three more times.

Volume (nm^3)	**Temperature (K)**

20. Does the data that you collected in the 3 tables match your predictions from #7, 11 & 16? If not, why?

Part 3: *Kinetic Molecular Theory (KMT) of Gases*

Our fundamental understanding of “ideal” gasses makes the following 4 assumptions. Describe how each of these assumptions is (or is not!) represented in the simulation.

Assumption of KMT	Representation in Simulation
1. Gas particles are separated by relatively large distances.	
2. Gas molecules are constantly in random motion and undergo elastic collisions (like billiard balls) with each other and the walls of the container.	
3. Gas molecules are not attracted or repulsed by each other.	
4. The average kinetic energy of gas molecules in a sample is proportional to temperature (in K).	

<u>Part 4:</u> *Properties of gasses*

Describe how each of these properties of gasses is demonstrated in the simulation.

Gas Property	Demonstrated in Simulation
Gasses are fluids.	
Gasses have low densities.	
Gasses are compressible.	
Gasses can expand to fill their container.	