CT Chem Unit 10 Gases
Dalton's Law of Partial Pressures Notes

Dalton's Law: When gases are mixed each gas has its own pressure, but share a volume.

Review:

- Ideal gas Law PV=nRT (R= .0821 L*atm/mol*K)

Notes:

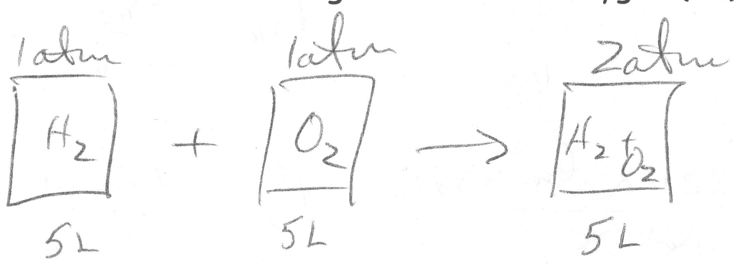
- This gas law is very simple. Just add the partial pressures to get the total pressure.
- Page 420 through 425 in the book.
- Mathematically: $P_{Total} = P_1 + P_2 + P_3 \ldots$ where the pressures are for each individual gas.
- Can be combined with the Ideal Gas Law: $P_{Total} = n_{Total}(RT/V)$

Cautions:

1. Always use Kelvin (K) and moles not Celsius (°C) and grams!
2. The volume is the SAME for both gasses!

Examples:

1. What is the total pressure when 5.0 L of Hydrogen (H_2) at 1.00 atm is pumped into a 5.0 L container along with 5.0 L of Oxygen (O_2) at 1.00 atm?



2. What is the total pressure, in Kpa, when 720mmHg of Hydrogen (H2) is mixed with 350 torr of Oxygen (O2) and .753 atm of Helium (He)?

$$P_{H_2} = \frac{720\,mmHg \times 101.3\,kPa}{760\,mmHg} = 96.0\,kPa$$

$$P_{He} = \frac{.753\,atm \times 101.3\,kPa}{1\,atm} = 76.3$$

$$P_{O_2} = \frac{350\,torr \times 101.3\,kPa}{760\,\cancel{mmHg}\ torr} = 46.7\,kPa$$

$$P_T = P_{H_2} + P_{O_2} + P_{He} = \boxed{219\,kPa}$$

3. Assume that oxygen gas is being collected over water at 25°C. Write an equation for the pressure of oxygen gas (assume the pressure in the bottle is STP)

$$P_T = P_{O_2} + P_{H_2O}\,(25°C) \qquad P_T = 760\,mm\,Hg$$

or

$$P_T = 1\,atm$$

$$P_{O_2} = P_T - P_{H_2O}$$

$$P_{O_2} = 760\,mmHg - P_{H_2O}\,(25°C)$$

4. If 4.0 g of $O_2(g)$ and 4.0 g of He(g) are placed in a 5.0 L vessel at 65°C, what will be the partial pressure of each gas and the total pressure in the vessel (Hint: calculate the number of moles using molar mass)?

$$O_2 = 32.0\,g/mol \qquad He = 4.00\,g/mol$$

$$V = 5.0\,L \qquad T = 65 + 273 = 338\,K$$

$$n_{O_2} = \frac{4.0\,g\;/\,mol}{32.0\,g} = .125\,mol \qquad n_{He} = \frac{4.0\,g\;/\,mol}{4.0\,g} = 1.0\,mol$$

$$P_{O_2} = \frac{n_{O_2}RT}{V} \qquad P_{He} = \frac{n_{He}RT}{V}$$

$$P_{O_2} = \frac{.125\,mol\;.0821\,L\cdot atm\;338\,K}{5.0\,L\;mol\cdot K} \qquad P_{He} = \frac{1.00\,mol\;.0821\,L\cdot atm\;338\,K}{5.0\,L\;mol\cdot K}$$

$$P_{O_2} = .694\,atm \qquad P_{He} = \cancel{.624\,atm}$$

$$= 5.55\,atm$$

$$P_T = .694 + 5.55$$

$$\boxed{P_T = 6.24\,atm}$$