Name: _____ PhET Gas Properties

Introduction

Scientists construct models to explain the behavior of substances. While the gas laws describe how gases behave, they do not explain why gases behave the way they do. The *Kinetic Molecular Theory (KMT)* is a model or theory that is used to explain the behavior of gases. This theory describes the relationships among pressure, volume, temperature, velocity, frequency and force of collisions.

In this activity you will be manipulating the temperature, pressure and volume of a gas in a closed container. The relationships between these three variables will then be examined further in class.

Part 1: Purpose: To determine the relationship between temperature and volume

1. Add three pumps of the blue gas particles and let the pressure generally stabilize (it will always fluctuate slightly).
2. Now in the upper right corner under "Hold Constant", select "Pressure ↕V". This will make sure that pressure will not change significantly.
3. Add heat to the container and increase the temperature; observe what happens to the volume of gas. Then remove heat from the container and decrease the temperature; observe what happens to the volume of gas.

4.What is the relationship between temperature and volume?

5. Is this a direct or indirect relationship?

Part 2: Purpose: To determine the relationship between pressure and volume

1. Hit the reset button. Add three pumps of the blue gas particles and let the pressure generally stabilize (it will always fluctuate slightly).
2. Now in the upper right corner under "Hold Constant", select "Temperature". This will make sure that temperature will not change significantly.
3. Using the handle, change the size of the container so that it is smaller; observe what happens to the pressure of the gas. Then change the size of the container so that it is larger; observe what happens to the pressure of the gas.

4. What is the relationship between volume and pressure?

5. Is this a direct or indirect relationship?

Part 3: Purpose: To determine the relationship between temperature and pressure

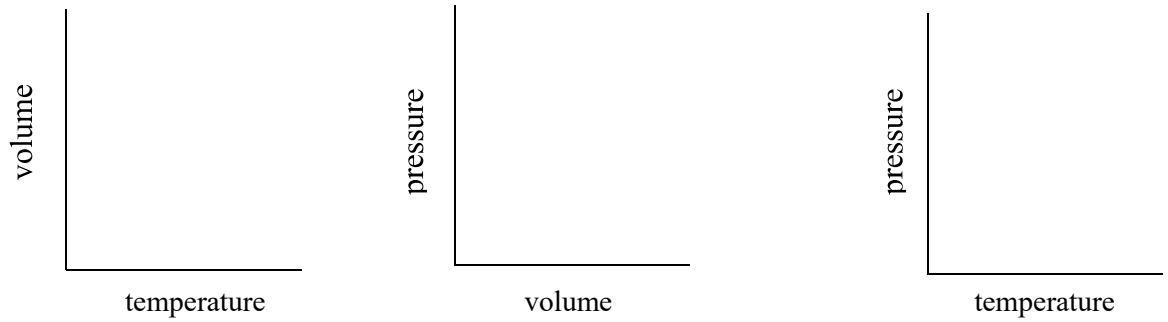
1. Hit the reset button. Add three pumps of the blue gas particles and let the pressure generally stabilize (it will always fluctuate slightly).
2. Now in the upper right corner under "Hold Constant", select "Volume". This will make sure that volume will not change significantly.
3. Add heat to the container and increase the temperature; observe what happens to the pressure of the gas. Then remove heat from the container and decrease the temperature; observe what happens to the pressure of gas.

4. What is the relationship between temperature and pressure?

5. Is this a direct or indirect relationship?

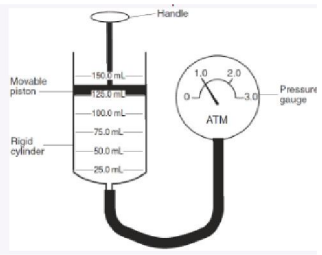
Follow-Up Questions:

1) In the spaces below, draw what the graphs would look like for the following relationships:



2) During a demonstration, a scientist takes a deflated balloon out of liquid nitrogen (-196°C). As the balloon rests on the table at room temperature, it begins to expand in volume. Explain this behavior *in terms of* collisions.

3) A gas is trapped inside a syringe. Explain, *in terms of collisions*, why the pressure of the gas increases when the movable piston is pushed down.



4) *In terms of collisions*, explain why on a cold autumn morning a camper's air mattress may appear to have deflated some as opposed to when it was first filled up the afternoon before. Assume no leaks.

____5) A sample of a gas is in a sealed, rigid container that maintains a constant volume. Which changes occur between the gas particles when the sample is heated?

a) The frequency of collisions increases and the pressure decreases.
b) The frequency of collisions increases, and the pressure increases.
c) The frequency of collisions decreases, and the pressure decreases.
d) The frequency of collisions decreases, and the pressure increases.

____6) As the pressure <u>on</u> a sample of a gas increases at constant temperature, the volume of the gas

a) decreases b) increases c) remains the same

____7) As the temperature of a given sample of a gas increases, the volume of the sample of gas

a) decreases b) increases c) remains the same

____8) As the pressure on a given sample of a gas in a fixed container increases at constant temperature, the number of gas particles

a) decreases b) increases c) remains the same