

Chemistry - Chapter 12 Review

1. What is stoichiometry?

Branch of chemistry dealing with calculations of quantities in chemical reactions.

2. Why do we balance a chemical equation? How do we use the information? How does it relate to the Law of Conservation of Mass?

- shows equal #s of atoms on both sides of equation, satisfies law of cons. of mass, = atoms, = mass
- use info to determine amount of product formed, amount of reactant needed

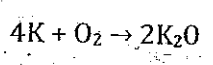
3. What two quantities are conserved in a chemical reaction?

Mass : atoms

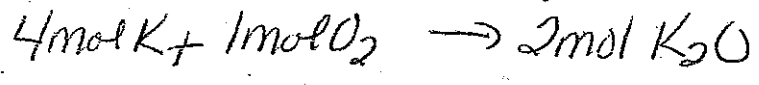
4. What are the representative particles of the following:

- a. KCl formula units
- b. O₂ molecules
- c. H₂O molecules
- d. Zn atoms
- e. Ca⁺² ions

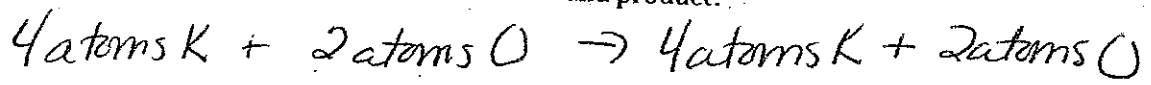
5. Use the equation below to answer the a, b, and c.



a. How many moles are there of each reactant and product?



b. How many atoms are there of each reactant and product?



c. Prove that the Law of Conservation of Mass is supported by the reaction.

$$4 \times 39.10 + 2 \times 16.00 \rightarrow 4 \times 39.10 + 2 \times 16.00$$

$$156.4 + 32.00 \rightarrow 156.4 + 32$$

$$188.4 \rightarrow 188.4$$

6. What is a mole ratio, and how do we use it in stoichiometry?

- conversion factor derived from coefficients of balanced equation

- used to convert between given moles of reactant or product to different react. or prod

7. Define limiting reactant and excess reactant.

Lim - 1st substance used up in reaction

Ex - not completely used up

8. Explain the difference between theoretical and actual yield. Which one is usually the greater amount?

T - max amount of product that could be formed from given reactants

A - amount of product actually formed in an experiment

9. How do you calculate percent yield?

$$\frac{\text{Act}}{\text{Theo}} \times 100 = \% \text{ yield}$$

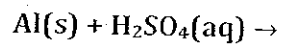
10. Complete the following table:

When converting from -

	Start With	End With
Grams to Moles (example)	Grams of Given	Moles from Balanced Equation
Liters to Grams	L of given	g (molar mass) from per tab
Moles to Molecules	mol of given	6.02×10^{23} molecules
Molecules to Grams	molec. of given	g from per tab
Moles to Liters	mol of given	22.4 L

Stoichiometry Worksheet #1

1) Balance the chemical equation and use it to solve for the following problems:



a. If 58.83 g of Aluminum is completely reacted, how many grams of Hydrogen sulfate are needed?

320.8g
H₂SO₄

b. If 45.60 L of Hydrogen gas forms at STP, what mass of Hydrogen sulfate was used?

199.7g
H₂SO₄

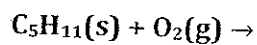
c. How many grams of Aluminum were needed to produce 3.5 moles of Aluminum sulfate?

190g Al

d. What volume of hydrogen gas will be produced @ STP from the complete reaction of 2.5 moles of Aluminum?

84L H₂

2) Balance the chemical equation and use it to solve for the following complete combustion:



a. If 180.3 g of C₅H₁₁ is burned how many molecules of CO₂ are produced?

7.627×10^{24}
molec. CO₂

b. If 63.4 Liters of carbon dioxide gas forms at STP, how many Liters of oxygen were used?

98.3L O₂

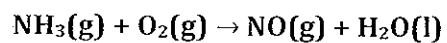
c. How many moles of oxygen gas were needed to produce 4.5 moles of water vapor?

6.3 mol O_2

d. What mass of C_5H_{11} when burned will produce 74 grams of H_2O vapor?

53g C_5H_{11}

3) Balance the chemical equation and use it to solve for the following problems:



a. How many grams of NH_3 were needed to produce 2.5×10^{24} molecules of water?

47g NH_3

b. What volume of O_2 gas is required to produce 34.0 Liters of NO ?

42.5L O_2

c. If 65.3 L of NO were produced at STP, how many grams of Ammonia were used?

49.7g NH_3

d. We want to collect 5 Liters of water, what mass of Ammonia will we need to start with?

