



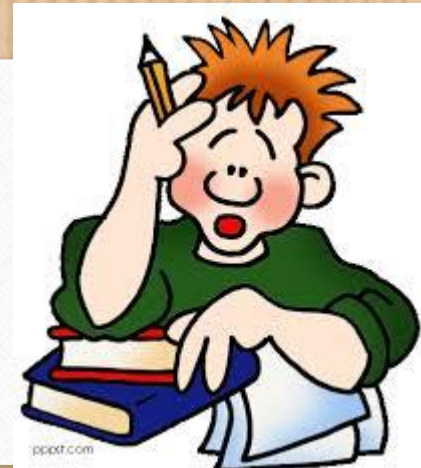
Stoichiometry

Mrs. Page

Chem. 10



What is Stoichiometry?



- The study of chemistry that looks at the relationship between the mass of the reactants and products in a chemical reaction.
- Uses chemical equations and mole calculations to look at the relationship between reactants and products.

How does this relate to my life?

Chewy Peanut Butter Chocolate Chip Cookies Recipe for 24 cookies

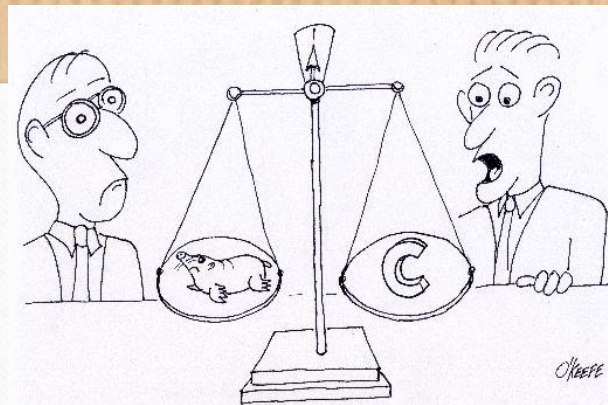
1/2 cup butter
1/2 cup peanut butter
1 cup brown sugar
1/2 cup white sugar
2 eggs
2 TBSP corn syrup
2 TBSP water
2 tsp vanilla
2 1/2 cups flour
1 tsp baking soda
1/2 tsp salt
2 cup choc. Chips

You want to make as many cookies as possible but you only have 7 eggs. How many cookies can you make?

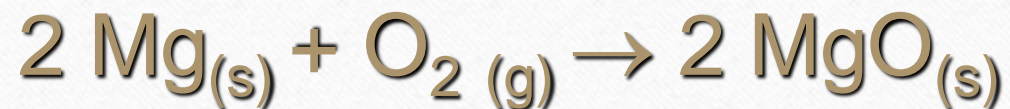
$$\cancel{7 \text{ eggs}} \cdot \frac{24 \text{ cookies}}{\cancel{2 \text{ eggs}}} = 84 \text{ cookies}$$



Mole Ratios



That's not what I meant by one mole of carbon.



- The coefficients of a **BALANCED** chemical equation tell us the **MOLE RATIO** of the reactants and the products
- In this reaction: 2 moles of magnesium metal react with 1 mole of oxygen gas to produce 2 moles of magnesium oxide

Tell the mole ratios for the following reactions

- $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$
- $\text{Cu} + 2\text{AgNO}_3 \rightarrow 2\text{Ag} + \text{Cu}(\text{NO}_3)_2$
- $4\text{NH}_3 + 5\text{O}_2 \rightarrow 6\text{H}_2\text{O} + 4\text{NO}$
- $\text{C}_4\text{H}_{10} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ **(CAREFUL!)**





Steps to Solving Stoichiometry Problems

1. Write a balanced equation.
2. Identify known & unknown.
3. Line up conversion factors
 - Mole ratios mole \leftrightarrow mole (from balanced equation)
 - Molar mass (Mr) mole \leftrightarrow grams (periodic table)
 - Avogadro mole \leftrightarrow molecules/atoms/f. units
4. Check you solution

How many moles of $\text{KClO}_{3(aq)}$ must decompose in order to produce 9 moles of oxygen gas?



- Balance the Equation
- Start with what you know
- Set up conversions
- Calculate & Check

$$\frac{9 \text{ mol } \text{O}_2}{3 \text{ mol } \text{O}_2} \times \frac{2 \text{ mol } \text{KClO}_3}{3 \text{ mol } \text{O}_2}$$

6 mol KClO_3



Mass Stoichiometry

How many grams of silver will be formed from 12.0 g copper?



- Balance the Equation
- Start with what you know
- Set up conversions
- Calculate & Check

12.0 g Cu	1 mol Cu	2 mol Ag	107.87 g Ag
	63.55 g Cu	1 mol Cu	1 mol Ag

40.7 g Ag



a) How many moles of H_2O can be made using 0.5 mol NH_3 ?



- Balance the Equation
- Start with what you know
- Set up conversions
- Calculate & Check

0.5 mol NH_3		6 mol H_2O
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		4 mol NH_3

0.8 mol H_2O



b) what mass of NH_3 is needed to make 1.5 mol NO ?

- Balance the Equation
- Start with what you know
- Set up conversions
- Calculate & Check

1.5 mol NO		4 mol NH₃		17.03 g NH ₃
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		4 mol NO		1 mol NH₃

26 g NH₃



c) how many grams of NO can be made from 120.0 g of O_2 ?

- Balance the Equation
- Start with what you know
- Set up conversions
- Calculate & Check

120.0 g O_2	1 mol O_2	4 mol NO	30.01 g NO
	32.00 g O_2	5 mol O_2	1 mol NO

90.02 g NO



Your Turn

Follow the rules for significant digits. Show all calculations.

- $$\text{C}_4\text{H}_{10} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$$
 - what mass of O_2 will react with 400.0 g C_4H_{10} ?
 - how many moles of water are formed in a)?
- $$\text{HCl} + \text{Al}(\text{OH})_3 \rightarrow \text{H}_2\text{O} + \text{AlCl}_3$$

How many grams of aluminum hydroxide will react with 5.3 moles of HCl?
- $$\text{Ca}(\text{ClO}_3)_2 \rightarrow \text{CaCl}_2 + \text{O}_2$$

What mass of O_2 results from the decomposition of 1.00 kg of calcium chlorate?
- The reaction of Ca with water can be predicted using the activity series. What mass of water is needed to completely react with 2.35 g of Ca?



More Practice Problems

Follow the rules for significant digits. Show all calculations.



- How many moles of carbon monoxide are required to react with 163.0 g of iron(III) oxide?
- How many grams of CO_2 are produced from a reaction that also produces 23.9 grams of Fe?



- how many moles of copper(II) nitrate can be prepared from 17.0 moles of Cu?
- how many grams of copper(II) nitrate can be prepared using 3.8 moles of HNO_3 ?
- what mass of water results from the reaction of 8.50 kg of copper metal?