Please show all work for partial credit

1. (10 points) Perform the following calculations and report your answers with the correct number of significant figures

   a. \( \frac{23.7}{0.0056} = 4,232.14 \ldots \) .0056 has 2 sig fig so round to 2 sig fig: **4200**

   b. \( 56.7 \times 0.1056 = 5.98752 \ldots \) 56.7 has 3 sig fig so round to 3 sig fig: **5.99**

   c. \( 0.2355 - 0.3 = 0.2355 - 0.3 \)
     \[ = 0.1 \] .0645 But digits past the tenths place are incorrect so:
     \[ = 0.1 \]

   d. \( 2.0 \times 10^{-3} - 0.001 = 0.001 \) or **1 \times 10^{-3}**

   e. \( \frac{2300 - 576}{873.5} = 1.97367 \)
     
     \[ \begin{array}{c}
        2300 \\
        -576 \\
        \hline
        1724,
        \text{but digits past the hundreds place are incorrect so:}
        \text{1700 with 2 sig fig is the correct way to express this number}
      \end{array} \]

     Final answer should therefore have 2 sig fig, and you should round UP to **2.0**

2. (10 points) Perform the following unit conversions.

   a. 536 mm to nm
     \[ 536 \text{ mm} \times \frac{1 \times 10^{-3} \text{ m}}{1 \text{ mm}} \times \frac{1 \text{ nm}}{1 \times 10^{-9} \text{ m}} = 536 \times 10^6 \text{ nm} \]

   b. 15 ounces to grams
     \[ 15 \text{ oz} \times \frac{1 \text{ lbs}}{16 \text{ oz}} \times \frac{1 \text{ kg}}{2.2046 \text{ lbs}} \times \frac{1000 \text{ g}}{1 \text{ kg}} = 425 \text{ g} \]

   c. 15 lbs/in² to g/cm²
     \[ \frac{15 \text{ lbs}}{\text{in}^2} \times \frac{1 \text{ kg}}{2.2046 \text{ lbs}} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ in}}{2.54 \text{ cm}} \times \frac{1 \text{ in}}{2.54 \text{ cm}} = 1.055 \text{ g/cm}^2 \]
3. (10 points) Name the following compounds
   a. MgBr\(_2\) Magnesium bromide
   b. Li\(_2\)SO\(_4\) Lithium sulfate
   c. HBr Hydrogen monobromide or hydrobromic acid
   d. N\(_2\)F\(_4\) Dinitrogen tetrafluoride
   e. ClF\(_3\) Chlorine trifluoride

4. (10 points) Give the correct chemical formulas for the following compounds
   a. potassium oxide \(K_2O\)
   b. copper(IV) sulfate \(Cu(SO_4)_2\)
   c. nitrous acid \(HNO_2\)
   d. sulfur difluoride \(SF_2\)
   e. chlorine monoxide \(ClO\)

5. (10 points) Give the % composition for each of the elements in the compound Mg(OH)\(_2\)
   \[\begin{align*}
   1 \text{ Mg} &= 1 \times 24.305 = 24.305 \\
   2 \text{ O} &= 2 \times 15.999 = 31.998 \\
   2 \text{ H} &= 2 \times 1.007 = 2.014 \\
   \text{Total} &= 58.317 \\
   \% \text{Mg} &= 24.305/58.317 = 41.677 \% \text{ Mg} \\
   \% \text{ O} &= 31.998/58.317 = 54.869 \% \text{ O} \\
   \% \text{ H} &= 2.014/58.317 = 3.454 \% \text{ H} \\
   \text{Total of % is 100.000, close enough for me}
   \end{align*}\]
6. (10 points) A compound has a molecular weight of 407.68, and it contains 6.62% aluminum and 93.38% iodine. What is the molecular formula of the compound?