3g NH_3

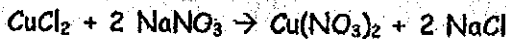
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Limiting Reagent Worksheet #2

- 1) If 15.6 grams of copper (II) chloride, CuCl_2 react with 20.2 grams of sodium nitrate, NaNO_3 , how many grams of sodium chloride, NaCl , can be formed?



$$15.6 \text{ g CuCl}_2 \times \frac{1 \text{ mol CuCl}_2}{134.5 \text{ g CuCl}_2} \times \frac{2 \text{ mol NaCl}}{1 \text{ mol CuCl}_2} \times \frac{58.5 \text{ g NaCl}}{1 \text{ mol NaCl}} = 13.6 \text{ g NaCl}$$

$$20.2 \text{ g NaNO}_3 \times \frac{1 \text{ mol NaNO}_3}{85.0 \text{ g NaNO}_3} \times \frac{2 \text{ mol NaCl}}{2 \text{ mol NaNO}_3} \times \frac{58.5 \text{ g NaCl}}{1 \text{ mol NaCl}} = 13.9 \text{ g NaCl}$$

Amount of NaCl produced 13.6 g NaClLimiting reactant CuCl_2 Excess reactant NaNO_3

- 2) If 10.4 grams of hydrogen, H_2 , and 9.14 grams of oxygen, O_2 , are placed together in a container and allowed to react according to the equation how many grams of water, H_2O , would be produced by the reaction?

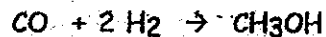


$$10.4 \text{ g H}_2 \times \frac{1 \text{ mol H}_2}{2 \text{ g H}_2} \times \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol H}_2} \times \frac{18 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 93.6 \text{ g H}_2\text{O}$$

$$9.14 \text{ g O}_2 \times \frac{1 \text{ mol O}_2}{32 \text{ g O}_2} \times \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol O}_2} \times \frac{18 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 10.3 \text{ g H}_2\text{O}$$

Amount of H_2O produced 10.3 g H_2O Limiting reactant O_2 Excess reactant H_2

3) Methyl alcohol (wood alcohol), CH_3OH , is produced via the reaction



When a mixture of 1.20 g $\text{H}_2(\text{g})$ and 7.45 g $\text{CO}(\text{g})$ are allowed to react, how many grams of methanol could be produced?

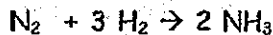
$$1.20 \text{ g H}_2 \times \frac{1 \text{ mol H}_2}{2.0 \text{ g H}_2} \times \frac{1 \text{ mol CH}_3\text{OH}}{2 \text{ mol H}_2} \times \frac{32.0 \text{ g CH}_3\text{OH}}{1 \text{ mol CH}_3\text{OH}} = 9.60 \text{ g CH}_3\text{OH}$$

$$7.45 \text{ g CO} \times \frac{1 \text{ mol CO}}{28 \text{ g CO}} \times \frac{1 \text{ mol CH}_3\text{OH}}{1 \text{ mol CO}} \times \frac{32.0 \text{ g CH}_3\text{OH}}{1 \text{ mol CH}_3\text{OH}} = 8.51 \text{ g CH}_3\text{OH}$$

Amount of CH_3OH produced 8.51 g CH_3OH

Limiting reactant CO Excess reactant H_2

4) How many grams of NH_3 can be produced from the reaction of 28.0 g of N_2 and 25.0 g of H_2 ?



$$28.0 \text{ g N}_2 \times \frac{1 \text{ mol N}_2}{28 \text{ g N}_2} \times \frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} \times \frac{17 \text{ g NH}_3}{1 \text{ mol NH}_3} = 34.0 \text{ g NH}_3$$

$$25.0 \text{ g H}_2 \times \frac{1 \text{ mol H}_2}{2.0 \text{ g H}_2} \times \frac{2 \text{ mol NH}_3}{3 \text{ mol H}_2} \times \frac{17 \text{ g NH}_3}{1 \text{ mol NH}_3} = 14.1 \text{ g NH}_3$$

Amount of NH_3 produced 34.0 g NH_3

Limiting reactant N_2 Excess reactant H_2

Percent Yield Worksheet #1

NOTE: $\% \text{ Yield} = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} \times 100$

Theoretical Yield = answer to your stoich problem.

Actual Yield = given in the problem or the experimental yield.

- 1) Balance the equation for the reaction of iron (III) phosphate with sodium sulfate to make iron (III) sulfate and sodium phosphate.



- a) If I perform this reaction with 25 grams of iron (III) phosphate and an excess of sodium sulfate, how many grams of iron (III) sulfate can I make?

33g $\text{Fe}_2(\text{SO}_4)_3$

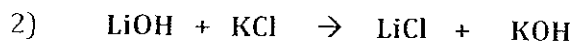
- b) If 18.5 grams of iron (III) sulfate are actually made when I do this reaction, what is my percent yield?

56%

- c) Is the answer from problem **b** reasonable? Explain.

- d) If I do this reaction with 15 grams of sodium sulfate and get a 65.0% yield, how many grams of sodium phosphate will I make?

7.8g Na_3PO_4

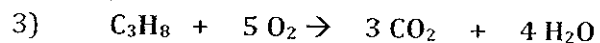


a) I began this reaction with 20 grams of lithium hydroxide. What is my theoretical yield of lithium chloride?

40g LiCl

b) I actually produced 6 grams of lithium chloride. What is my percent yield?

20%



a) If I start with 5 grams of C_3H_8 , what is my theoretical yield of water?

8g H_2O

b) I got a percent yield of 75%. How many grams of water did I make?

6g H_2O



My theoretical yield of beryllium chloride was 10.7 grams. If my actual yield was 4.5 grams, what was my percent yield?

42%