Exploring Gas Laws

Learning Goals: Once you have completed this activity, you should understand the concepts of:

-Kinetic molecular theory

-Dalton's Law of Partial Pressure

-Boyle's Law

-Charles'Law

-Gay-Lussac's Law

In the boxes below, draw a diagram of what you think the gas particles would look like if you could zoom really close in to see them. Use ● for particles, → to show their movement. Bigger arrows mean more velocity. The box is the container.

Low temperature High temperature high volume low volume

High pressure Low pressure

Kinetic Molecular Theory: Go to http://phet.colorado.edu/en/simulation/gas-properties

1. Use the pump to put one pump of gas into the box.

What happens to the clump of particles?____

(To answer the following questions, keep your eye on one particle and notice how it moves.)_

How do the particles move? (straight line, circular, random, etc.)_________________________________

Do the particles stay at a constant speed?_______________

If not, what causes the speed to change?____

Do they always move in the same direction?_________________

If not, what causes their direction to change?____

2. a Using the settings on the right side of the screen, put 100 “heavy species” in the container. Give it time for the pressure to stabilize.

b. Record the pressure_____________ (The number will jump around- choose an average.)

c. Reset the number of “heavy species” to zero, and the “light species” to 100.

d. Record the pressure_______________

e. Does the mass of the particles significantly affect the pressure of the container? ______________

f. How can you explain this? ____

Partial Pressures

3a. Put 100 of “heavy species” and no “light species”.

b. Record the pressure. _____________

c .Put 50 of the “light species” and no “heavy species”

d. Record the pressure__________________

e. Put 50 “light species” AND 100 “heavy species” together. Record the pressure________________

f. How does this compare to the pressures from 3b. and 3d?_________________________________

Boyle’s Law:

Since Boyle’s Law deals with pressure and volume, temperature must be constant.

1. On the constant parameter box in the top right, select temperature to be constant.

2. Place 200 “heavy species” in your container.

3. Use the little man to change the volume of the container.

a. What happens to the pressure as the volume changes?___________________________

As the volume goes______________ the pressure goes____________________.

This is a(n) ______________________ relationship.

4. Play around with the number of species, volume and pressure. What combination do you need to blow the top off?____

Diagram the particles in the boxes that would Model Boyle’s Law. (Include arrows.)

Charles' Law: (Note: this simulation sometimes does not work correctly. If the volume does not adjust when you change the temperature, you will not be able to answer questions 3a-c.

Since Charles' Law deals with temperature and volume, _________________ must be constant.

1. On the constant parameter box in the top right, select the appropriate constant.

2. Place 200 "heavy species" in your container.

3. Use the flame at the bottom to heat up the container.

a. What happens to the volume as the changes?__________________________

b. As the temperature goes______________ the volume goes____________________.

c. This is a(n) ______________________ relationship.

4. Play around with the temperature and volume. What combination do you need to blow the top

off?____

Diagram the particles in the boxes that would

Model Charles' Law. (Include arrows.)

Gay-Lussac's Law:

Since Gay-Lussac's Law deals with pressure and temperature, ____________________ must be constant.

1. On the constant parameter box in the top right, select the appropriate constant.

2. Place 200 "heavy species" in your container.

3. Use the flame to change the temperature of the container.

a. What happens to the pressure as the temperature changes?__________________________

As the temperature goes______________ the pressure goes____________________.

This is a(n) ______________________ relationship.

4. Play around with the number of species, temperature and pressure. What combination do you need to blow the top

off?____

Diagram the particles in the boxes that would

Model Gay-Lussac's Law. (Include arrows.)