Name: ____________________ Date: _________________ Class: ___________

Gas Laws Worksheet (Charles', Boyle's, and The Combined)

Screen 1 (5 minutes): Gabriella's Challenge

What was the temperature in the morning? ___________________________

What was the temperature like the night before? _______________________

What three variables do the gas laws examine? ____ _______________

Screen 2 (5 to 10 minutes) How to Use the Gas Laws program

Variable	Unit (what it is measured in)	Comparison

List the 2 ways you can adjust each variable (they are the same for each variable):

____

____

____

What is the difference between INTERNAL and EXTERNAL pressure?

____

____

____

In this case, is internal pressure always going to be the same as external pressure?

____

Screen 3: The simulation (15 minutes)

We are going to study 2 of the famous gas laws: **Boyle's Law**, which looks at the relationship between **Pressure and Volume**, and **Charles's Law**, which looks at the relationship between **Volume and Temperature**.

Look at the axis on each graph and tell me the independent variable, the dependent variable, and the constant.

Boyle's Law

Independent Variable	Dependent Variable	Constant (doesn't change)

Charles's Law

Independent Variable	Dependent Variable	Constant (doesn't change)

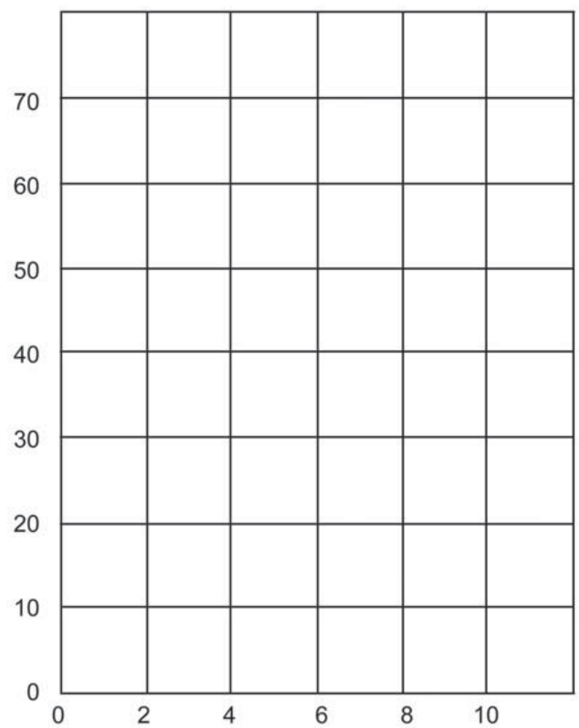
BOYLE'S LAW

Lock the temperature between 300 K and 550 K: Temperature = _________ K

Complete the following table and recopy the graph that is created while you are collecting data. YOU NEED TO COLLECT **15 POINTS**; *this should only take you a matter of minutes!*

PRESSURE (atm)	VOLUME (L)

Label the axes and add a title!



As you **increase** the pressure, the volume _______________________
(increases or decreases)

As you **decrease** the pressure, the volume _______________________
(increases or decreases)

We say that pressure and volume are *inversely proportional.*

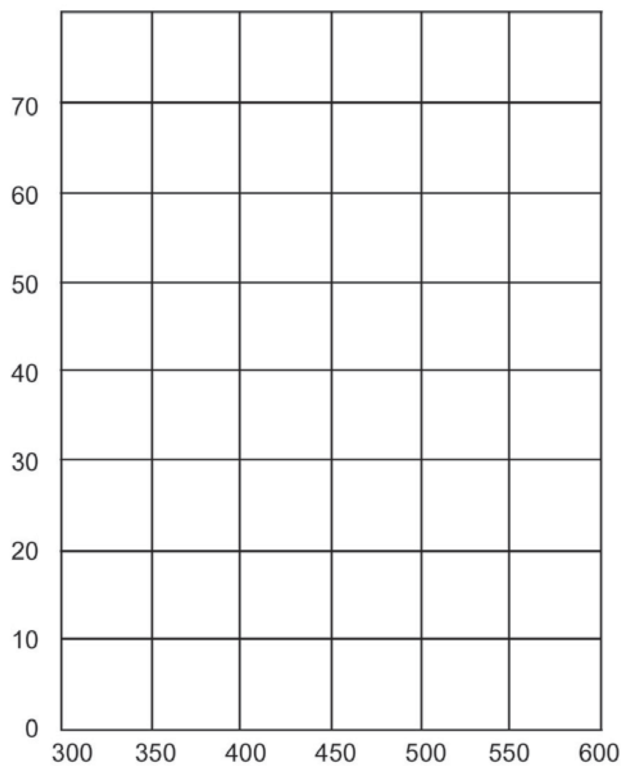
CHARLES'S LAW

Lock the pressure between 0.5 atm and 10.00 atm: Pressure = _____________ atm

Complete the following table and recopy the graph that is created while you are collecting data. YOU NEED TO COLLECT **15 POINTS**; *this should only take you a matter of minutes!*

Temperature (K)	VOLUME (L)
300	
.550	

Label the axes and add a title!



