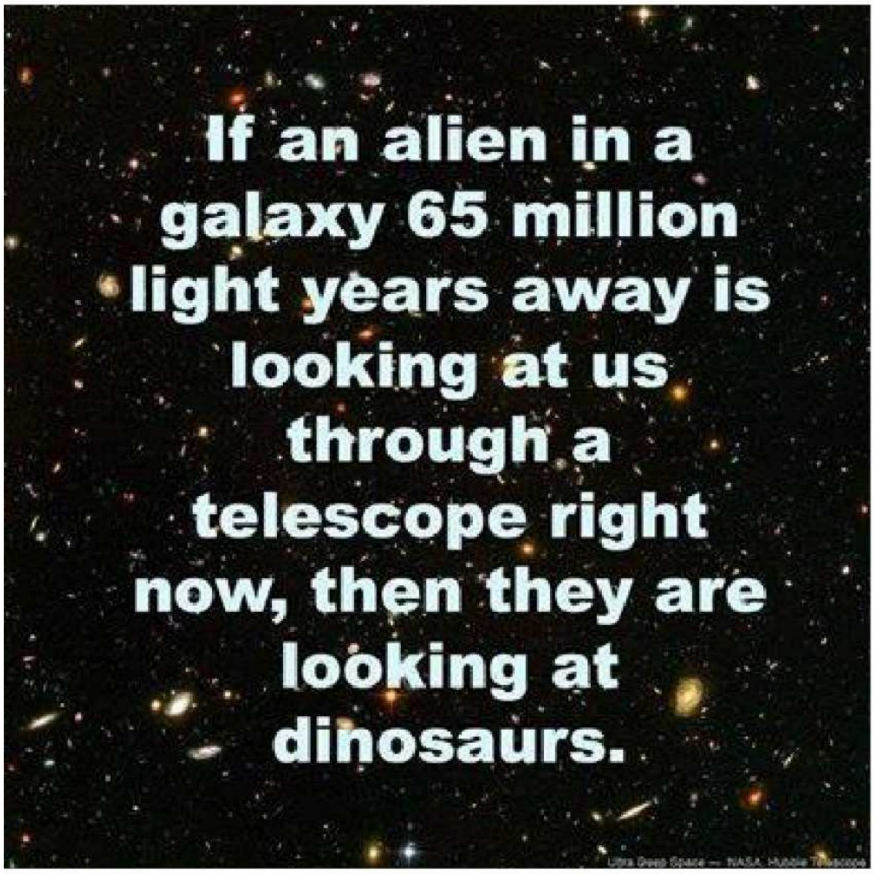

If an alien in a galaxy 65 million light years away is looking at us through a telescope right now, then they are looking at dinosaurs.

Good Morning:

Please take out your notebook, a pencil, and your calculator.

Please write the balanced equation for the silver nitrate and copper lab in your notebook.

Grab a handout from the front desk.

STOICHIOMETRY

- the study of the quantitative aspects of chemical reactions.

Chapter 12: Stoichiometry

What we know

- Ch. 10: Chemical Quantities
  - The Mole and Dimensional Analysis
    Reference Eqns
  - Percent Composition and Empirical Formulas
- Ch. 11: Chemical Reactions
  - Types of Chemical Reactions
  - Balancing Chemical Reactions

Stoichiometry

- Apply previous knowledge of molar quantities and balancing reactions.
- Chemicals can be measured in many ways. We will now use balanced equations to make sense of different types of chemical quantities using dimensional analysis.

If I have 1 mole of $AgNO_3$, how many moles of silver are produced?

K_0° 1 mol $AgNO_3$

U_0° # mol Ag

$$\frac{1 \text{ mol } AgNO_3}{1} \times \frac{2 \text{ mol Ag}}{2 \text{ mol } AgNO_3} = 1 \text{ mol Ag}$$

If I have 1 mole of Cu, how many moles of $Cu(NO_3)_2$ would be produced?

Ko 1 mol Cu

Uo _ mol $Cu(NO_3)_2$

$$\frac{1 \text{ mol Cu}}{1} \times \frac{1 \text{ mol } Cu(NO_3)_2}{1 \text{ mol Cu}} = 1 \text{ mol } Cu(NO_3)_2$$

Ingredients Edit and Save

Original recipe makes 2 dozen Change Servings

- [ ] 1 cup butter flavored shortening
- [ ] 3/4 cup white sugar
- [ ] 3/4 cup brown sugar
- [ ] 2 eggs
- [ ] 2 1/4 cups all-purpose flour
- [ ] 1 teaspoon baking soda
- [ ] 1 teaspoon salt
- [ ] 2 cups milk chocolate chips

