

## Chapter 5 – Problem Set 2

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1. Calculate the molecular mass of a liquid that, when vaporized at  $99[^\circ\text{C}]$  and  $716[\text{TORR}]$  gave  $225[\text{mL}]$  of vapor with a mass of  $0.773[\text{g}]$ . (1)

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

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

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

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

$$\begin{aligned}\frac{1}{14} \cdot .985 &= \frac{P}{.0821 \cdot 298} \\P &= .86[\text{ATM}]\end{aligned}\tag{3}$$

4. How many liters of  $\text{CO}_2$  measured at  $26[^\circ\text{C}]$  and  $767[\text{TORR}]$  are produced in the combustion of  $125[\text{mL}]$  of propanol ( $d = 0.804 [\frac{\text{g}}{\text{mL}}]$ )? (??)

(4)

5. Oxygen is collected over water (vapor pressure of water =  $31.8[\text{MMHG}]$ ) at  $30[^\circ\text{C}]$  and a barometric pressure of  $742[\text{TORR}]$ . What is the partial pressure and mole fraction of oxygen?
6. What volume is occupied by  $1.25[\text{g}]$  of oxygen saturated with water vapor at  $25[^\circ\text{C}]$  (vp water =  $23.8[\text{MMHG}]$ ) and a total pressure of  $749[\text{MMHG}]$ ?
7. A quantity of nitrogen gas originally held at  $3.8[\text{ATM}]$  in  $1.0[\text{L}]$  container at  $25[^\circ\text{C}]$  is transferred to a  $10.0[\text{L}]$  container at  $20[^\circ\text{C}]$ . A quantity of oxygen gas originally at  $4.75[\text{ATM}]$  and  $26[^\circ\text{C}]$  in a  $5.0[\text{L}]$  container is transferred to the same container. What is the total pressure in the new container?
8. Nitrogen gas is held in a  $2.0[\text{L}]$  container at  $1.0[\text{ATM}]$  and  $25[^\circ\text{C}]$ . Oxygen gas is held in another  $3.0[\text{L}]$  container at  $2.0[\text{ATM}]$  and  $25[^\circ\text{C}]$ . 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?