As you **increase** the temperature, the volume ________________________
(increases or decreases)

As you **decrease** the temperature, the volume ________________________
(increases or decreases)

We say that temperature and volume are *directly proportional.*

PLEASE HIT THE 'DONE' BUTTON on the computer – thank you

Bringing it all together - Screen 4, Revisiting Gabriella's challenge (10 minutes)

How is the air in Gabriella's tires like the gas in the program?

____

____

____

How are the tires like the closed container in the program?

____

____

____

How is the warm and cool weather like turning the flame on and off?

____

____

____

SUMMARY

As the day gets hotter, will a balloon increase in size or decrease? ________________

As temperature goes up, so does the ______________.

As you increase the pressure inside the balloon, the volume will __________________.

Why did Gabriella's tires look flat in the morning?

____

____

____

Should she go buy new tires?

____

What is the difference between the containers in the first 2 simulations and the container in this simulation?

____

____

____

Which container is most similar to a balloon?

____

Lesson Plan: What have these simulations and the gas laws shown us?

Aim: How are pressure, volume, and temperature related?

Agenda:

- Do Now – 5 minutes
- Pressure: Internal vs. external – 10 minutes
- Gas Laws – Boyle's and Charles's Law – 15 minutes
- Demo: Balloon in hot water – 5 minutes
- Summary: Gases and how they behave – 15 minutes
- Homework: Question on gas laws

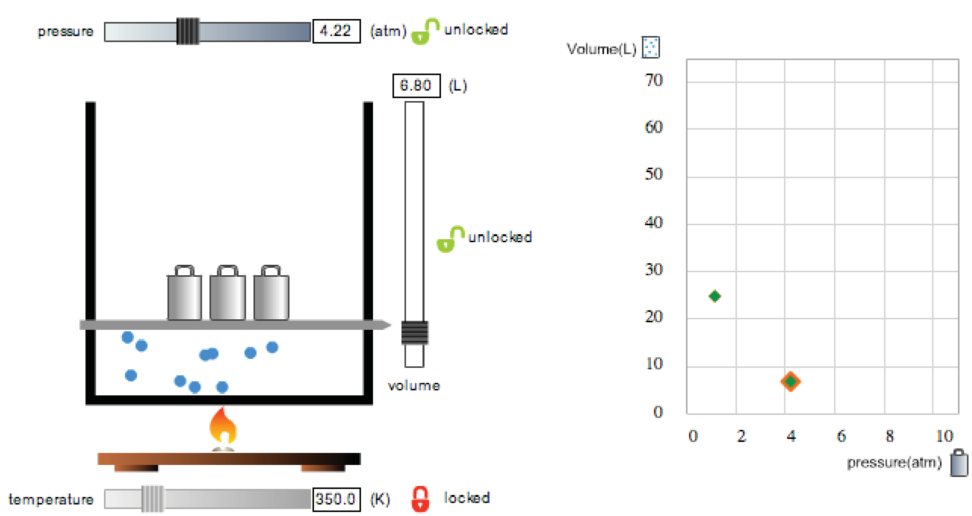
Pressure: Internal vs. external *(start boiling water)*

Draw a balloon…arrows going in and out. When something isn't moving, like a balloon, the pressure from the air all around us is equal to the amount the gas inside the balloon is pushing out.

So let's say I have a box that has a lid that slides up and down, if I apply pressure on the top and the lid stops sliding, that means that the gas inside the box is putting the same pressure on the inside to hold you there.

So if you apply pressure on the top of the box, do you see why pressure is going up inside the box as well?

If you apply external pressure, why doesn't the volume go to zero? What is holding it up? [no longer conforming to the Ideal Gas Law]



Demonstration Analogy

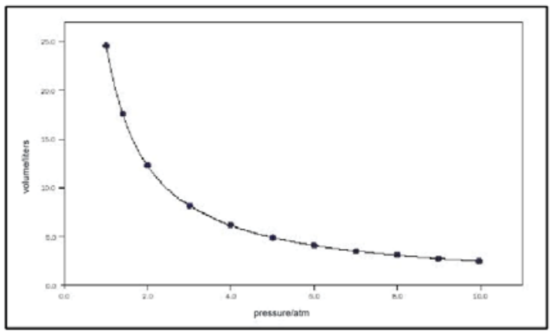
Use 8 volunteers…put them in a square. (4 inside [they are the gas molecules], 4 make the walls, I push them in) As the wall goes in what happens to the gas molecules? Do they like this?

