SCH 3UI **Gases Review #2** Name:_____

1. What are the five gas laws and their names?

Boyle's Law $P_1V_1 = P_2V_2$

Charles' Law $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

Gay-Lussac $\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $P_1$ $T_1$

Combined $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

Ideal $PV = nRT$

2. A sample of gas has a pressure of 128 kPa at 297 °C. To what Celsius temperature must the gas be heated to double its pressure if there is no change in the volume of the gas? V = constant

$P_1 = 128$ kPa

$T_1 = 297 + 273.15 = 570.15$

$P_2 = 256$ kPa

$T_2 = ?$

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

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

$= \frac{(256\text{ kPa})(570.15\text{ K})}{128\text{ kPa}}$

$= 1140.3$ K

$T(°C) = 1140.3\text{ K} - 273.15$

$= 867.15°C$

$= 867$ °C

3. What volume in liters does 1.67 g of $N_2$ occupy at 22.0 °C and 101 kPa?

$n = \frac{m}{M}$

$= \frac{1.67\text{ g}}{28.014\text{ g/mol}}$

$= 0.05961$ mol

$T = 22°C + 273.15 = 295.15$

$P = 101$ kPa

$PV = nRT$

$V = \frac{nRT}{P}$

$= \frac{(0.05961\text{ mol})(8.314\ \frac{\text{kPa}\cdot\text{L}}{\text{mol}\cdot\text{K}})(295.15\text{ K})}{101\text{ kPa}}$

$= 1.45$ L

4. A sample of carbon dioxide has a volume of 26.5 mL at 20.0 °C and 83 kPa. How many grams of $CO_2$ are in the sample?

$V = 26.5\text{ mL} = 0.0265$ L

$T = 20.0 + 273.15 = 293.15$ K

$P = 83$ kPa

$M_{CO_2} = 44.009$ g/mol

$PV = nRT$

$n = \frac{PV}{RT}$

$= \frac{(83\text{ kPa})(0.0265\text{ L})}{(8.314)(293.15\text{ K})}$

$= 0.00090245$ mol

$m = n \times M$

$= 0.00090245\text{ mol} \times 44.009\ \frac{\text{g}}{\text{mol}}$

$= 0.0397$ g

$= 0.040$ g

5. Nitric acid is formed when $NO_2$ is dissolved in water. What volume of $NO_2$ at 25.0 °C and 100.0 kPa are needed to form 12.0 g of $HNO_3$?

$$3\ NO_2\ (g) + H_2O\ (l) \rightarrow 2\ HNO_3\ (aq) + NO\ (g)$$

$V = ?$ 12.0 g

$T = 273.15 + 25 = 298.15\ K$ $M = 63.012\ g/mol$

$P = 100.0\ kPa$

$$n_{HNO_3} = \frac{12.0\ g}{63.012\ g/mol} = 0.1904\ mol$$

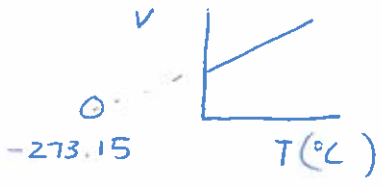
$$n_{NO_2} = 0.1904\ mol\ HNO_3 \times \frac{3\ mol\ NO_2}{2\ mol\ HNO_3} = 0.2857\ mol$$

$PV = nRT$

$V = \frac{nRT}{P}$

$$V = \frac{(0.2857\ mol)(8.314)(298.15)}{100.0\ kPa} = 7.08\ L$$

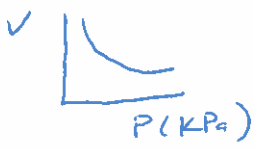
6. Your friend missed the class lesson on Charles' Law. Explain in words and with the help of a diagram/graph why temperature units need to be converted into Kelvin from Celsius.





* to get graph to go through the origin add 273.15 to °C

7. Your same friend missed the class on Boyle's Law. Explain in words and with the help of a diagram/graph why pressure units need to be converted to 1/P.





* 1/P to get a linear graph that goes through the origin.