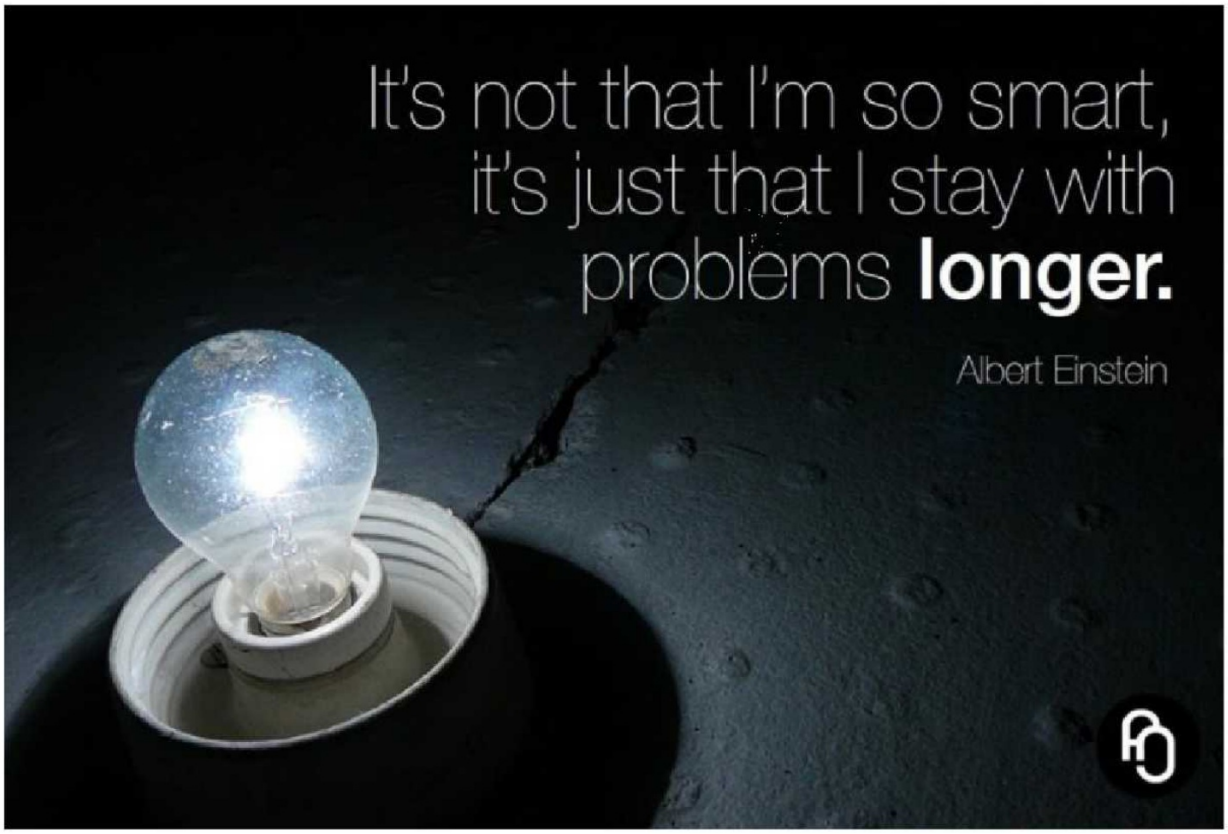
Converting Cookies

Recipe: 24 Cookies

- 1 C shortening
- 3/4 C White Sugar
- 3/4 C Brown Sugar
- 2 Eggs
- 2.25 C Flour
- 1 tsp Baking Soda
- 1 tsp salt
- 2 C Chocolate Chips

How much flour would I want to use to make 36 cookies?

How many cookies can I make with 2 cups of brown sugar?


It's not that I'm so smart,
it's just that I stay with
problems longer.
Albert Einstein

Four Steps to Stoichiometry

- Step 1: Write a balanced chemical equation. write ref eqns for KE U
- Step 2: Convert the **given** to moles.
- Step 3: Establish a ratio of reactants and products. or K E U K

coefficients in balanced chem eqn

- Step 4: Convert the moles of the unknown into the unit that the question asks for.

Mass to Moles to Mass

- 2) What mass of sodium chloride is produced when chlorine reacts with 0.29 g of sodium iodide?
- Step 1: Write a balanced chemical equation.
- $Cl_2+2NaI--->2NaCl+I_2$

- $Cl_2+2NaI--->2NaCl+I_2$
  - Step 2: Convert the **given** to moles.
  - 0.29 g of NaI = 0.0019 moles

- $Cl_2+2NaI--->2NaCl+I_2$

- Step 3: Establish a ratio of reactants and products.
- For every 2NaI of reactants there are 2NaCl. Therefor, it is a 2 to 2 or 1 to 1 ratio.
- For every one mole of NaI of reactants, there will be one mole of NaCl produced.

- $Cl_2+2NaI--->2NaCl+I_2$
  - Step 4: Convert the moles of the unknown into the unit that the question asks for.
  - In this case: grams of NaCl produced.
  - 0.00193 moles of NaCl weighs 0.1131 g.

