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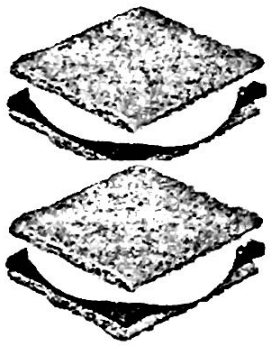

(*) Cu+S example

S'more Stoichiometry

Definitions: 'Stoichio' means element and 'metry' means the process of measuring. The mass and quantity relationships among reactants and products in a reaction are found using the process of stoichiometry.

Problem:

1) If you are given one bag of large marshmallows, what is the maximum number of S'mores that can be made?
2) How many boxes of graham crackers and how many chocolate bars are needed to make this many S'mores?

1st Step: Write a chemical equation using the following symbols:

Substance	Symbol	Unit Mass
Graham Cracker	S	7.00 g
Marshmallow	Mm	7.10 g
Chocolate Pieces	Or	3.30 g
S'more	$SMmOr_3$	24.0 g

Calculate the unit mass of the S'more ($SMmOr_3$)below:

$S\ Mm\ Or_3$

$7.00g\ \ 7.10g\ \ 3\times3.30g$

$= 24.0g$

2nd Step: Balance the equation: What does the equation tell us? What do the coefficients represent?

$$1S + 1Mm + 3Or \rightarrow SMmOr_3$$

*Count, NOT mass!

They represent the ratio of the reactants or the products.

3rd Step: Calculating the number of units (or moles) given:

Determine the number of unit marshmallows that are available in the bag. If there are 454 g marshmallows in one bag, how many marshmallows do you have?

$$454g \frac{1\ m}{7.10\ g} = 63.94\ marshmallows$$

4th Step: Finding the units of other substances in the reaction:

Now, determine how many units of graham crackers and chocolate segments are needed to make the maximum number of s'mores available.

	1 Mm	+ 1S	+ 3Or	→ 1SMmOr$_3$
Before	63.94	?	?	0
Change	−63.94	-63.94 / $63.94 \times \frac{1}{1}$ =	-191.82 / $63.94 \times \frac{3}{1}$ =	$+63.94$ / $63.94 \times \frac{1}{1}$ =
After	0	0	0	63.94

5th Step: Convert your number of graham crackers and chocolate segments into mass (gram) values:

When you go to the store, you cannot quickly determine the exact number of graham crackers or chocolate segments there are in a box or bar. The mass is easy to read, however. Using mass values, you can quickly determine how much you need to buy.

$$63.94\ 8 \times \frac{7.00\,g}{1\ 8} = 447.58\,g \text{ of } S$$

$$191.82\ 3 \times \frac{3.30\,g}{1\ 3} = 633.01\,g \text{ of } Or$$

6th Step: Finally-convert the masses into your needed units.

In this case, if a box of graham crackers has a mass of 254 g, how many boxes do you need? Also, if one chocolate bar has a mass of 49.5 g, how many bars do I need?

$$447.58\,g \times \frac{1\ box}{254\,g} = 1.76 \text{ boxes of } S$$

$$633.5\,g \times \frac{1\ bar}{49.5\,g} = 12.80 \text{ bars of } Or$$

mass ≠ count

Now we will transfer this process into the language of chemical reactions. If we were to add a piece of solid Cu to an aqueous solution of silver nitrate, the Silver would be replaced in a single replacement reaction forming aqueous copper (II) nitrate and solid silver. How much silver is produced if 15.00 grams of Cu is added to the solution of excess silver nitrate? Show all work and don't forget to use significant figures.

Steps 1 and 2: Write and balance the chemical equation:

$$1\,Cu + 2\,AgNO_3 \longrightarrow 1\,Cu(NO_3)_2 + 2\,Ag$$

Step 3: Convert g Cu to moles Cu:

$$15.00\,g\ Cu \ \frac{1\ mol\ Cu}{63.55\,g} = 0.236\ mol\ Cu$$

Step 4: Convert moles of Cu to moles of Ag produced:

	$1Cu$	$+\ 2\,AgNO_3$	$\longrightarrow$	$1\,Cu(NO_3)_2$	$+\ 2Ag$
B	0.236	XS		0	0
C	-0.236	-0.472 $0.236 \times \frac{2}{1} =$		$+0.236$ $0.236 \times \frac{1}{1} =$	$+0.472$ $0.236 \times \frac{2}{1} =$
A	0	XS		0.236	(0.472)

Step 5: Convert moles Ag to grams of Ag produced:

$$0.472\,mol \ \frac{107.87\,g}{1\ mol\ Ag} = 50.91\ g\ Ag$$

Step 6: If silver metal sells for $4.50/ounce, could you get rich from this lab? (How much would it be worth?) Conversion factor: (1 gram = 0.0353 oz)

$$50.91\,g\ Ag \ \frac{0.0353\,oz}{1\,g} = 1.80\,oz$$

$$1.80\,oz \ \frac{\$4.50}{1\,oz} = \$8.10$$