1. Titration of 5.0183 g of vinegar requires 43.50 mL of 0.1012 NaOH solution. What is the mass percent of acetic acid in the vinegar? (3 points)

Titration Reaction:
\[ \text{CH}_3\text{COOH}(aq) + \text{NaOH}(aq) \rightarrow \text{CH}_3\text{COONa}(aq) + \text{H}_2\text{O}(l) \]

Acetic acid
MW = 60.05 g/mol

\[ \frac{43.50 \text{ mL NaOH} \times 0.1012 \text{ mole NaOH}}{1000 \text{ mL}} \times \frac{1 \text{ mole CH}_3\text{COOH}}{1 \text{ mole NaOH}} \times \frac{60.05 \text{ g CH}_3\text{COOH}}{1 \text{ mole}} = 0.2644 \text{ g CH}_3\text{COOH} \]

\[ \% \text{ mass} = \frac{0.2644 \text{ g CH}_3\text{COOH}}{5.0183 \text{ g vinegar}} \times 100 = 5.268 \% \]

This is the calculation for Part B of Exp 15.

2. Sulfur (S\(_8\)) and chlorine (Cl\(_2\)) react to produce disulfur dichloride S\(_2\)Cl\(_2\) according to the balanced equation below. (4 points)

\[ \text{S}_8 + 4 \text{Cl}_2 \rightarrow 4 \text{S}_2\text{Cl}_2 \]

Molar Mass
256.48 g/mol
70.905 g/mol
135.04 g/mol

a. How many grams of S\(_2\)Cl\(_2\) can be made from 50.0 g of S\(_8\) and 75.0 g of Cl\(_2\)?

b. How many grams, and of which reactant, are left over when the reaction is complete?

\[ \frac{50.0 \text{ g S}_8 \times 1 \text{ mole S}_8}{256.48 \text{ g}} \times \frac{4 \text{ mole S}_2\text{Cl}_2}{1 \text{ mole S}_8} = 0.7798 \text{ mole S}_2\text{Cl}_2 \times \frac{135.04 \text{ g S}_2\text{Cl}_2}{1 \text{ mole}} = 105.3 \text{ g S}_2\text{Cl}_2 \text{ produced} \]

\[ \frac{75.0 \text{ g Cl}_2 \times 1 \text{ mole Cl}_2}{70.905 \text{ g}} \times \frac{4 \text{ mole S}_2\text{Cl}_2}{4 \text{ mole Cl}_2} = 1.058 \text{ mole S}_2\text{Cl}_2 \]

\[ \frac{50.0 \text{ g S}_8 \times 1 \text{ mole S}_8}{256.48 \text{ g}} \times \frac{4 \text{ mole Cl}_2}{1 \text{ mole S}_8} \times \frac{70.905 \text{ g Cl}_2}{1 \text{ mole}} = 55.29 \text{ g Cl}_2 \text{ consumed} \]

\[ 75.0 \text{ g} - 55.29 \text{ g} = 19.7 \text{ g Cl}_2 \text{ leftover} \]

3. 1.25 g of PbS(s) is reacted with excess O\(_2\) according to the balanced equation below. If the reaction proceeds with 75.0% yield, how many grams of PbO(s) will be produced? (3 points)

\[ 2 \text{PbS(s)} + 3 \text{O}_2(g) \rightarrow 2 \text{PbO(s)} + 2 \text{SO}_2(g) \]

\[ 1.25 \text{ g PbS} \times \frac{1 \text{ mole PbS}}{239.266 \text{ g}} \times \frac{2 \text{ mole PbO}}{2 \text{ mole PbS}} \times \frac{233.199 \text{ g PbO}}{1 \text{ mole}} = 1.166 \text{ g PbO} \times 0.75 = 0.875 \text{ g PbO} \text{ yield} \]