

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

Molar masses: He = 4.00, K = 39.01, Mn = 54.94, O = 16.00, S = 32.06

1. (4 Pts) A mixture of three gases has a total pressure of 1,380 mmHg at 298 K. The mixture is analyzed and is found to contain 2.27 mol CO₂, 3.04 mol CO, and 2.50 mol Ar. What is the partial pressure of Ar?

$$\frac{2.50}{(2.27 + 3.04 + 2.50)} \times 1380 \text{ mmHg} = 442 \text{ mmHg}$$

2. (5 Pts) Calculate the density of SO₂ gas, in grams per liter, at 65°C and 1.5 atm.

Density = g ÷ L
 p = 1.5 atm
 V = ?
 use 1 mol (SO₂ = 64.06g)
 n = 1 mol
 R = $\frac{0.0821 \text{ L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$
 T = 65 + 273 = 338K

$$V = \frac{nRT}{p} = \frac{(1 \text{ mol})(0.0821 \text{ L} \cdot \text{atm})(338 \text{ K})}{(1.5 \text{ atm})} = 18.5 \text{ L}$$

$$\text{Density} = \frac{64.06 \text{ g}}{18.5 \text{ L}} = 3.46 \frac{\text{g}}{\text{L}}$$

3. (3 Pts) A spacecraft is filled with 0.500 atm of O₂ and 0.500 atm of He. If there is a very small hole in the side of this craft such that gas is lost slowly into outer space,

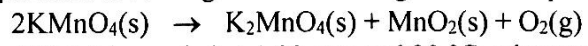
- (A) He is lost 2.8 times faster than O₂ is lost. B) He is lost 8 times faster than O₂ is lost.
 (C) He is lost twice as fast as O₂ is lost. D) O₂ is lost 2.8 times faster than He is lost.
- $$2.8 = \sqrt{\frac{32}{4}}$$

4. (4 Pts) The following data describes an initial and final state for an ideal gas. Given that the amount of gas does not change in the process, what is the final temperature (°C) of the gas?

	P	V	T
initial:	1.10 atm	1.30 L	25 °C
final:	1.25 atm	1.30 L	?

$$T_2 = \frac{1.25 \text{ atm} (298 \text{ K})}{1.10 \text{ atm}} = 339 \text{ K} = 66 \text{ °C}$$

5. (5 Pts) A convenient way to produce very high purity oxygen in the laboratory is to decompose KMnO₄(s) at high temperature according to the following chemical equation:



If 3.50 L of O₂(g) is needed at 1.00 atm and 20.°C, what mass (in grams) of KMnO₄(s) should be decomposed? Assume the decomposition of KMnO₄(s) goes to completion.

1st: $n = \frac{PV}{RT} = \frac{(1.00 \text{ atm})(3.50 \text{ L})}{(293 \text{ K})(0.0821 \text{ L} \cdot \text{atm})} = 0.145 \text{ moles O}_2$

then: $0.145 \text{ mol O}_2 \times \frac{2 \text{ mol KMnO}_4}{1 \text{ mol O}_2} \times \frac{157.95 \text{ g KMnO}_4}{\text{mol KMnO}_4} = 45.96 \text{ g KMnO}_4$

6. (4 Pts) The following data describes an initial and final state for an ideal gas. Given that the amount of gas does not change in the process, what was the initial volume (L) of the gas?

	P	V	T
initial:	830 mmHg	?	35 °C
final:	720 mmHg	1.2 L	58 °C

$$V = \frac{(720 \text{ mmHg})(1.2 \text{ L})(35 + 273 \text{ K})}{(830 \text{ mmHg})(58 + 273 \text{ K})} = 0.97 \text{ L}$$