

SHOW ALL WORK TO RECEIVE CREDIT.

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad P_1 V_1 T_2 = P_2 V_2 T_1 \quad PV = nRT \quad R = \frac{62.37 \text{ L} \cdot \text{Torr}}{\text{mol} \cdot \text{K}} = \frac{0.0821 \text{ L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} = \frac{8.314 \text{ J}}{\text{mol} \cdot \text{K}}$$

Molar masses: C = 12.01, N = 14.01, F = 19.00, O = 16.00, S = 32.07

1. (5 Pts) A sample of nitrogen gas at 278 K and 745 torr has a volume of 37.42 L. What volume will it occupy if the pressure is increased to 994 torr at constant temperature?

$$P_1 = 745 \text{ torr} \quad P_2 = 994 \text{ torr} \quad P_1 V_1 = P_2 V_2$$

$$V_1 = 37.42 \text{ L} \quad V_2 = ? \text{ L} \quad V_2 = \frac{(745 \text{ torr})(37.42 \text{ L})}{994 \text{ torr}}$$

$$T_1 = 273 \text{ K} \quad T_2 = 273 \text{ K} \quad V_2 = 28.0 \text{ L}$$

2. (5 Pts) A sample of carbon dioxide gas at 125°C and 248 torr occupies a volume of 275 L. What will the gas pressure be if the volume is increased to 321 L at 345°C?

$$P_1 = 248 \text{ torr} \quad P_2 = ? \quad P_2 = \frac{P_1 V_1 T_2}{V_2 T_1}$$

$$V_1 = 275 \text{ L} \quad V_2 = 321 \text{ L} \quad P_2 = \frac{(248 \text{ torr})(275 \text{ L})(618 \text{ K})}{(321 \text{ L})(398 \text{ K})} = 330 \text{ torr}$$

$$T_2 = 125 + 273 = 398 \text{ K} \quad T_1 = 618 \text{ K}$$

3. (5 Pts) Calculate the density in g/L of gaseous SF₆ at 60.0°C and 650. torr.

$$P = 650 \text{ torr} \quad V = ? \text{ L} \quad n = \text{use } 1 \text{ mol } (146.07 \text{ g/mol})$$

$$R = \frac{62.37 \text{ L} \cdot \text{torr}}{\text{mol} \cdot \text{K}} \quad V = \frac{nRT}{P} = \frac{(1 \text{ mol})(62.37 \text{ L} \cdot \text{torr})(333 \text{ K})}{650 \text{ torr}}$$

$$T = 333 \quad V = 31.95 \text{ L}$$

$$\text{Density} = \frac{146.07 \text{ g}}{31.95 \text{ L}} = 4.57 \frac{\text{g}}{\text{L}}$$

4. (5 Pts) A sample of nitrogen gas is confined to a 16.0 L container at 375 torr and 37.0°C. How many moles of nitrogen are in the container?

$$P = 375 \text{ torr} \quad V = 16.0 \text{ L} \quad n = ?$$

$$R = \frac{62.37 \text{ L} \cdot \text{torr}}{\text{mol} \cdot \text{K}} \quad T = 310 \text{ K}$$

$$n = \frac{PV}{RT} = \frac{(375 \text{ torr})(16.0 \text{ L})}{(62.37 \text{ L} \cdot \text{torr} / \text{mol} \cdot \text{K})(310 \text{ K})}$$

$$n = 0.310 \text{ mol}$$

5. (5 Pts) A flask with a volume of 3.16 L contains 9.33 grams of an unknown gas at 32.0°C and 1.10 atm. What is the molar mass of the gas?

$$P = 1.10 \text{ atm} \quad V = 3.16 \text{ L} \quad n = ?$$

$$R = 0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \quad T = 305 \text{ K}$$

$$n = \frac{PV}{RT} = \frac{(1.10 \text{ atm})(3.16 \text{ L})}{(0.0821 \text{ L} \cdot \text{atm} / \text{mol} \cdot \text{K})(305 \text{ K})}$$

$$n = 0.139 \text{ mol}$$

$$\text{molar mass} = \frac{9.33 \text{ g}}{0.139 \text{ mol}} = 67.2 \text{ g/mol}$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad P_1 V_1 T_2 = P_2 V_2 T_1 \quad PV = nRT \quad R = \frac{62.37 \text{ L} \cdot \text{Torr}}{\text{mol} \cdot \text{K}} = \frac{0.0821 \text{ L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} = \frac{8.314 \text{ J}}{\text{mol} \cdot \text{K}}$$

