Answers to the review packet that was given Wednesday and won't be checked:

Review for Test 4. Test 4 is Thursday April 7.

Study everything since the previous stripe on the Website (http://genest.weebly.com)

There are two main types of problems.

Problem Type 1

If 25.0 g of magnesium reacts with excess hydrogen nitrate, how many grams of magnesium nitrate are produced?

Balanced reaction!

$$1\,Mg + 2\,HNO_3 \rightarrow 1\,Mg(NO_3)_2 + 1\,H_2$$

Write given and goal

$$25.0\ \text{grams Mg} \times \left(\frac{1\ \text{mole Mg}}{24.31\ \text{grams Mg}}\right)\left(\frac{1\ \text{mole } Mg(NO_3)_2}{1\ \text{MOLE Mg}}\right)\left(\frac{148.325\ \text{grams } Mg(NO_3)_2}{1\ \text{mole } Mg(NO_3)_2}\right) = 153\ \text{grams } Mg(NO_3)_2$$

from p.t. — from Balanced reaction coefficients — from p.t.

Answer: 153 grams $Mg(NO_3)_2$

Review for Test 4. Test 4 is Thursday April 7.

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There are two main types of problems.

Problem Type 2

Determine the mass of carbon dioxide that should be produced in the reaction between 3.74 g of carbon and 11.2 grams of O_2. What is the % yield if 11.34 g of CO_2 is recovered?

Be careful. We need to find which reactant is excess, which is limiting reactant. Then use the limiting reactant to know which amount of grams is the "truth."

first write correct names of formulas using periodic table. Then balance

$$1\,C + 1\,O_2 \rightarrow 1\,CO_2$$

These orange numbers are used to convert substance to substance

$$3.74\text{ grams C} \times \left(\frac{1\text{ mole C}}{12.01\text{ gram C}}\right)\left(\frac{1\text{ mole }CO_2}{1\text{ mole C}}\right)\left(\frac{44.01\text{ GRAMS }CO_2}{1\text{ MOLE }CO_2}\right) = 13.7\text{ g }CO_2$$

$$11.2\text{ grams }O_2 \times \left(\frac{1\text{ mol }O_2}{32.00\text{ gram }O_2}\right)\left(\frac{1\text{ mol }CO_2}{1\text{ mol }O_2}\right)\left(\frac{44.01\text{ gram }CO_2}{1\text{ mol }CO_2}\right) = 15.4\text{ gram }CO_2$$

the answer that's more is a lie the answer that's less is the truth

periodic table — coefficients in balanced reaction — periodic table

Answer: 13.7 grams should be produced (in theory)

Calculate % yield

$$\% = \frac{\text{actual yield}}{\text{theoretical calculated yield}} \times 100 \qquad \% = \frac{11.34\text{ gram}}{15.4\text{ gram}} \times 100 \qquad \% = 74.6$$

ANSWER

Ag: 1 × 107.87 = 107.87
N: 1 × 14.01 = 14.01
O: 3 × 16 = 48.00
169.88 grams/mole

Now you try it

Problem Type 1

If 2.7 grams of silver nitrate react with excess copper metal, how many grams of silver are produced?

$$1\,AgNO_3 + 1\,Cu \rightarrow 1\,CuNO_3 + 1\,Mg$$

$$2.7\text{ grams } AgNO_3 \times \left(\frac{1 \text{ mole } AgNO_3}{169.88 \text{ grams } AgNO_3}\right)\left(\frac{1 \text{ mole } Ag}{1 \text{ mole } AgNO_3}\right)\left(\frac{107.87 \text{ grams } Ag}{1 \text{ mole } Ag}\right) = 1.7 \text{ grams Ag}$$

Zn: $1 \times 65.38 = 65.38$
Cl: $2 \times 35.45 = 70.90$
136.28 grams / mole $ZnCl_2$

Now you try it

Problem Type 2

Suppose 8.61 g of zinc was allowed to react with 1.61 g HCl gas to produce zinc chloride and hydrogen gas.

a. What is the balanced equation?

$1\,Zn + 2\,HCl \rightarrow 1\,ZnCl_2 + 1\,H_2$

b. Which reactant is limiting?

solve for how much product forms. The lower product amount will tell us which reactant is limiting:

$$8.61\text{ g Zn} \times \left(\frac{1\text{ mol Zn}}{65.38\text{ g Zn}}\right)\left(\frac{1\text{ mol } ZnCl_2}{1\text{ mol Zn}}\right)\left(\frac{136.28\text{ g } ZnCl_2}{1\text{ mol } ZnCl_2}\right) = 17.9\text{ g } ZnCl_2$$

$$1.61\text{ g HCl} \times \left(\frac{1\text{ mol HCl}}{36.46\text{ g HCl}}\right)\left(\frac{1\text{ mol } ZnCl_2}{2\text{ mol HCl}}\right)\left(\frac{136.28\text{ g } ZnCl_2}{1\text{ mol } ZnCl_2}\right) = 3.01\text{ g } ZnCl_2$$

So HCl runs out. HCl is LIMITING

c. According to the grams of ZnCl2 you calculated in (b) for the Limiting Reactant what mass of zinc chloride would be the Theoretical Yield?

See (b) above, we found that HCl is limiting so the grams of $ZnCl_2$ that form is 3.01 g $ZnCl_2$

d. Suppose that you actually recovered 1.56 g of zinc chloride. What is your percent yield?

