WKS
Gay-Lussac's Law & Combined Gas Law

NAME Answer Key
Period _____ **Date** _____

Gay-Lussac's Law	Combined Gas Law
$\frac{P_1}{T_1}=\frac{P_2}{T_2}$	$\frac{P_1V_1}{T_1}=\frac{P_2V_2}{T_2}$
V, moles constant	moles constant

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? [remember to convert to K first then back to °C!]

$T_1 = 25°C + 273 = 298\ K;\ \frac{4.40\ atm}{298\ K} = \frac{6.50\ atm}{T_2};\ T_2 = \frac{(6.50\ \cancel{atm})(298\ K)}{4.40\ \cancel{atm}} = 440\ K$

$T_2 = 440\ K - 273 = \boxed{167°C}$

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?

$T_2 = 8°C + 273 = 281\ K;\ \frac{4.882\ atm}{T_1} = \frac{4.690\ atm}{281\ K};\ T_1 = \frac{(4.882\ \cancel{atm})(281\ K)}{4.69\ \cancel{atm}} = 293\ K$

$T_1 = 293\ K - 273 = \boxed{20°C}$

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?

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

$\frac{107.0\ kPa}{295\ K} = \frac{P_2}{318\ K};\ P_2 = \frac{(107.0\ kPa)(318\ \cancel{K})}{295\ \cancel{K}} = \boxed{115.3\ kPa}$

4. A container is filled with argon gas has a pressure of 127.5 kPa at a temperature of 290. K. What is the temperature when the pressure is 3.51 kPa? [You do not need to convert back to °C.]

$\frac{127.5\ kPa}{290.\ K} = \frac{3.51\ kPa}{T_2};\ T_2 = \frac{(3.51\ \cancel{kPa})(290.\ K)}{127.5\ \cancel{kPa}} = \boxed{7.98\ K}$

5. 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?

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

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2};\ \frac{(0.992\ atm)(65.0\ mL)}{289\ K} = \frac{(0.984\ atm)V_2}{298\ K};$

$V_2 = \frac{(0.992\ \cancel{atm})(65.0\ mL)(298\ \cancel{K})}{(289\ \cancel{K})(0.984\ \cancel{atm})} = \boxed{67.6\ mL}$

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6. 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?

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

$$\frac{(100.\ kPa)(450.\ mL)}{290.\ K} = \frac{P_2(350.\ mL)}{273\ K};\ P_2 = \frac{(100.\ kPa)(450.\ \cancel{mL})(273\ \cancel{K})}{(350.\ \cancel{mL})(290.\ \cancel{K})} = \boxed{121\ kPa}$$

7. A scientist has a sample of gas that was collected several days earlier. The sample now has a volume of 392 mL at a pressure of 0.987 atm and a temperature of 21°C. What was the original temperature (in °C) of the gas, if the volume was 379 mL and the pressure was 0.992 atm? [remember to convert to K first then back to °C!]

$T_1 = ?;\ T_2 = 21°C + 273 = 294\ K$

$$\frac{(0.992\ atm)(379\ mL)}{T_1} = \frac{(0.987\ atm)(392\ mL)}{294\ K};\ T_1 = \frac{(0.992\ \cancel{atm})(379\ \cancel{mL})(294\ K)}{(0.987\ \cancel{atm})(392\ \cancel{mL})} = 286\ K$$

$T_1 = 286\ K - 273 = \boxed{13°C}$

8. 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?

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

$$\frac{(650.\ mmHg)(3.50\ L)}{198\ K} = \frac{(875\ mmHg)V_2}{631\ K};\ V_2 = \frac{(650.\ \cancel{mmHg})(631\ \cancel{K})(3.50\ L)}{(875\ \cancel{mmHg})(198\ \cancel{K})} = 8.29\ L$$

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

9. Which of the three variables that apply to equal amounts of gases are directly proportional? Which are inversely proportional?

P and V are directly proportional to T. P and V are inversely proportional to each other.

10. **Thinking Critically** Explain why gases such as the oxygen found in tanks used at hospitals are compressed. Why must care be taken to prevent compressed gases from reaching a high temperature?

They are compressed to make it easier to store and transport large amounts of gas. Heating up the containers will increase the already high pressure to a point that the container might burst.

11. What variable is assumed to be constant when using the combined gas law?

The number of moles of the gas.