

## Objective 1:

1. Define

2. a.  $P_1 V_1 = P_2 V_2$  ~~Boyle's~~ Boyle's law states that at constant temperature, pressure and volume are inversely related.

b.  $P_1 = 1.5 \text{ atm}$  Temperature is constant

$$V_1 = 2.5 \text{ L} \quad P_1 V_1 = P_2 V_2$$

$$P_2 = ? \quad 1.5 \text{ atm} \cdot 2.5 \text{ L} = x \cdot .75 \text{ L}$$

$$V_2 = .75 \text{ L} \quad V_2 = \boxed{5.0 \text{ L}}$$

c.  $P_1 = 315 \text{ kPa}$  Temperature is constant

$$V_1 = 355 \text{ mL} \quad P_1 V_1 = P_2 V_2$$

$$P_2 = 50 \text{ kPa} \quad 315 \text{ kPa} \cdot 355 \text{ mL} = 50 \text{ kPa} \cdot x$$

$$V_2 = ? \quad V_2 = \boxed{2240 \text{ mL}}$$

$$3. \frac{V_1}{T_1} = \frac{V_2}{T_2}$$

Charles' Law states that the volume of a gas is directly proportional to the Kelvin temperature, if the pressure is constant.

$$b. V_1 = 4789 \text{ mL}$$

$$T_1 = 485 \text{ K}$$

$$V_2 = ?$$

$$T_2 = 200 \text{ K}$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \frac{4789 \text{ mL}}{485 \text{ K}} = \frac{x}{200 \text{ K}}$$

$$V_2 = \boxed{1975 \text{ mL}}$$

$$c. V_1 = 45.0 \text{ L}$$

$$T_1 = 298 \text{ K}$$

$$V_2 = 12 \text{ L}$$

$$T_2 = ?$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \frac{45.0 \text{ L}}{298 \text{ K}} = \frac{12 \text{ L}}{x}$$

$$T_2 = \boxed{79.5 \text{ K}}$$

## Gas Law HW9

4. a.  $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

Gay-Lussac's Law states that temperature and the pressure of a gas are directly related at constant volume.

b.  $P_1 = 7.5 \text{ atm}$

$T_1 = 25 + 273$

$P_2 = ?$

$T_2 = 100 + 273$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \quad \frac{7.5 \text{ atm}}{298 \text{ K}} = \frac{X}{373 \text{ K}}$$

$P_2 = \boxed{9.4 \text{ atm}}$

c.  $P_1 = 6.3 \text{ atm}$

$T_1 = 845 \text{ K}$

$P_2 = 1000 \text{ kPa} = 9.87 \text{ atm}$

$T_2 = ? \text{ } ^\circ\text{C}$

$$1000 \text{ kPa} \times \frac{1 \text{ atm}}{101.3 \text{ kPa}} = 9.87 \text{ atm}$$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \quad \frac{6.3 \text{ atm}}{845 \text{ K}} = \frac{9.87 \text{ atm}}{X}$$

$T_2 = 1323.8 \text{ K} - 273 = \boxed{1051 \text{ } ^\circ\text{C}}$

5.  $\frac{V_1}{n_1} = \frac{V_2}{n_2}$

$n = \text{moles}$

b.  $V_1 = 4500 \text{ mL}$

$n_1 = 10 \text{ mol}$

$V_2 = ?$

$n_2 = 10 \text{ mol} + 5 \text{ mol} = 15 \text{ mol}$

$$\frac{V_1}{n_1} = \frac{V_2}{n_2} \quad \frac{4500 \text{ mL}}{10 \text{ mol}} = \frac{X}{15 \text{ mol}}$$

$V_2 = \boxed{6750 \text{ mL}}$

## Objective 2

Gashaw HW 9

1. Define

2. a.  $P_1 = 3.5 \text{ atm}$ 

$$V_1 = 5.2 \text{ L}$$

$$T_1 = 35 + 273$$

$$P_2 = ?$$

$$V_2 = \frac{3.2}{2} = 2.6 \text{ L}$$

$$T_2 = 400 \text{ K}$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$T_1$$

$$P_2 = \boxed{9.1 \text{ atm}}$$

$$\frac{3.5 \text{ atm} \cdot 5.2 \text{ L}}{308 \text{ K}} = \frac{x \cdot 2.6 \text{ L}}{400 \text{ K}}$$

$$308 \text{ K}$$

$$400 \text{ K}$$

b.  $P_1 = 300 \text{ kPa} = 2.96 \text{ atm}$   $300 \text{ kPa} \times \frac{1 \text{ atm}}{101.3 \text{ kPa}} = 2.96 \text{ atm}$ 

