$P_1 \times T_2 = P_2 \times T_1$ or $P_1/T_1 = P_2/T_2$

Name _____ Hour _____

Gay-Lussac's Law

Honors Chemistry

Solve the following <u>assuming constant volume and mass</u>. (All answers should be in Kelvin or in atm!)

1. A sample of hydrogen gas has a pressure of 3.41-atm at 25 °C. What is its pressure at 95 °C?

$P_1 = 3.41$ atm $\quad P_2 = ?$

$T_1 = 298$ K $\quad T_2 = 368$ K

$$P_2 = \frac{P_1 \times T_2}{T_1} = \frac{(3.41\text{ atm})(368\text{ K})}{298\text{ K}} = \boxed{4.21\text{ atm}}$$

2. Oxygen gas is a temperature of 40 °C when it has a pressure of 98.3-kPa. To what temperature should it be raised to have a pressure of 121.7-kPa?

$P_1 = 0.970$ atm $\quad P_2 = 1.201$ atm

$T_1 = 313$ K $\quad T_2 = ?$

$$T_2 = \frac{P_2 \times T_1}{P_1} = \frac{(1.201\text{ atm})(313\text{ K})}{0.970\text{ atm}} = \boxed{388\text{ K}}$$

3. Hydrogen gas was cooled from 150 °C to 50 °C. Its new pressure is 0.371-atm. What was its original pressure?

$P_1 = ?$ $\quad P_2 = 0.371$ atm

$T_1 = 423$ K $\quad T_2 = 323$ K

$$P_1 = \frac{P_2 \times T_1}{T_2} = \frac{(0.371\text{ atm})(423\text{ K})}{323\text{ K}} = \boxed{0.486\text{ atm}}$$

4. Chlorine gas has a pressure of 3.41-atm at 300 K. What pressure will it have at 600 K?

$P_1 = 3.41$ atm $\quad P_2 = ?$

$T_1 = 300$ K $\quad T_2 = 600$ K

$$P_2 = \frac{P_1 \times T_2}{T_1} = \frac{(3.41\text{ atm})(600\text{ K})}{300\text{ K}} = \boxed{6.82\text{ atm}}$$

5. A sample of neon gas at 50 °C and a pressure of 3.7-atm is cooled to 25 °C. What is the new pressure?

$P_1 = 3.7$ atm $\quad P_2 = ?$

$T_1 = 323$ K $\quad T_2 = 298$ K

$$P_2 = \frac{P_1 \times T_2}{T_1} = \frac{(3.7\text{ atm})(298\text{ K})}{323\text{ K}} = \boxed{3.4\text{ atm}}$$

Determining the Gas Law

Honors Chemistry

Determine the gas law that applies and solve. Your answers must be in Liters, atmospheres, or Kelvin!

1. A dry gas occupies a volume of 4.7-L at 2.34-atm. Assuming constant temperature and mass, what will be the volume of this gas at 1.05-atm?

Boyle's Law

$P_1 = 2.34\ atm$ $P_2 = 1.05\ atm$

$V_1 = 4.7\ L$ $V_2 = ?$

$$V_2 = \frac{P_1 \times V_1}{P_2} = \frac{(2.34 atm)(4.7 L)}{1.05\ atm} = 11\ L$$

2. A dry gas occupies a volume of 6.5- L at a temperature of 22.0 °C. Assuming constant mass and pressure, what volume will the gas occupy at a temperature of 28.0 °C?

Charles' Law

$V_1 = 6.5\ L$ $V_2 = ?$

$T_1 = 295\ K$ $T_2 = 301\ K$

$$V_2 = \frac{V_1 \times T_2}{T_1} = \frac{(6.5 L)(301 K)}{295\ K} = 6.6\ L$$

3. A gas at a pressure of 780.3-torr and 24.2 °C increased its temperature to 45.7 °C. Assuming constant mass and volume, what is the new pressure of this gas?

Gay-Lussac's Law

$P_1 = 1.027 atm$ $P_2 = ?$

$T_1 = 297.2\ K$ $T_2 = 318.7\ K$

$$P_2 = \frac{P_1 \times T_2}{T_1} = \frac{(1.027 atm)(318.7 K)}{297.2\ K} = 1.101\ atm$$

4. A dry gas with a volume of 588.8-mL at a pressure of 1.0-atm is subjected to a new pressure of 1.4-atm. Assuming constant temperature and mass, what is its volume under the new pressure?

Boyle's Law

$P_1 = 1.0\ atm$ $P_2 = 1.4\ atm$

$V_1 = .5888\ L$ $V_2 = ?$

$$V_2 = \frac{P_1 \times V_1}{P_2} = \frac{(1.0 atm)(.5888 L)}{1.4\ atm} = .4206\ L$$

5. At a temperature of 24.3 °C, a dry gas occupies a volume of 4.6-L. Assuming constant pressure and mass, what volume will the gas occupy at a temperature of 21.2 °C?

Charles' Law

$V_1 = 4.6\ L$ $V_2 = ?$

$T_1 = 297.3\ K$ $T_2 =$

$$V_2 = \frac{V_1 \times T_2}{T_1} = \frac{(4.6 L)(294.2 K)}{297.3\ K} = 4.55\ L$$

6. A dry gas has a temperature of 67.5 °C and a pressure of 1.43-atm. Assuming constant mass and volume, what will be the new temperature if the pressure is lowered to 0.97-atm?

Gay-Lussac's Law

$P_1 = 1.43\ atm$ $P_2 = 0.97\ atm$

$T_1 = 340.5\ K$ $T_2 = ?$

$$T_2 = \frac{P_2 \times T_1}{P_1} = \frac{(0.97 atm)(340.5 K)}{1.43\ atm} = 231\ K$$