

Ideal Gas Laws Homework:

$$PV = nRT \quad PV_m = gRT$$

\uparrow moles \uparrow molar mass \uparrow mass

1. $P = 710 \text{ mmHg}$
 $V = ?$
 $m = 17.04 \text{ g/mol}$
 $g = 34 \text{ g}$
 $R = 62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}}$
 $T = 24^\circ\text{C} \rightarrow 297 \text{ K}$

$$V = \frac{gRT}{P m.m.}$$

$$V = \frac{(34 \text{ g})(62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}})(297 \text{ K})}{(710 \text{ mmHg})(17.04 \text{ g/mol})}$$

$V = 52 \text{ L}$

2. $P = ? \text{ mmHg}$
 $V = 6.00 \text{ L}$
 $m = 16.05 \text{ g/mol}$
 2sf $g = 16.0 \text{ g}$
 $R = 62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}}$
 $T = 26^\circ\text{C} \rightarrow 299 \text{ K}$

$$P = \frac{gRT}{V m.m.}$$

$$P = \frac{(16.0 \text{ g})(62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}})(299 \text{ K})}{(6.00 \text{ L})(16.05 \text{ g/mol})}$$

$P = 3100 \text{ mmHg}$

3. $P = ? \text{ mmHg}$
 $V = 50.0 \text{ L}$
 $m = 17.04 \text{ g/mol}$
 $g = 34 \text{ g}$
 $R = 62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}}$
 $T = 300 \text{ K}$

$$P = \frac{gRT}{V m.m.}$$

$$P = \frac{(34.0 \text{ g})(62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}})(300 \text{ K})}{(50.0 \text{ L})(17.04 \text{ g/mol})}$$

$P = 750 \text{ mmHg}$

$$747 \text{ mmHg} \times \frac{101.3 \text{ kPa}}{760 \text{ mmHg}} = \frac{150}{99.6 \text{ kPa}}$$

$$\begin{aligned}
 4 \quad P &= 735 \text{ mmHg} \\
 V &= 5.6 \text{ L} \\
 n &= 0.120 \text{ mol} \\
 R &= 62.4 \frac{\text{L mmHg}}{\text{mol K}} \\
 T &=?
 \end{aligned}$$

$$PV = nRT \quad T = \frac{PV}{nR}$$

$$T = \frac{(735 \text{ mmHg})(5.6 \text{ L})}{(0.120 \text{ mol})(62.4 \frac{\text{L mmHg}}{\text{mol K}})} \quad \boxed{T = 550 \text{ K}}$$

$$\begin{aligned}
 5. \quad P &= 124 \text{ atm} \\
 V &=? \\
 n &= 3.40 \text{ mol} \\
 R &= 0.0821 \frac{\text{L atm}}{\text{mol K}} \\
 T &= 323 \text{ K}
 \end{aligned}$$

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

$$V = \frac{(3.40 \text{ mol})(0.0821 \frac{\text{L atm}}{\text{mol K}})(323 \text{ K})}{124 \text{ atm}}$$

$$\boxed{V = 0.727 \text{ L}}$$

For gases: $D_{\text{STP}} = \frac{\text{molar mass}}{22.4 \text{ L}}$

$$D_{\text{new}} = \frac{\text{molar mass}}{V_2}$$

V_2 is found combined gas Law

$$V_1 = 22.4 \text{ L}$$

$$V_2 = ?$$

$$P_1 = \text{Standard Pressure}$$

$$P_2 = ?$$

$$T_1 = 273 \text{ K}$$

$$T_2 = ?$$

$\left. \begin{matrix} P_2 \\ T_2 \end{matrix} \right\} \text{ word problem}$

8. find D_{new} - 1st find V_2

$$V_1 = 22.4 \text{ L} \quad V_2 = ?$$

$$P_1 = 760 \text{ mmHg} \quad P_2 = 800 \text{ mmHg}$$

$$T_1 = 273 \text{ K}$$

$$V_1 P_1 = V_2 P_2$$

$$\frac{(22.4 \text{ L})(760 \text{ mmHg})}{800 \text{ mmHg}} = \frac{V_2 (800 \text{ mmHg})}{800 \text{ mmHg}}$$

$$V_2 = 21.28 \text{ L}$$

$$D_{\text{new}} = \frac{\text{molar mass}}{V_2} = \frac{44.01 \text{ g}}{21.28 \text{ L}} = 2.07 \text{ g/L}$$

$$6. \quad D_{\text{STP}} = \frac{32.06 \text{ g}}{22.4 \text{ L}} = \boxed{1.43 \text{ g/L}}$$

$$7. \quad \frac{64.07 \text{ g}}{22.4 \text{ L}} = \boxed{2.86 \text{ g/L}}$$