Molar masses: C = 12.01, N = 14.01, F = 19.00, O = 16.00, S = 32.07

1. (5 Pts) A sample of nitrogen gas at 298 K and 745 torr has a volume of 37.42 L. What volume will it occupy if the pressure is increased to 894 torr at constant temperature?

$$P_1 = 745 \text{ torr} \quad P_2 = 894 \text{ torr} \quad P_1 V_1 = P_2 V_2$$

$$V_1 = 37.42 \text{ L} \quad V_2 = ? \text{ L} \quad V_2 = \frac{(745 \text{ torr})(37.42 \text{ L})}{894 \text{ torr}} = 31.2 \text{ L}$$

$$T_1 = 298 \text{ K} \quad T_2 = 298 \text{ K}$$

2. (5 Pts) A sample of carbon dioxide gas at 125°C and 248 torr occupies a volume of 275 L. What will the gas pressure be if the volume is increased to 321 L at 245°C?

$$P_1 = 248 \text{ torr} \quad P_2 = ?$$

$$V_1 = 275 \text{ L} \quad V_2 = 321 \text{ L}$$

$$T_1 = 398 \text{ K} \quad T_2 = 518 \text{ K}$$

$$P_2 = \frac{P_1 V_1 T_2}{V_2 T_1} = \frac{(248 \text{ torr})(275 \text{ L})(518 \text{ K})}{(321 \text{ L})(398 \text{ K})}$$

$$P_2 = 277 \text{ torr}$$

3. (5 Pts) Calculate the density in g/L of gaseous SF₆ at 50.0°C and 650. torr.

$$P = 650 \text{ torr}$$

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

$$n = \text{use 1 mol (146.07 g)}$$

$$R = 62.37 \text{ L} \cdot \text{torr} / \text{mol} \cdot \text{K}$$

$$T = 323 \text{ K}$$

$$V = \frac{nRT}{P} = \frac{(1 \text{ mol})(62.37 \text{ L} \cdot \text{torr})(323 \text{ K})}{(650 \text{ torr})}$$

$$V = 31.0 \text{ L}$$

$$\text{Density} = \frac{g}{L} = \frac{146.07 \text{ g}}{31.0 \text{ L}} = 4.71 \text{ g/L}$$

4. (5 Pts) A sample of nitrogen gas is confined to a 14.0 L container at 375 torr and 37.0°C. How many moles of nitrogen are in the container?

$$P = 375 \text{ torr}$$

$$V = 14.0 \text{ L}$$

$$n = ?$$

$$R = 62.37 \text{ L} \cdot \text{torr} / \text{mol} \cdot \text{K}$$

$$T = 310 \text{ K}$$

$$n = \frac{PV}{RT} = \frac{(375 \text{ torr})(14.0 \text{ L})}{(62.37 \text{ L} \cdot \text{torr})(310 \text{ K})}$$

$$n = 0.272 \text{ mol}$$

5. (5 Pts) A flask with a volume of 3.16 L contains 9.33 grams of an unknown gas at 32.0°C and 1.00 atm. What is the molar mass of the gas?

$$P = 1.00 \text{ atm}$$

$$V = 3.16 \text{ L}$$

$$n = ?$$

$$R = 0.0821 \text{ L} \cdot \text{atm} / \text{mol} \cdot \text{K}$$

$$T = 305 \text{ K}$$

$$\text{molar mass} = g / \text{mol}$$

$$n = \frac{PV}{RT} = \frac{(1.00 \text{ atm})(3.16 \text{ L})}{(0.0821 \text{ L} \cdot \text{atm})(305 \text{ K})}$$

$$n = 0.126 \text{ mol}$$

$$\text{molar mass} = \frac{9.33 \text{ g}}{0.126 \text{ mol}} = 73.9 \text{ g/mol}$$