Introduction to the gas laws
https://phet.colorado.edu/sims/html/gas-properties/latest/gas-properties_en.html

Name

_____

Period

_____

Date

_____

In this virtual lab you will observe the behavior of gases when different variables are changed. The variables that we will be changing are temperature, pressure, volume and number of gasmolecules.

Getting to know the system
1. Open the Gas Properties HTML5 simulation.
2. Spend a few minutes just playing with the controls to see what happens.
3. Notice the effect of changing the Constant Parameter.

Activity #1
1. Reset the system and make sure the Constant Parameter button is set to None.
2. Pump 50 heavy gasmolecules and 50 light gasmolecules in the gascontainer.
How do the velocities of the heavy gasmolecules compare to those of the light gasmolecules?
3. Use the Heat Control to add energy.
Notice that the thermometer shows an increasing temperature.
What happens to the velocities of the gasmolecules?
4. Use the Heat Control to remove energy.
What happens to the velocities of the gasmolecules?

Activity #2
1. Reset the system.
2. Add 50 light gasmolecules.
3. Set the Constant Parameter button to Volume.
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
8. What is the mathematical relationship between temperature and pressure? (direct or inverse)
9. Write the mathematical equation for this relationship and the name of the scientist credited with its discovery.

Activity #3
1. Reset the system.
2. Add 50 light gasmolecules.
3. Set the Constant Parameter button to Pressure.
4. Record the temperature and volume of the system.
Temperature: _____ K
Volume (lenght A): _____ nm A
5. Add heat to the system using the Heat Control.
6. What happens to the volume of the gascontainer?
Notice the way the Vertical Lid moves to maintain the same pressure.
7. What happens to the temperature and volume?
8. Record the temperature and volume of the system.
Temperature: _____ K
Volume: _____ nm A
9. What is this mathematical relationship between the temperature and the volume? (direct or inverse)
10. Write the mathematical equation for this relationship and the name of the scientist credited with its discovery.

Activity #4
1. Reset the system.
2. Add 50 light gasmolecules.
3. Set the Constant Parameter button to Temperature.
4. Record the pressure and volume of the system.
Pressure: _____ atm
Volume: _____ nm A
5. While you are watching the Heat Control, move the Vertical Lid so that the volume of the gascontainer is smaller.
6. What does the Heat Control do when you move the Vertical Lid?
7. What happens to the pressure and volume?

8. Record the pressure and volume of the system.
Pressure: _____ atm
Volume: _____ nm A
9. What is this mathematical relationship between the pressure and the volume? (direct or inverse)
10. Write the mathematical equation for this relationship and the name of the scientist credited with its discovery.

Activity #5
1. Reset the system.
2. Add 50 light gasmolecules.
3. Set the Constant Parameter button to Temperature.
Also the Pressure has to be constant.
4. Record the Number of gasmolecules and Volume of the system.
Number of gasmolecules: _____
Volume : _____ nm A
5. Add another 50 light gasmolecules.
7. What happens to the volume?
8. Record the number of gasmolecules and voume of the system.
Number of gasmolecules: _____
Volume : _____ nm A
9. What is this mathematical relationship between the number of gasmolecules and pressure? (direct or inverse)
10. Write the mathematical equation for this relationship and the name of the scientist credited with its discovery.

Activity #6
1. Redo Activities 2 - 3 - 4 - 5.
2. Collect five data points on the parameters that vary.
3. Make a data table of the variable parameters for each parameter that is held constant.
4. Use this data to make a graph of each relationship.
The graph needs to include axis labels and units.
5. Describe the relationship.

Need an example?

Charles (Regnault) Law

Constant: pressure
Variables: temperature and lenght (volume)

Data 1
300 K
15.0 nm

Data 2
250 K
12.5 nm

Data 3
200 K
10.0 nm

Data 4
150 K
7.5 nm

Data 5
100 K
5.0 nm

Gay - Lussac Law

Constant: lenght (volume)
Variables: temperature and pressure

Data 1
300 K
3.9 atm

Data 2
250 K
3.2 atm

Data 3
200 K
2.6 atm

Data 4
150 K
2.0 atm

Data 5
100 K
1.3 atm

Boyle (- Mariotte) Law

Constant: temperature

Variables: pressure and lenght (volume)

Data 1
4.0 atm
15.0 nm

Data 2
4.8 atm
12.5 nm

Data 3
6.0 atm
10.0 nm

Data 4
7.9 atm
7.5 nm

Data 5
11.0 atm
5.0 nm

Avogadro Law

Constants: temperature and pressure
Variables: number of gasmolecules and lenght (volume)

Data 1
50
5.0 nm

Data 2
75
7.5 nm

Data 3
100
10.0 nm

Data 4
125
12.5 nm

Data 5
150
15.0 nm