Name: _____ Date: _____

CHEMISTRY: Gases and Gas Laws
Gay-Lussac's Law & Combined Gas Law

Part 1: Gay-Lussac's Law. Gay-Lussac's Law relates the amount of pressure of a gas acting on its surroundings as a function of changing temperature when volume does not change. Pressure is proportional to temperature. As temperature is increased, the pressure inside of a sealed vessel or container will increase.

Gay-Lussac's law

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

P_1 = initial pressure (Pa or atm
T_1 = initial temperature (K)
P_2 = final pressure (Pa or atm)
T_2 = final temperature (K)

Solving for final pressure or final temperature.

$$P_2 = \frac{P_1 \cdot T_2}{T_1} \quad \text{or} \quad T_2 = \frac{P_2 \cdot T_1}{P_1}$$

Temperature is absolute. It must be in Kelvin.

Show your work in the large rectangles to the right of the questions. Volume is constant.

2.40 moles of Kr gas at 0ºC has a volume of 4.75 L with a pressure of 11.3 atm. Calculate the pressure of the Kr gas when temperature is decreased to -220ºC.	
1.25 moles of CO_2 gas at -123ºC has a volume of 13.5 L with a pressure of 1.14. atm. Calculate the pressure of the CO_2 gas when the temperature is increased to 127ºC.	
0.065 moles of He gas at 20ºC has a volume of 5.0 L with a pressure 0.312 atm. Calculate the temperature needed to increase the pressure to 1.20 atm.	

Part 2: Combined Gas Law. Combined Law relates how temperature and volume changes will affect pressure of a system when the gas is unconfined. The gas is not in a sealed container, but in container or space that allows for volume changes. Volume will expand or contract with temperature changes, thus affecting the gas's internal pressure.

Charles's law

$$\frac{P_1 \cdot V_1}{T_1} = \frac{P_2 \cdot V_2}{T_2}$$

Solving for final volume, final pressure, or final temperature.

V_1 = initial volume (L or m^3)
P_1 = initial pressure (Pa or atm
T_1 = initial temperature (K)
V_2 = final volume (L or m^3)
P_2 = final pressure (Pa or atm)
T_2 = final temperature (K)

$$V_2 = \frac{P_1 \cdot V_1 \cdot T_2}{P_2 \cdot T_1} \quad \text{or} \quad T_2 = \frac{P_2 \cdot V_2 \cdot T_1}{P_1 \cdot V_1}$$

$$P_2 = \frac{P_1 \cdot V_1 \cdot T_2}{V_2 \cdot T_1}$$

Volume is allowed to change with pressure and temperature. Show your work in the large rectangles to the right of the questions. Temperatures must be in Kelvin.

2.40 moles of Kr gas at 0ºC has a volume of 4.75 L with a pressure of 11.3 atm. Calculate the pressure of the Kr gas when temperature is decreased to -220ºC and the volume contracts to 2.80 L.	
1.25 moles of CO_2 gas at -123ºC has a volume of 13.5 L with a pressure of 1.14. atm. Calculate the pressure of the CO_2 gas when the temperature is increased to 127ºC and the volume expands to 30.0 L.	
0.065 moles of He gas at 20ºC has a volume of 5.0 L with a pressure 0.312 atm. Calculate the volume of the He gas when the temperature is increased to 290ºC with a pressure of 0.936 atmo.	