The Gas Laws: Boyle's and Charles's Law

Boyle's Law: Relates pressure and volume at constant temperature.
Pressure – independent / **Volume** – dependent / **Temperature** – constant

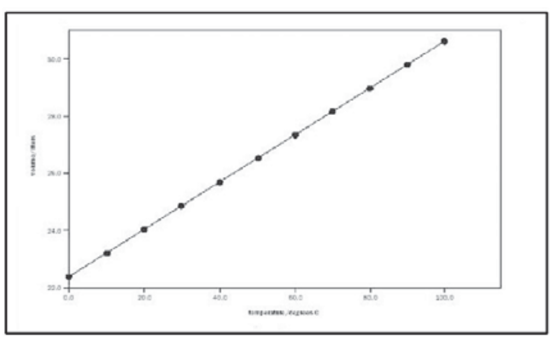
Demonstration: Squeeze a balloon…as I apply pressure to the outside of the balloon, what is happening to the volume of the balloon? What happens to the pressure inside the balloon? Why? (the gas molecules are hitting the walls quicker and it increases the pressure inside).

Draw a graph similar to this:



Charles's Law: Relates temperature and volume at constant pressure
Temperature – independent / **Volume** – dependent / **Pressure** – constant

Draw a graph similar to this: (perhaps the students can suggest what the graph might look like?)



Demonstration: Take the water that you have been heating and put it in a large container and then add a balloon that you have partly inflated (perhaps using a student helper or two to feel the balloon at various stages) and tied off. What happens to the internal pressure of the balloon when I put it in the hot water? What happens to the volume? Why? Excitement of particles.

Summary of Gas Laws and Simulations (Notes)

KINETIC MOLECULAR THEORY	DIFFUSION	GAS LAWS
TEMP and PRESSURE PARTICLE # and PRESSURE	SIZE/MASS and TIME OF DIFFUSION TEMPERATURE and TIME OF DIFFUSION	PRESSURE and VOLUME TEMP and VOLUME
Examples: Boiling water and the lid popping off. Gas cylinder: chained down	Examples: tea in hot water, food coloring in hot water. Farting in a warm shower is smellier than one in a cold shower.	Examples: Balloon rising with temp. Cramming gases into a small container increases pressure.
Simulation narrative: Stinky bathroom	Simulation narrative: Popcorn smell	Simulation narrative: Bike tires in the cold and in the warm weather.
Demos: Heating and cooling balloon on flask	Demos: Food coloring in water	Demos: Balloon in hot and cold water

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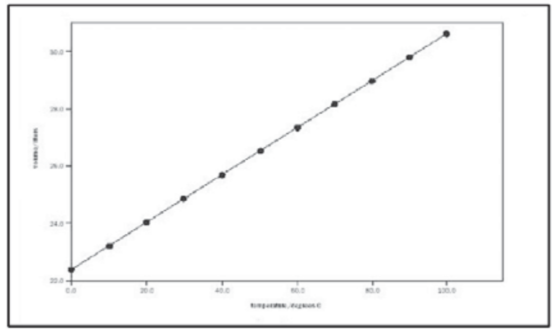
Do Now: Gas Laws

1. Using what you know about the Gas Laws from the simulation, label the axes on this graph. What does the graph tell you about the relationship between the variables on the graph?

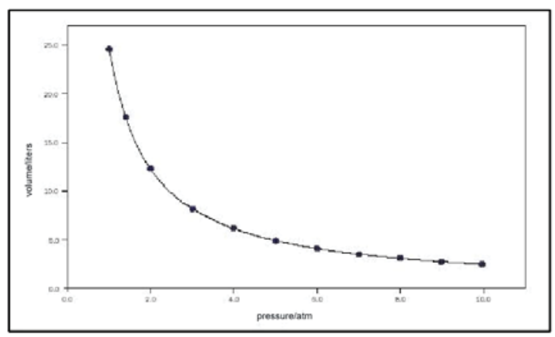


____

____

Which property/factor is held constant? __________________________________

2. Using what you know about the Gas Laws from the simulation, label the axes on this graph. What does the graph tell you about the relationship between the variables on the graph?



____

____

Which property/factor is held constant? __________________________________

3. Why did Gabriella's tires look flat in the COLD morning when they looked full during the WARM night? ____

Homework question:

How can we use the gas laws to understand how a carbon dioxide fire extinguisher works?