1 mole of compound will weigh 407.68 g so
1 mole of compound will contain
407.68 g \times 0.0662 = 26.99 g Al
407.68 g \times 0.9338 = 380.69 g I

26.99 g Al = 26.99 g / (26.98 g Al/mol Al) = 1 mol Al
380.69 g I = 380.69 / (126.9 g I/mol I) = 3 mol I

So molecular formula is AlI₃

7. Balance the following chemical equation:

\[ 2\text{NH}_3(g) + \frac{5}{2}\text{O}_2(g) \rightarrow 2\text{NO}(g) + 3\text{H}_2\text{O}(g) \]

H \quad 3 \quad 2
adjust \times 2 \quad \times 3
N \quad 2 \quad 1
adjust \times 2

2 \quad 2 \quad 3
adjust \times \frac{5}{2}

Multiply entire equation by 2 to get rid of the fraction
\[ 4\text{NH}_3(g) + 2\text{O}_2(g) \rightarrow 4\text{NO}(g) + 6\text{H}_2\text{O}(g) \]

8. I am going to perform the following reaction in the lab:

\[ \text{C}_3\text{H}_8(g) + 5\text{O}_2 \rightarrow 3\text{CO}_2(g) + 4\text{H}_2\text{O}(g) \]

a. If I have 5 g of C\textsubscript{3}H\textsubscript{8}, how many grams of O\textsubscript{2} will I need for this reaction?

\[
5 \text{ g } \text{C}_3\text{H}_8 \times \frac{1 \text{ mole } \text{C}_3\text{H}_8}{44 \text{ g } \text{C}_3\text{H}_8} \times \frac{5 \text{ mole } \text{O}_2}{1 \text{ mole } \text{C}_3\text{H}_8} \times \frac{32 \text{ g } \text{O}_2}{1 \text{ mole } \text{O}_2} = 18.18 \text{ g } \text{O}_2
\]

b. If I have 5 g of C\textsubscript{3}H\textsubscript{8} and an excess of O\textsubscript{2}, how many grams of CO\textsubscript{2} will this reaction produce?

Excess O\textsubscript{2} insures that C\textsubscript{3}H\textsubscript{8} is limiting reagent so:

\[
5 \text{ g } \text{C}_3\text{H}_8 \times \frac{1 \text{ mole } \text{C}_3\text{H}_8}{44 \text{ g } \text{C}_3\text{H}_8} \times \frac{3 \text{ mole } \text{CO}_2}{1 \text{ mole } \text{C}_3\text{H}_8} \times \frac{44 \text{ g } \text{CO}_2}{1 \text{ mole } \text{CO}_2} = 15 \text{ g } \text{CO}_2
\]
9. Consider the reaction:
   \( \text{Mg}(s) + \text{I}_2(s) \rightarrow \text{MgI}_2(s) \)

   If I have 2 g each of Mg and \( \text{I}_2 \), which is the limiting reagent?

   \[
   2 \text{ g Mg} \times \frac{1 \text{ mole Mg}}{24.305 \text{ g Mg}} \times \frac{1 \text{ mole MgI}_2}{1 \text{ mole Mg}} = 0.0823 \text{ mole MgI}_2
   \]

   \[
   2 \text{ g I}_2 \times \frac{1 \text{ mole I}_2}{2538 \text{ g I}_2} \times \frac{1 \text{ mole MgI}_2}{1 \text{ mole I}_2} = 0.00788 \text{ mole MgI}_2
   \]

   \( \text{I}_2 \) yields smaller amount of product so it is the limiting reagent

10. Aluminum burns in bromine in the following reaction:

   \( 2\text{Al}(s) + 3\text{Br}_2(l) \rightarrow 2\text{AlBr}_3(s) \)

   If I start with 7.0 g of aluminum and an excess of Bromine, and I have a final yield of 50.3 g aluminum bromide, what was the percent yield for my reaction.

   Excess \( \text{Br}_2 \) so Al must be limiting reagent

   \[
   7 \text{ g Al} \times \frac{1 \text{ mole Al}}{26.981 \text{ g Al}} \times \frac{2 \text{ mole AlBr}_3}{2 \text{ mole Al}} \times \frac{266.68 \text{ g AlBr}_3}{1 \text{ mole AlBr}_3} = 69.188 \text{ g AlBr}_3
   \]

   \% yield = \( \frac{50.3 \text{ g}}{69.188 \text{ g}} \times 100\% = 72.7\% \) yield