Grams to Moles to Liters

- 11) How many liters of oxygen are necessary for the combustion of 425 g of sulfur, assuming the reaction occurs at STP?
- Step 1: Balanced Equation
- $S+O_2--->SO_2$

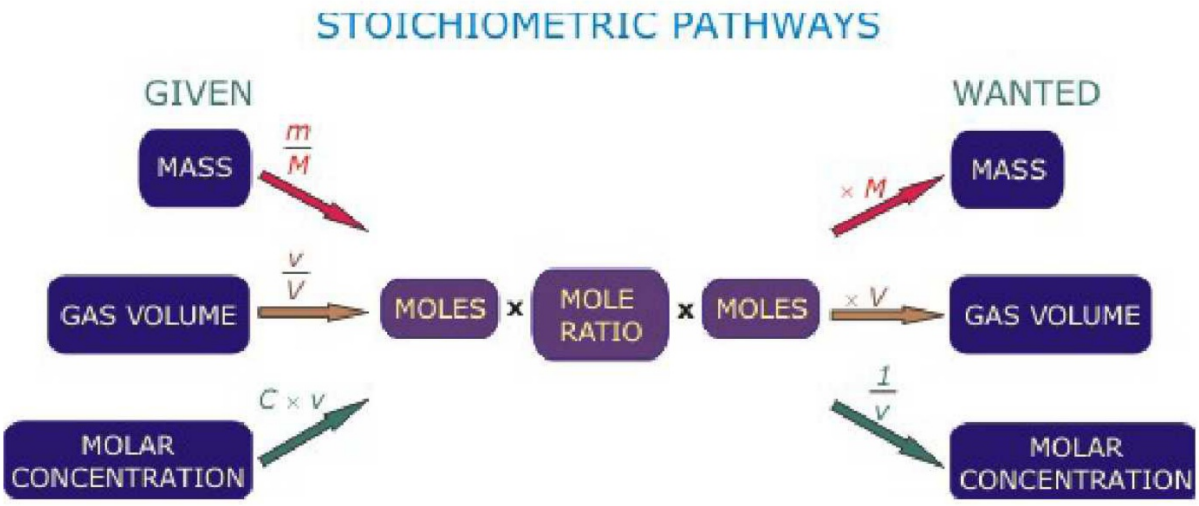
- $S+O_2--->SO_2$
  - Step 2: convert the **given** to moles.
  - 425 g S = _____ moles S

- $S+O_2--->SO_2$

  - Step 3: Establish a ratio of knowns and unknowns.
  - For every mole of S, you need one mole of O_2.

- $S+O_2--->SO_2$
  - Step 4: Convert the moles of the unknown into the unit that the question asks for.
  - 13.3 moles of O_2 has a volume of _____L.

297L of oxygen gas



Stoichiometry Map

Do Now:

Please take out your homeowork.

Check your answers on the side of the room.

Grab a whiteboard and write down the number of the problem that you would like me to go over.

Requested Homework:

Molar Ratio Differences

- 12) Find the mass of benzene required to produce 2.66 L of carbon dioxide gas at STP.
- Equation given. Balance it

$C_6H_6+O_2-->H_2O+CO_2$

$2C_6H_6 + 15O_2 \rightarrow 6H_2O + 12CO_2$

- Step 2: convert the **given** to moles.
- 2.66 L of CO_2 = _____ moles.

$2C_6H_6 + 15O_2 \text{--->} 6H_2O + 12CO_2$

- Step 3: Establish a ratio of knowns and unknowns.
- For every 12 moles of CO_2, there are 2 moles of C_6H_6.
- Therefor, for every 6 moles of CO_2, there is one mole of C_6H_6.
- How many moles of C_6H_6_____?

$2C_6H_6+15O_2--->6H_2O+12CO_2$

- Step 4: Convert the moles of the unknown into the unit that the question asks for.
- For the mass of 0.0198 moles C_6H_6 =_____g.

Ask Questions:

You and your partner will make up your own stoichiometry problem.
Put it on a whiteboard and solve it in your notes.
Trade boards with another group.
Check to see if they come up with the same ansewer.

12.3: Limiting Reagent and % Yield

- It is rare in real life that a chemical reaction uses all of the reactants completely.
- It is important to be able to determine how much of each of the reactants is used.

Limiting Reactant

- In a reaction, if one of the chemicals is used up, the reaction cannot continue.
- The chemical that limits the reaction from continuing is the limiting reactant.

See other presentation

Excess Reactant

- Likewise, there is often a chemical in a reaction that does not get completely used up.
- The chemical that there is an excess of after the reaction is complete is the excess reactant.

Example

- 18 g of Al reacts with 70 g of HCl in a single replacement reaction.
  - a) Determine the limiting and excess reactants.
  - b) Determine the mass of AlCl formed in the reaction.
  - c) Determine the mass of excess reactant when the reaction stops.

Balance the Equation

Convert to Moles

- Moles of Al in 18 g:_____
- Moles of HCl in 70 g:_____

Mole Ratio

- $2Al+6HCl--->2AlCl_3+3H_2$
- For every 2 moles of Al, I need 6 moles of HCl. Therefor, the ratio of Al to HCl is _____.

Limiting and Excess Reactants

- Based on our calculations, the limiting reactant is _____ because _____.
- Based on our calculations, the excess reactant is _____ because _____.

Mass of AlCl formed

- $2Al+6HCl\text{--->}2AlCl_3+3H_2$
- Determine the mass of $AlCl_3$ formed.

Mass of excess reactant

- Mass of the excess reactant _____g.