Marathon Problems

Unit: Stoichiometry

MA Curriculum Frameworks (2016): HS-PS1-2, HS-PS1-7, HS-PS2-8(MA)

Mastery Objective(s): (Students will be able to…)

- Solve challenging problems that combine several aspects of chemistry.

Success Criteria:

- Problems correctly utilize strategies from various topics throughout the year.
- Solutions use the equation appropriate for the information given.
- Solutions have the correct quantities substituted for the correct variables.
- Algebra and rounding to appropriate number of significant figures is correct.

Language Objectives:

- Explain what each part of each problem is asking and which topic it relates to.

Notes:

These are intentionally challenging problems that relate topics we studied throughout the year, including gas laws, solutions & concentration, solubility, naming compounds and writing formulas, predicting products, activity series, balancing equations, stoichiometry, limiting reactant, and percent yield.

A couple of the answers are provided so you can check your work at key points in the process, but you're on your own for the rest!

Use this space for summary and/or additional notes:

Homework Problems

1. 0.75 L of 2.5 M sodium phosphate is mixed with 1.25 L of 2.0 M calcium chloride.

    a. Predict the products, write and balance the chemical equation.

    b. Use your solubility rules to determine whether a chemical reaction happens based on whether a precipitate forms.
    (*If no reaction happens, you may skip the rest of this question. Hint: a reaction <u>does</u> happen.* ☺)

    c. Calculate the number of moles of each reactant and determine which one is limiting.

    d. How many *grams* of the precipitate are produced?

    Answer: 260 g

    e. If 150. g of precipitate was recovered on the filter paper, what is the percent yield?

    f. If one of the products remains in solution (*Hint: it does.*), what is its concentration in $\frac{\text{mol}}{\text{L}}$?
    (*Hint: you will need to add the volumes of the two solutions that you started with to find the total volume.*)

Use this space for summary and/or additional notes:

2. In a laboratory experiment 115 g of sulfur (S_8) was reacted with 89.6 L of oxygen gas (O_2) at S.T.P., in a synthesis reaction, producing only compound *X*. This compound contains 50 % sulfur by mass, and its empirical formula is the same as its molecular formula.

    a. Use percent composition data to determine the chemical formula of compound *X*.

    b. Write a balanced chemical equation for the reaction.

    c. Which of the reactants was limiting?

    d. What is the theoretical yield of compound *X*, in grams?

    Answer: 229 g

    e. If 189 g of compound *X* was actually recovered, what was the percent yield of *X*?

    Answer: 82.4 %

Use this space for summary and/or additional notes: