**Introduction to the gas laws**

Name

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Period

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Date

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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