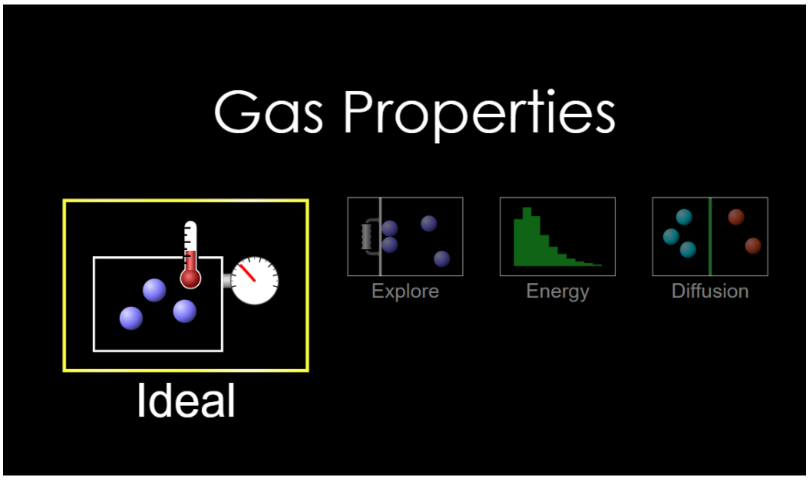
Introduction to the Gas Laws

Name : ______________________________



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

Getting to know the system:
Open the Gas Properties [Ideal] HTML5 simulation. Run the simulation. Spend a few minutes just playing with the controls to see what happens.

Activity #1
Reset the system and make sure the Hold Constant parameter is set to Nothing.
Pump 50 heavy (blue) gas molecules and 50 light gas molecules in the gas container.
1. How do the velocities of the heavy gas molecules compare to those of the light gasmolecules?
Use the Heat Control to add energy. Notice that the thermometer shows an increasing temperature.
2. What happens to the velocities of the gas molecules?
Use the Heat Control to remove energy.
3. What happens to the velocities of the gas molecules?

Activity #2
Reset the system. Add 200 light (red) molecules. (Each pump releases 50 molecules) Set the Hold Constant parameter to Volume.
Record the temperature and pressure of the system.
1. Temperature: ______________ K
2. Pressure: ________________ Atm
Add heat to the system using the Heat Control.
3. What happens to the temperature and pressure?
Record the new temperature and pressure of the system.
4. Temperature: ____________ K
5. Pressure: ________________ Atm
6. What is the mathematical relationship between temperature and pressure? (direct or inverse)

Activity #3
Reset the system. Add 200 light molecules.
Set the Hold Constant parameter to Pressure↕V *(You won't be able to do this until particles are in the box.)*
Record the temperature and volume of the system.
1. Temperature: ____________ K
The height of the box is **always** 8.75 nm and the depth of the box is **always** 4.00 nm. To find the volume you need to measure the width in nm (check the width box) and then multiply by 8.75 nm X 4 nm (35 nm^2).
2. Volume: ________________ nm^3
Add heat to the system using the Heat Control.
3. What happens to the volume of the gas container?
Notice the way the side of the container moves to keep the pressure constant.
4. What happens to the temperature and volume?
Record the new temperature and volume of the system.
5. Temperature: ____________ K
6. Volume: ________________ nm^3

7. What is this mathematical relationship between the temperature and the volume? (direct or inverse)

Activity #4

Reset the system. Add 200 light molecules. Set the Hold Constant parameter to Temperature.
Record the pressure and volume of the system.

1. Pressure: ____________ atm
2. Volume: ________________ nm^3

Move the side of the box so that the volume of the gas container is smaller.

3. What happens to the pressure and volume?

Record the ptessure and volume of the system.

4. Pressure: ____________ atm
5. Volume: ________________ nm^3
6. What is this mathematical relationship between the pressure and the volume? (direct or inverse)

Activity #5

Reset the system using the Reset button. Set the Hold Constant parameter to Nothing.
Add 100 heavy molecules to the gas container and watch the gas molecules move.

1. Describe their motion.
2. Do all the molecules move at the same velocity?
3. Record the temperature ________________ K.

Slide the handle at the top to make a small opening and notice the rate of **effusion** *(particles escaping out of the box through a hole).*

4. Do all molecules leave the box at the same velocity?

Try to count the number of heavy molecules that leave the gas container in 30 seconds.

5. Record your answer here: _____________ # heavy molecules escaped /30 seconds.

Reset the activity and add 100 light molecules.

6. How do the velocities of the light molecules compare to the velocities of the heavy molecules that you previously had in the gas container?
7. Record the temperature of the gas container: ________________ K.
8. What is the relationship between the velocities of the small molecules vs. the velocities of the large molecules at the same temperature?

Slide the handle at the top to make a small opening and notice the rate of effusion. Try to count the number of light molecules that leave the gas container in 30 seconds.

9. Record your answer here: _____________ # light molecules escaped /30 seconds.

The rate of effusion is inversely related to the molar mass.

10. How does your data support this statement?

Activity #6

1. Repeat Activities 2 - 3 – 4 but collect data.
2. Collect **five actual data points** on the parameters that vary for each activity,2, 3 and 4.
3. Make a data table of the data you collect. (you will have three data tables)
4. Use this data to make a small graph of each relationship. (you will have three graphs)

The graph needs to include axis labels and units.

Example : Constant Volume

Temp	Pressure
300K	17.0 atm
414K	24.3 atm