WKS – Honors
Gay-Lussac's & Combined Gas Laws

NAME _____
Period _____ **Date** _____

Solve the following problems using Gay-Lussac's and the Combined Gas Laws. If a property is not mentioned in a problem, assume that it is held constant. Show all calculations including temperature conversions.

1) A cylinder of gas has a pressure of 4.40 atm at 25°C. At what temperature, in °C, will it reach a pressure of 6.50 atm?

$T_1 = 25°C + 273 = 298\ K$

$$T_2 = \left(\frac{P_2}{P_1}\right)T_1 = \left(\frac{6.50\ \cancel{atm}}{4.40\ \cancel{atm}}\right)(298\ K) = 440\ K;\ T_2 = 440\ K - 273 = \boxed{167°C}$$

2) A cylinder of compressed gas has a pressure of 4.882 atm on one day. The next day, it has a pressure of 4.690 atm at a temperature of 8°C. What was the temperature, in °C, on the first day?

$T_2 = 8°C + 273 = 281\ K$

$$T_1 = \left(\frac{P_1}{P_2}\right)T_2 = \left(\frac{4.882\ \cancel{atm}}{4.69\ \cancel{atm}}\right)(281\ K) = 293\ K;\ T_1 = 293\ K - 273 = \boxed{20.°C}$$

3) A mylar balloon is filled with helium gas to a pressure of 107.0 kPa when the temperature is 22°C. If the temperature changes to 45°C, what will be the pressure of the helium in the balloon?

$T_1 = 22°C + 273 = 295\ K;\ T_2 = 45°C + 273 = 318\ K;$

$$P_2 = \left(\frac{T_2}{T_1}\right)P_1 = \left(\frac{318\ \cancel{K}}{295\ \cancel{K}}\right)(107.0\ kPa) = \boxed{115\ kPa}$$

4) A sample of hydrogen gas has a volume of 65.0 mL at a pressure of 0.992 atm and a temperature of 16°C. What volume will the hydrogen occupy at 0.984 atm and 25°C?

$T_1 = 16°C + 273 = 289\ K;\ T_2 = 25°C + 273 = 298\ K$

$$V_2 = \left(\frac{P_1}{P_2}\right)\left(\frac{T_2}{T_1}\right)V_1 = \left(\frac{0.992\ \cancel{atm}}{0.984\ \cancel{atm}}\right)\left(\frac{298\ \cancel{K}}{289\ \cancel{K}}\right)(65.0\ mL) = \boxed{67.6\ mL}$$

5) A student collects 450. mL of HCl gas at a pressure of 100. kPa and a temperature of 17°C. What is the pressure when the volume of the HCl is 350. mL at 0°C?

$T_1 = 17°C + 273 = 290\ K;\ T_2 = 0°C + 273 = 273\ K$

$$P_2 = \left(\frac{V_1}{V_2}\right)\left(\frac{T_2}{T_1}\right)P_1 = \left(\frac{450.\ \cancel{mL}}{350.\ \cancel{mL}}\right)\left(\frac{273\ \cancel{K}}{290.\ \cancel{K}}\right)(100.\ kPa) = \boxed{121\ kPa}$$

6) A piston containing argon gas, originally in a volume of 3.50 L at 650. mmHg and –75°C is heated to 358°C and a pressure of 875 mmHg. What is the *change* in the volume of the piston?

$T_1 = -75°C + 273 = 198\ K;\ T_2 = 358°C + 273 = 631\ K$

$$V_2 = \left(\frac{P_1}{P_2}\right)\left(\frac{T_2}{T_1}\right)V_1 = \left(\frac{650.\ \cancel{mmHg}}{875\ \cancel{mmHg}}\right)\left(\frac{631\ \cancel{K}}{198\ \cancel{K}}\right)(3.50\ L) = 8.29\ L$$

$$\Delta V = 8.29\ L - 3.50\ L = \boxed{4.79\ L}$$