Chemistry 20 - Unit 2 - Guy Lussac's Law

Name: _____

Complete all of the following problems to the best of your ability. Ensure that you show all of your work, including the formula used and the substitution of numerical values. Write legibly, and make sure that your name is on this sheet. If you have any questions, please refer to your notes or chapter four of your textbook. Good luck!

You may find the following formulas and constants useful:

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

760.000 mmHg = 101.325 kPa = 1.00000 atm

1000 mL = 1.000 L

1. A sample of gas at $1.65 \times 10^2 mmHg$ in a tank is cooled from 240C to 0C. What is the final pressure inside the steel tank?

$P_1 = 1.65 \times 10^2 mmHg$

$T_1 = 240°C + 273.15 = 513K$

$P_2 = ?$

$T_2 = 0°C + 273.15 = 273K$

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

$P_2 = \frac{P_1}{T_1} \times T_2 = \frac{(1.65 \times 10^2 mmHg)}{513K} \times 273K$

$= \boxed{87.8 mmHg}$

2. If a gas inside a closed container is pressurized from 15 atm to 16 atm and its original temperature is 25C, what is the final temperature?

$P_1 = 15 atm$

$T_1 = 25°C + 273.15 = 298K$

$P_2 = 16 atm$

$T_2 = ?$

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

$T_2 = \frac{T_1}{P_1} \times P_2 = \frac{298K}{15 atm} \times 16 atm$

$3.2 \times 10^2 K - 273.15 = \boxed{4 \times 10^1 °C}$

3. A 28.4 L sample of nitrogen inside a rigid, metal container at 51C is placed inside an over whose temperature is 254 C. The pressure inside the container at 51C was 2.7 atm. What is the pressure of the nitrogen after the temperature is increased?

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

$P_2 = \frac{(2.7 atm)}{324K} \times 527K$

$\boxed{P_2 = 4.4 atm}$

4. If a gas is cooled from 323.0 K to 273.15 K and the volume is kept constant. What final pressure would result if the original pressure was 750 mmHg?

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

$$= \frac{(750\text{mmHg})}{323.0\text{K}} \times 273.15\text{K}$$

$$\boxed{P_2 = 634\text{mmHg}}$$

5. A gas has a pressure of 699.0 mmHg at 40.0C. What is the temperature at standard pressure?

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

$$= \frac{273.2\text{K}}{760\text{mmHg}} \times 699.0\text{mmHg}$$

$$\boxed{T_2 = 251.3\text{K} = -21.9°\text{C}}$$

6. Determine the pressure when a constant volume of gas at 1.00 atm is heated from 20.0 C to 30.0 C.

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

$$= \frac{1.00\text{atm}}{293.2\text{K}} \times 303.2\text{K}$$

$$\boxed{P_2 = 1.03\text{atm}}$$