Stoichiometry   Name_____

Welcome to Mole Island

Read from **Lesson 2: Relating Stoichiometric Quantities** in the **Chemistry Tutorial Section, Chapter 9** of **The Physics Classroom**:

Part a: Mole-to-Mole Relationships   Part b: Mole-to-Mass   Part c: Mass-to-Mass Relationships

Stoichiometry problems revolve around two main aspects: the information provided (the given) and the information to be determined (the unknown). Both the given and unknown may be reactants, products, or a mix of the two. Quantities of these substances can be expressed in either moles or grams.

The Mole Island graphic organizer (shown below) can be used to develop a conversion plan between the given quantity and the unknown quantity. Identify the location of the given quantity—grams or moles of reactant or product—on the diagram. Identify the location of the unknown quantity—grams or moles of reactant or product. The arrows show the conversion pathway. If there are two arrows between the given and the desired quantities, then the solution to the problem will require two conversion steps.
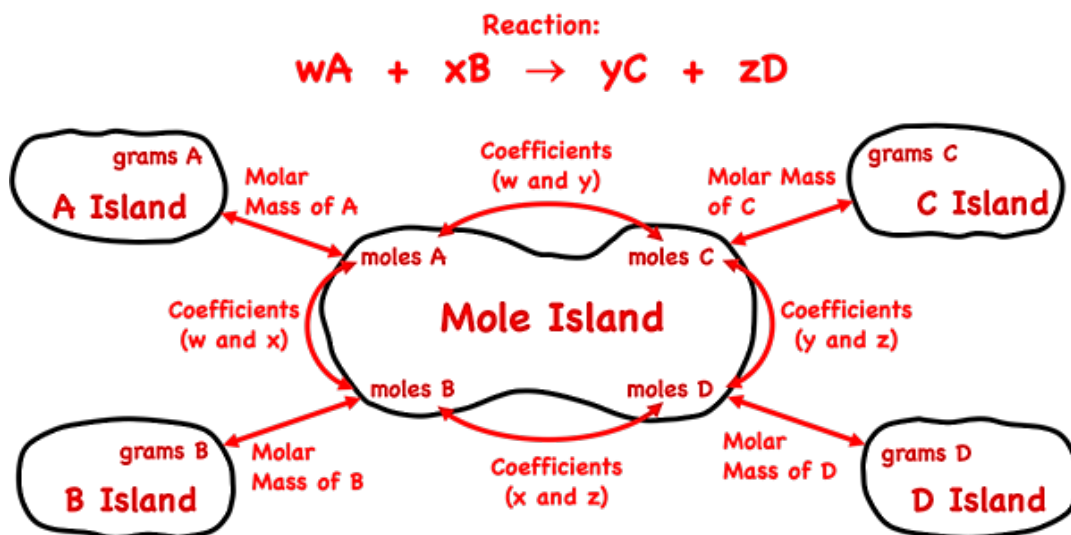
Problems: First, plot out a plan using Mole Island. Then use dimensional analysis or the factor label method to show all work as you solve each problem. Remember to include units and the correct number of sig figs.

1. Sodium sulfate reacts with aluminum nitrate to form aluminum sulfate and sodium nitrate.
   a. Write out the balanced equation with the correct formulae and coefficients.

   b. If 13.14 moles of aluminum nitrate react, how many moles of sodium nitrate will form?

   c. If 14.2 g of sodium sulfate reacts, how many moles of aluminum nitrate are required to completely use it up?

   d. If 1.00 kg of aluminum sulfate needs to be produced, how many grams of aluminum nitrate are required?

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2. Potassium chloride is used in fertilizers and as a salt substitute. It is produced when potassium chlorate decomposes into potassium chloride and oxygen. For the production of one ton (907 kg) of potassium chloride:
    a. Write out the balanced equation with the decomposition of potassium chlorate to potassium chloride and oxygen. Use the correct formulae and coefficients.

    b. How many grams of potassium chlorate are needed to produce 907 kg of potassium chloride?

    c. If 907 kg of potassium chloride is produced, how many moles of oxygen molecules are produced as well?

    d. If 907 kg of potassium chloride is produced, how many oxygen molecules are produced?

3. Every biology student knows that green plants make their own food through photosynthesis. (Thank goodness for chemistry!) In plants, this reaction of carbon dioxide and water produces glucose ($C_6H_{12}O_6$) and oxygen.
    a. Write out the balanced equation with the correct formulae and coefficients.

    b. A mature tree can absorb approximately 48 pounds (21.8 kg) of carbon dioxide per year. How many moles of glucose can be produced from this amount of carbon dioxide?

    c. How many grams of water are needed to react with 21.8 kg of carbon dioxide in a photosynthesis reaction?

    d. How many grams of oxygen molecules can be produced by this tree when the 21.8 kg of carbon dioxide react in a photosynthesis reaction?