$$V_1 = 50 \text{ L}$$

$$T_1 = 23 + 273 = 296 \text{ K}$$

$$P_2 = 3.9 \text{ atm}$$

$$V_2 = ?$$

$$T_2 = 315 \text{ K}$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$T_1$$

$$V_2 = \boxed{40.4 \text{ L}}$$

$$\frac{2.96 \text{ atm} \cdot 50 \text{ L}}{296 \text{ K}} = \frac{3.9 \text{ atm} \cdot x}{315 \text{ K}}$$

$$296 \text{ K}$$

$$315 \text{ K}$$

c.  $P_1 = 800 \text{ atm}$ 

$$V_1 = 2000 \text{ L}$$

$$T_1 = ?$$

$$P_2 = 101.3 \text{ kPa} = 1 \text{ atm}$$

$$V_2 = 10^5 \text{ L}$$

$$T_2 = 292 \text{ K}$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$T_1$$

$$T_1 = \boxed{4672 \text{ K}}$$

$$\frac{800 \text{ atm} \cdot 2000 \text{ L}}{x} = \frac{1 \text{ atm} \cdot 10^5 \text{ L}}{292 \text{ K}}$$

$$x$$

$$292 \text{ K}$$

3. a.  $PV = nRT$

$P = 5.2 \text{ atm}$

$V = 6.8 \text{ L}$

$T = 600 \text{ K}$

$n = ?$

$5.2 \text{ atm} \cdot 6.8 \text{ L} = .0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \cdot 600 \text{ K} \cdot n$

$n = \boxed{.72 \text{ mol}}$

b.  $P = ?$

$n = 85 \text{ g} \times \frac{1 \text{ mol } \text{N}_2}{28 \text{ g}} = 3 \text{ mol}$

$PV = nRT$

$X \cdot 100 \text{ L} = 3.04 \text{ mol} \cdot .0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \cdot 323 \text{ K}$

$T = 50 + 273 = 323 \text{ K}$

$V = 100 \text{ L}$

$P = \boxed{.81 \text{ atm}}$

c.  $P = 85 \text{ kPa}$

$V = 1758 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}}$

$T = ?$

$PV = nRT$

$85 \text{ kPa} \cdot 1.758 \text{ L} = 5.0 \text{ mol} \cdot 8.31 \frac{\text{L} \cdot \text{kPa}}{\text{mol} \cdot \text{K}} \cdot T$

$T = \boxed{3.6 \text{ K}}$

$n = 5.0 \text{ mol}$

d.  $P = 300 \text{ kPa}$

$V = 180 \text{ L}$

$n = ?$

$PV = nRT$

$300 \text{ kPa} \cdot 180 \text{ L} = n \cdot 8.31 \frac{\text{L} \cdot \text{kPa}}{\text{mol} \cdot \text{K}} \cdot 313 \text{ K}$

$T = 40 + 273 = 313 \text{ K}$

$n = 20.8 \text{ mol } \text{SO}_2$

$20.8 \text{ mol } \text{SO}_2 \times \frac{64 \text{ g}}{1 \text{ mol}} = \boxed{1331.2 \text{ g } \text{SO}_2}$

$$4. a. P_{total} = P_1 + P_2 + P_3 \dots$$

Dalton's law of partial Pressure states that the total pressure inside the container is equal to the sum of the partial pressure due to each gas.

$$b. V = 7.00L$$

$$T = 25 + 273 = 298K$$

$$\text{He } PV = nRT \quad P \cdot 7.00L = .477 \text{ mol} \cdot .0821 \cdot 298K$$

$$P_{\text{He}} = 1.68 \text{ atm}$$

$$\text{Ne } PV = nRT \quad P \cdot 7.00L = .280 \text{ mol} \cdot .0821 \cdot 298K$$

$$P_{\text{Ne}} = .98 \text{ atm}$$

$$\text{Ar } PV = nRT \quad P \cdot 7.00L = .110 \text{ mol} \cdot .0821 \cdot 298K$$

$$P_{\text{Ar}} = .38 \text{ atm}$$

$$P_{total} = 1.68 \text{ atm} + .98 \text{ atm} + .38 \text{ atm} = \boxed{3.04 \text{ atm}}$$

$$c. V = 15.0L$$

$$P_{total} = 210 \text{ kPa}$$

$$T = 300K$$

$$P_{total} = P_{\text{Xe}} + P_{\text{O}_2} + P_{\text{H}_2}$$

$$210 \text{ kPa} = 57.1 \text{ kPa} + 64.8 \text{ kPa} + P_{\text{H}_2}$$

$$P_{\text{H}_2} = \boxed{88.1 \text{ kPa}}$$

$$45.2 \text{ g Xe} \times \frac{1 \text{ mol}}{131.29 \text{ g}} = .344 \text{ mol Xe}$$

