Introduction to Gas Laws Lab

NAME:_____DATE:_____PERIOD:_____

Background:

In a gas, particles are spread far apart; therefore a gas takes up more volume than a solid or a liquid. For example, water in the form of steam takes up about 2000 times the volume that the same amount of water does in liquid form.

There are many formulas to describe the behavior of a gas under certain conditions. Boyle's Law, $PV=k$, states that the pressure is inversely proportional to the volume. Charles's Law, $V/T=k$, states that volume is directly proportional to the temperature. Gay-Lussac's Law, $P/T=k$, states that pressure is directly proportional to the temperature. Relationships that are directly proportional produce a straight line graph, while inversely proportional relationships produce a curve. Applying these laws to compare gases under two different sets of conditions gives the formulas: $P_1V_1=P_2V_2$, $V_1/T_1=V_2/T_2$, $P_1/T_1=P_2/T_2$.

These three laws together give the Combined Gas Law: $P_1V_1/T_1=P_2V_2/T_2$.

Procedure & Observations:

Part 1

1) Obtain a large beaker (600-1000 mL) and fill 3/4 full of tap water.
2) Obtain an aluminum can and add 7-10 milliliters of water.
3) Place the can on a heating set up (hotplate or wire gauze/ring stand) and heat until a steady stream of steam flows out of the can.
4) Using beaker tongs, grab the aluminum can near the bottom of the can and quickly turn it upside down into the beaker of water.

Observation:

When the can was heated, the water turned to _____, which takes up _____ (more/less) volume than liquid water. When the can was inverted into the water this created a closed system. The temperature inside the can _____ (increased/decreased), causing the steam to change from gas state to _____state. A partial vacuum was created causing the pressure inside the can to be _____ (greater/less) than the pressure outside the can.

Part 2

1) Obtain a small balloon filled with air. Submerge the balloon in a large beaker of ice water and hold for 3 minutes. Use beaker tongs to keep the balloon submerged. Observe.
2) Transfer balloon to large beaker of hot water and submerge for 3 minutes. Observe.

Observation:

As the water temperature increased, the volume of the balloon _____.

This is an example of _____ Law.

Part 3

1) Obtain a 250-mL Erlenmeyer flask and place 15-20 milliliters of water inside.
2) Place the flask onto a heating setup (hotplate or wire gauze/ring stand) and heat until a steady stream of steam comes out. DO NOT let the water boil away.
3) Take the flask off of the gauze using flask tongs.
4) While holding onto the neck of the flask using flask tongs, have a lab partner stretch the mouth of a large balloon over the mouth of the flask. Make sure the balloon is centered on the opening of the flask. This creates a closed system.
5) Wait 2-3 minutes and observe. Then place the flask into a beaker of ice water.

Observation:

Placing the balloon over the mouth of the flask created a _____ system. As the _____ in the flask dropped the steam turned to water. Since water in the liquid state takes up less _____ than water in the gas state, a partial vacuum was created. The greater _____ outside of the flask pushed the balloon inside.

Part 4

1) Obtain a 1000 mL beaker / candle set-up.
2) Fill the beaker with water until the water level is halfway up the candle. Light the candle.
3) Carefully invert a 1000 mL Erlenmeyer flask over the candle. Observe both candle and the water level.

Observation:

Propose an explanation:

Conclusion:

1) Give the name of the law that relates pressure to volume. _____
2) Give the name of the law that relates volume to temperature._____
3) The condensing of steam in a closed system creates a partial _____.
4) If the volume of a gas is cut by 1/2, the pressure will _____ (increase/decrease) by a factor of _____ (2, 1/2) times.
5) If the temperature of a gas is doubled, the volume of the gas will _____ (increase/decrease) by a factor of _____ (2, 1/2) times.
6) If the temperature of a gas is tripled, the pressure of the gas will _____ (increase/decrease) by a factor of _____ (3, 1/3) times.
7) Graphing pressure vs. volume would produce a _____.
8) Graphing volume vs. temperature would produce a _____ line.