Chapter 5 – Problem Set 2

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1. Calculate the molecular mass of a liquid that, when vaporized at 99[°C] and 716[TORR] gave 225[mL] of vapor with a mass of 0.773[g]. (1)

$$\begin{aligned} n &= \frac{PV}{RT} \\ &= .00694[\text{mol}] \\ m_{molar} &= \frac{.773}{.00694} \\ &= 111.4\left[\frac{\text{g}}{\text{mol}}\right] \end{aligned} \tag{1}$$

2. Calculate the density of ammonium dichromate at STP. (**??**)

$$\begin{aligned} m_{molar} &= 252\left[\frac{\text{g}}{\text{mol}}\right] \\ \frac{n}{V} &= \frac{1}{.0821 \cdot 273} \\ &= .0446\left[\frac{\text{mol}}{\text{L}}\right] \\ 252 \cdot .0446 &= 11.2\left[\frac{\text{g}}{\text{L}}\right] \end{aligned} \tag{2}$$

3. At what pressure will nitrogen have a density of $0.985\left[\frac{\text{g}}{\text{L}}\right]$ at 25[°C].

4. How many liters of CO_2 measured at 26[°C and 767[TORR] are produced in the combustion of 125[mL] of propanol ($d = 0.804\left[\frac{\text{g}}{\text{mL}}\right]$)?

5. Oxygen is collected over water (vapor pressure of water = 31.8[MMHG]) at 30[°C] and a barometric pressure of 742[TORR]. What is the partial pressure and mole fraction of oxygen?

6. What volume is occupied by 1.25[g] of oxygen saturated with water vapor at 25[°C] (vp water = 23.8[mmHg]) and a total pressure of 749[mmHg]?

7. A quantity of nitrogen gas originally held at 3.8[atm] in 1.0[L] container at 25[°C] is transferred to a 10.0[L] container at 20[°C]. A quantity of oxygen gas originally at 4.75[atm] and 26[°C] in a 5.0[L] container is transferred to the same container. What is the total pressure in the new container?

8. Nitrogen gas is held in a 2.0[L] container at 1.0[atm] and 25[°C]. Oxygen gas is held in another 3.0[L] container at 2.0[atm] and 25[°C]. The containers are then put together to allow both gases to mix. What is the partial pressure of each gas and the total pressure in the combined container?