

4/28/16

Ideal Gas Laws Hmwk:

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

↑ ↑ ↑
moles molar mass mass

1. $P = 710 \text{ mmHg}$

$V = ?$

$m = 17.04 \text{ g/mol}$

$g = 34 \text{ g}$

$R = 62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}}$

$T = 24^\circ\text{C} \rightarrow 297 \text{ K}$

$$V = \frac{gRT}{Pm}$$

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

$$V = 52 \text{ L}$$

2. $P = ? \text{ mmHg}$

$V = 6.00 \text{ L}$

$m = 16.05 \text{ g/mol}$

2sf $g = 16.0 \text{ g}$

$R = 62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}}$

$T = 26^\circ\text{C} \rightarrow 299 \text{ K}$

$$P = \frac{gRT}{Vm}$$

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

$$P = 3100 \text{ mmHg}$$

3. $P = ? \text{ mmHg}$

$V = 50.0 \text{ L}$

$m = 17.04 \text{ g/mol}$

$g = 34 \text{ g}$

$R = 62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}}$

$T = 300 \text{ K}$

$$P = \frac{gRT}{Vm}$$

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

$$P = 750 \text{ mmHg}$$

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

$$PV = nRT$$

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

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

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

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

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

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

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

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

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

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

$$V_2 = ?$$

$$P_2$$

$$T_2$$

word problem

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

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

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

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

$$V_1 P_1 = V_2 P_2$$

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

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

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

$$9. D_{\text{new}} = \frac{\text{molar mass}}{V_2} = \frac{32.00 \text{ g}}{25.6 \text{ L}} = \boxed{1.39 \text{ g/L}}$$

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

$$T_1 = 273 \text{ K} \quad T_2 = 312 \text{ K}$$

$$\frac{(22.4 \text{ L})(312 \text{ K})}{273 \text{ K}} = V_2$$

$$V_2 = 25.6 \text{ L}$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$



Total Room Pressure $1.02 \text{ atm} \rightarrow 104.3 \text{ kPa}$

$$1.02 \text{ atm} \times \frac{101.3 \text{ kPa}}{1 \text{ atm}} = 104.3 \text{ kPa}$$

Temp. 25°C

$$P_{\text{H}_2\text{O}} = 3.17 \text{ kPa} \text{ on table}$$

$$P_{\text{H}_2} = ?$$
$$P_{\text{TOTAL}} = P_{\text{H}_2\text{O}} + P_{\text{H}_2}$$

$$104.3 \text{ kPa} = 3.17 \text{ kPa} + P_{\text{H}_2}$$

$$P_{\text{H}_2} = 101.1 \text{ kPa}$$

Practice # 3

$$P_{\text{TOT}} = 788 \text{ mmHg} \quad RT = 35.0^\circ\text{C} \quad P_{\text{H}_2\text{O}} = 42.2 \text{ mmHg}$$

$$788 \text{ mmHg} - 42.2 \text{ mmHg} = P_2$$

4/28/16
Gas Laws #2

$$PV = nRT$$

↑
moles

$$PV_m = gRT$$

molar mass ← ← grams

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 $m = 17.04 \text{ g/mol}$
 $g = 34 \text{ g}$
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 $T = 297 \text{ K}$

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

$$V = 52 \text{ L}$$

2. $P = ? \text{ mmHg}$
 $V = 6.00 \text{ L}$
 $m = 16.05 \text{ g/mol}$

2sf $g = 16.0 \text{ g}$
 $R = 62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}}$
 $T = 26^\circ\text{C} \rightarrow 299 \text{ K}$

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

$$P = 3100 \text{ mmHg}$$

3. $P = ? \text{ mmHg}$
 $V = 50.0 \text{ L}$
 $m = 17.04 \text{ g/mol}$

$g = 34 \text{ g}$
 $R = 62.4 \frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}}$
 $T = 300 \text{ K}$

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

$$P = 750 \text{ mmHg}$$