

CHEM 150 – Fall 2013 – Problem Set #1

1. What is the mass of 1.38mols of: Ru atoms, Li atoms, Br₂ molecules, NCl₃ molecules?

$$\begin{aligned}(1.38\text{mols Ru})(101.07 \frac{\text{g Ru}}{\text{mol Ru}}) &= 139\text{g Ru} \\ (1.38\text{mols Li})(6.941 \frac{\text{g Li}}{\text{mol Li}}) &= 9.58\text{g Li} \\ (1.38\text{mols Br}_2)(159.808 \frac{\text{g Br}_2}{\text{mol Br}_2}) &= 221\text{g Br}_2 \\ (1.38\text{mols NCl}_3)(120.366 \frac{\text{g NCl}_3}{\text{mol NCl}_3}) &= 166\text{g NCl}_3\end{aligned}$$

2. How many moles are present in 28.419g of: sulfur dioxide, carbon atoms, magnesium atoms?

$$\begin{aligned}(28.419\text{g SO}_2) / (64.064 \frac{\text{g SO}_2}{\text{mol SO}_2}) &= 0.44360\text{g SO}_2 \\ (28.419\text{g C}) / (12.011 \frac{\text{g C}}{\text{mol C}}) &= 2.3661\text{g C} \\ (28.419\text{g Mg}) / (24.305 \frac{\text{g Mg}}{\text{mol Mg}}) &= 1.1693\text{g Mg}\end{aligned}$$

3. How many pieces (atoms or molecules) are present in 17.309g of: PCl₅, I₂, Si atoms, He atoms?

$$\begin{aligned}\{ (17.309\text{g PCl}_5) / (64.064 \frac{\text{g PCl}_5}{\text{mol PCl}_5}) \} (6.022 \times 10^{23} \frac{\text{PCl}_5 \text{ molecules}}{\text{mol PCl}_5}) &= 1.627 \times 10^{23} \text{ PCl}_5 \text{ molecules} \\ \{ (17.309\text{g I}_2) / (253.80 \frac{\text{g I}_2}{\text{mol I}_2}) \} (6.022 \times 10^{23} \frac{\text{I}_2 \text{ molecules}}{\text{mol I}_2}) &= 4.107 \times 10^{22} \text{ I}_2 \text{ molecules} \\ \{ (17.309\text{g Si}) / (28.086 \frac{\text{g Si}}{\text{mol Si}}) \} (6.022 \times 10^{23} \frac{\text{Si atoms}}{\text{mol Si}}) &= 3.711 \times 10^{23} \text{ Si atoms} \\ \{ (17.309\text{g He}) / (4.0026 \frac{\text{g He}}{\text{mol He}}) \} (6.022 \times 10^{23} \frac{\text{He atoms}}{\text{mol He}}) &= 2.604 \times 10^{24} \text{ He atoms}\end{aligned}$$

4. What is the pressure of a 3.916L sample of 0.6182mol of ideal gas at -16.92°C?

$$\begin{aligned}PV &= nRT \\ P(3.916\text{L}) &= (0.6182\text{mol})(0.08206 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}})(-16.92+273.15\text{K}) \\ P &= 3.319\text{atm}\end{aligned}$$

5. A sample of neon gas has a volume of 38.946L at 1.237atm and 19.32°C. If we assume that Ne is an ideal gas under these conditions, what is the mass of this sample?

$$\begin{aligned}PV &= nRT \\ (1.237\text{atm})(38.946\text{L}) &= n(0.08206 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}})(19.32+273.15\text{K}) \\ n &= 2.0073\text{mol Ne} \\ (2.0073\text{mol Ne})(20.180 \frac{\text{g Ne}}{\text{mol Ne}}) &= 40.51\text{g Ne}\end{aligned}$$