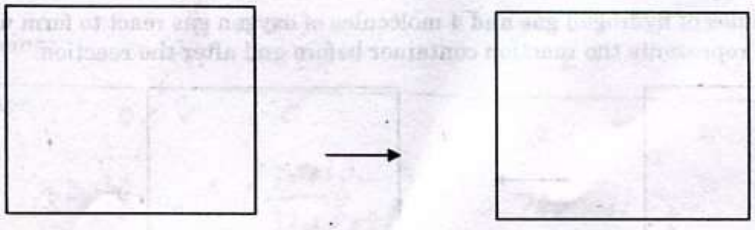
$$\frac{1.56\text{ g}}{3.01\text{ g}} \times 100 = 51.8\%$$

Answers to the homework due Wednesday

2. Write the equation for the formation of ammonia from nitrogen gas and hydrogen gas.

2b Balanced Equation: $N_2 + 3H_2 \longrightarrow 2NH_3$

2a Given 6 molecules of nitrogen and 12 molecules of hydrogen, make a drawing that represents the reaction container before and after the reaction.



Before After

8 How many molecules of ammonia can be produced?

N_2 Which reactant is in excess? Why?

2 How many molecules of excess reactant are there?

Construct a Before-Change-After Table for this reactant mixture:

2b

Equation:	N_2	+ $3H_2$	$\longrightarrow$ $2NH_3$
Before	6 mol	12 mol	0 mol
Change	−4 mol	−12 mol	+ 8 mol
After	2 mol	0 mol	8 mol

According to the table you just made,

8 How many molecules of ammonia can be produced?

N_2 Which reactant is in excess? Why?

2 How many molecules of excess reactant are there?

Describe what you must look for in a particular reactant mixture to decide which reactant will be in excess (have some left over after the reaction):

When 0.50 mole of aluminum reacts with 0.72 mole of iodine to form aluminum iodide,

How many moles of the excess reactant will remain? 0.02

How many moles of aluminum iodide will be formed? 0.48

Equation: $2\,Al + 3\,I_2 \longrightarrow 2\,AlI_3$

Before	.50	.72	0
Change	−.48	−.72	+.48
After	−.02	0	.48

$.50 \text{ mol Al} \times \left(\frac{3 \text{ mol } I_2}{2 \text{ mol Al}}\right) = .75 \text{ mol } I_2$

$.72 \text{ mol } I_2 \times \left(\frac{2 \text{ mol Al}}{3 \text{ mol } I_2}\right) = .48 \text{ mol Al}$

4. When sodium hydroxide reacts with sulfuric acid (H_2SO_4), water and sodium sulfate are the products. Calculate the <u>mass</u> of sodium sulfate produced when 15.5 g of sodium hydroxide are reacted with 46.7 g of sulfuric acid. [Hint: which unit is used in all stoichiometry reasoning?]

Equation: $2\,NaOH + H_2SO_4 \longrightarrow 2\,H_2O + Na_2SO_4$

Before	.387	.476	0	0
Change	−.387	−.194	+.387	+.194
After	0	.282	.387	.194

$15.5 \text{ g NaOH} \times \left(\frac{1 \text{ mol NaOH}}{40. \text{ g NaOH}}\right) = .387 \text{ mol NaOH}$

$46.7 \text{ g } H_2SO_4 \times \left(\frac{1 \text{ mol}}{98 \text{ g } H_2}\right) = .476 \text{ mol } H_2SO_4$

$.194 \text{ mol } Na_2SO_4 \times \left(\frac{192 \text{ g } Na_2SO_4}{1 \text{ mol } Na_2SO_4}\right) = 27.5 \text{ g } Na_2SO_4$

5. A 22.4 g sample of oxygen gas is placed in a sealed container with 2.50 g of hydrogen gas. The mixture is sparked, producing water vapor. Calculate the mass of water formed. Calculate the number of moles of the excess reactant remaining.

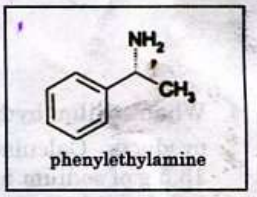
	$2H_2$	+ O_2	⟶ $2H_2O$
Equation:			
Before	0.70	1.24	0
Change	−0.62	−1.24	+1.24
After	0.08	0	1.24

$22.4\text{ g } O_2 \times \left(\frac{1\text{ mol } O_2}{32.00\text{ g } O_2}\right) = 0.700\text{ mol } O_2$

$2.50\text{ g } H_2 \times \left(\frac{1\text{ mol } H_2}{2.02\text{ g } H_2}\right) = 1.24\text{ mol } H_2$

$1.24\text{ mol } H_2O \left(\frac{18.02\text{ g } H_2O}{1\text{ mol } H_2}\right) = 22.3\text{ g } H_2O$

6. Neuroscientists believe that the only chemical in chocolate that may have a feel-good effect on the human brain is phenylethylamine (PEA). Although the PEA in chocolate occurs naturally, PEA can be made in the laboratory by the following reaction:



phenylethylamine

CH_5NO_2	+	C_8H_8O	→	$C_8H_{11}N$	+	CO_2	+	H_2O
ammonium formate		acetophenone		phenylethylamine (PEA)				

How much PEA can be made from 75.0g of ammonium formate and 125g of acetophenone? What mass of the excess reactant remains?

	$C_5H_5NO_2$	+ C_8H_8O	⟶ $C_8H_{11}N$	+ CO_2	+ H_2O
B	1.19 mol	1.04 mol	0	0	0
C	−1.04 mol	−1.04 mol	+1.04 mol	+1.04 mol	+1.04 mol
A	.15 mol	0 mol	1.04 mol	1.04 mol	1.04 mol

4. 27.5 g 5. 22.5 g, 0.075 moles xs 6. 126 g, 9.45g xs