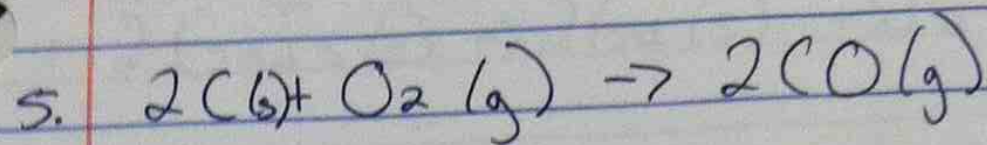
$$PV = nRT \quad P \cdot 15.0L = .344 \text{ mol} \cdot 8.31 \cdot 300K$$

$$P_{\text{Xe}} = 57.1 \text{ kPa}$$

$$12.5 \text{ g O}_2 \times \frac{1 \text{ mol O}_2}{32 \text{ g}} = .39 \text{ mol O}_2$$

$$PV = nRT \quad P \cdot 15.0L = .39 \text{ mol} \cdot 8.31 \cdot 300K$$

$$P_{\text{O}_2} = 64.8 \text{ kPa}$$



$$P = 600 \text{ kPa}$$

$$T = 180 + 273 = 453 \text{ K}$$

$$V = ?$$

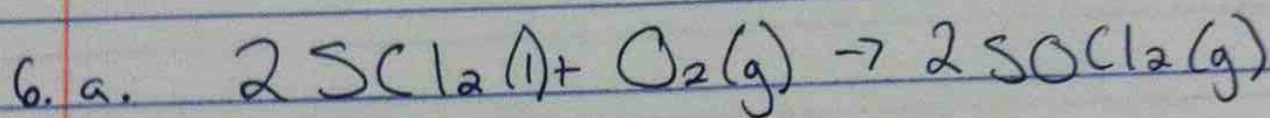
$$n = ?$$

$$PV = nRT$$

$$600 \text{ kPa} \cdot V = 6.25 \text{ mol} \cdot 8.31 \cdot 453 \text{ K}$$

$$V = \boxed{39.2 \text{ L CO}}$$

$$100 \text{ g } O_2 \times \frac{1 \text{ mol } O_2}{32 \text{ g } O_2} \times \frac{2 \text{ mol CO}}{1 \text{ mol } O_2} = 6.25 \text{ mol CO} = n$$



$$100 \text{ g } SCl_2 \times \frac{1 \text{ mol } SCl_2}{102.9 \text{ g}} \times \frac{2 \text{ mol } SOCl_2}{2 \text{ mol } SCl_2} \times \frac{118.9 \text{ g}}{1 \text{ mol } SOCl_2} = 115.5 \text{ g } SOCl_2$$

$$25 \text{ g } O_2 \times \frac{1 \text{ mol } O_2}{32 \text{ g}} \times \frac{2 \text{ mol } SOCl_2}{1 \text{ mol } O_2} \times \frac{118.9 \text{ g}}{1 \text{ mol } SOCl_2} = 185.8 \text{ g } SOCl_2$$

b. The theoretical yield is 115.5 g  $SOCl_2$   
which is .9718 mol  $SOCl_2$

$$c. \quad P = ?$$

$$V = 100 \text{ L}$$

$$T = 655 \text{ K}$$

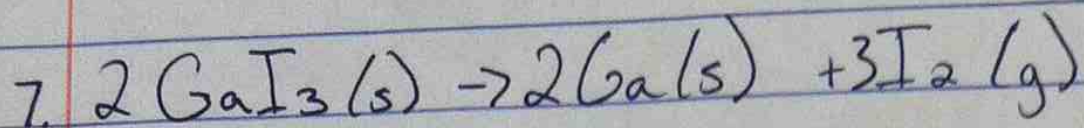
$$n = .9718 \text{ mol}$$

$$PV = nRT$$

$$P \cdot 100 \text{ L} = .9718 \text{ mol} \cdot 655 \text{ K} \cdot .0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$$

$$P = \boxed{.52 \text{ atm}}$$

Gashaw HW9



$$200 \text{g GaI}_3 \times \frac{1 \text{mol}}{450.4 \text{g}} \times \frac{3 \text{mol I}_2}{2 \text{mol GaI}_3} = .666 \text{ mol I}_2$$

$$P = 2.2 \text{ atm}$$

$$T = 600 + 273 = 873 \text{ K}$$

$$n = .666 \text{ mol I}_2$$

$$V = ?$$

$$PV = nRT$$

$$2.2 \text{ atm} \cdot V = .666 \text{ mol I}_2 \cdot .0821 \cdot 873 \text{ K}$$

$$V = \boxed{21.7 \text{ L I}_2}$$