

## 5.6 Dalton's Law of Partial Pressures

Dalton's Law of Partial Pressure; "The total pressure of a gas is the sum of all its parts".

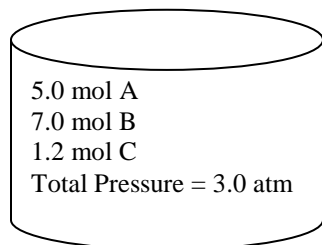
$$P_{\text{total}} = P_1 + P_2 + P_3 + P_n$$

Pressures are directly related to moles:

$$n_{\text{Total}} = n_1 + n_2 + n_3 + n_n + \dots$$

Example Problems:

1.)



What is the partial pressure of:

Total moles = 13.2 moles

$$P_A = (5/13.2) * 3.0 \text{ atm} = 1.1 \text{ atm}$$

$$P_B = 1.6 \text{ atm}$$

$$P_C = 0.27 \text{ atm}$$

2.) 75.0 ml of O<sub>2</sub> gas is collected over water at 23.0°C and 753 torr. Vapor Pressure of water is 21.05 mm Hg at 23.0°C. Calculate pressure of dry gas. ( $P_{\text{tot}} = 743 \text{ torr} = P_{\text{O}_2} + P_{\text{H}_2\text{O}}$ ;  $P_{\text{O}_2 \text{ dry}} = 743 - 21.05 = 722 \text{ torr}$ )

3.) How many molecules are in your lungs? Assume that the volume is 3 liters and the air pressure of 1 atm at 37°C.

$$\text{See P. 224, Table 5.4, } X_{\text{H}_2} = 5 \times 10^{-7} : n = \frac{(3\text{L})(5 \times 10^{-7} \times 1 \text{ atm})}{R(310\text{K})} = 9 \times 10^{-8} \text{ mol}$$

$$9 \times 10^{-8} \text{ mol (} 6.02 \times 10^{23} \text{ molecules)} = 5 \times 10^{16} \text{ molecules H}_2$$

4.) (P. 233 #59),  $n = 0.177 \text{ mol}$ ,  $P_{\text{CO}_2} = nRT/V = 1.09 \text{ atm}$ ,

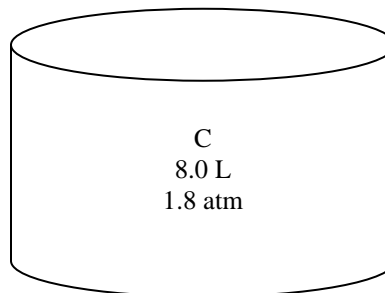
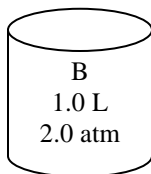
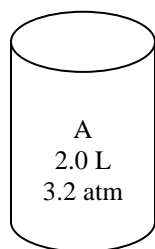
$$\text{b.) } 740/760 = 0.974 \text{ atm} + 1.09 \text{ atm} = 2.06 \text{ atm}$$

5.)  $\text{N}_{2(\text{g})} + 3\text{H}_{2(\text{g})} \longrightarrow 2\text{NH}_{3(\text{g})}$

1 atm N<sub>2</sub> + 4 atm H<sub>2</sub>. If reaction goes to completion, what is total pressure in tank?

$$\text{XS H}_2 \text{ by (4 atm H}_2 \text{ total need - 3 atm needed = excess 1 atm H}_2) + 2 \text{ atm NH}_3 = 3 \text{ atm}$$

6.) Tanks below are connected and allowed to mix. What is the partial pressure of each gas and the total pressure of the system when the valves are open?



Boyles' Law ( $P_1V_1 = P_2V_2$ ),  
Total volume = 7.0 L

$$P_A = \frac{(2.0\text{L})(3.2\text{atm})}{(3.2 + 2.0 + 1.8)} = 0.91\text{atm}$$

$$P_B = 0.29 \text{ atm}$$

$$P_C = 2.1 \text{ atm}$$

Homework: P. 221 #66, 68, 69, 72, 73, 74, 75, 104