

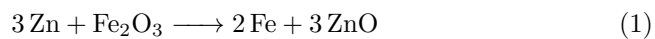
Problem Set #2
CHEM101A: General College Chemistry

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1 Topic A Problem 12

What mass of Fe_2O_3 would react with 20.00 g of Zn? The chemical equation for this reaction is:



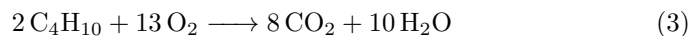
1.1 Solution

The simple stoichiometry is the way to go here.

$$20.00\text{g} \times \frac{1 \text{ mol Zn}}{65.38\text{g}} \times \frac{1 \text{ Fe}_2\text{O}_3}{3 \text{ Zn}} \times \frac{159.7 \text{ g Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} = \boxed{16.28 \text{ g Fe}_2\text{O}_3} \quad (2)$$

2 Topic A Problem 13

x moles of C_4H_{10} reacts with oxygen according to the following equation:



- a) How many moles of water are formed?
- b) How many moles of oxygen are consumed?

2.1 Solution (a)

The ratio of C_4H_{10} used to H_2O created in this reaction is 1:5. With x moles of C_4H_{10} , that would give us $\boxed{5x \text{ mol H}_2\text{O}}$.

2.2 Solution (b)

The ratio of C_4H_{10} used to O_2 consumed in this reaction is 2:13. With x moles of C_4H_{10} , that would give us $\boxed{\frac{13}{2}x \text{ mol O}_2}$.

3 Topic A Problem 14

10.00 g of N_2 is mixed with 33.61 g of F_2 , and the elements react according to the following equation:



- a) Which element is the limiting reactant?
- b) What is the theoretical yield of NF_3 ?
- c) If the reaction goes to completion, how many grams of the excess reactant will remain?
- d) Set up an ICE table for this reaction.

3.1 Solution (a)

First, we calculate the theoretical yields for each for the reactants.

$$m_{\text{N}_2} = 10.00 \text{ g} \times \frac{1 \text{ mol N}_2}{28.02 \text{ g N}_2} \times \frac{2 \text{ NF}_3}{1 \text{ N}_2} \times \frac{71.01 \text{ g NF}_3}{1 \text{ mol NF}_3} = 50.69 \text{ g NF}_3 \quad (5)$$

$$m_{\text{F}_2} = 33.61 \text{ g} \times \frac{1 \text{ mol F}_2}{38.00 \text{ g F}_2} \times \frac{2 \text{ NF}_3}{3 \text{ F}_2} \times \frac{71.01 \text{ g NF}_3}{1 \text{ mol NF}_3} = 41.87 \text{ g NF}_3 \quad (6)$$

With a lower final mass, $\boxed{\text{F}_2}$ is the limiting reactant.

3.2 Solution (b)

The theoretical yield was found in part (a). $\boxed{41.87 \text{ g NF}_3}$

3.3 Solution (c)

Use a similar strategy to part (a).

$$33.61 \text{ g} \times \frac{1 \text{ mol F}_2}{38.00 \text{ g F}_2} \times \frac{1 \text{ N}_2}{3 \text{ F}_2} \times \frac{28.02 \text{ g N}_2}{1 \text{ mol N}_2} = 8.261 \text{ g NF}_3 \quad (7)$$

Subtract this from the available mass of N_2 to get the final N_2 .

$$10.00 \text{ g N}_2 - 8.261 \text{ g N}_2 = \boxed{1.74 \text{ g N}_2} \quad (8)$$

3.4 Solution (d)

I used tabular for this table. Please excuse any poor or improper formatting.

mol	N_2	$+ 3 \text{F}_2$	$\longrightarrow 2 \text{NF}_3$
I	0.3569	0.8844	0
C	-0.2948	-0.8844	0.5896
E	0.0621	0	0.5896

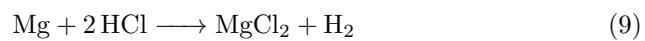
4 Topic A Problem 15

- a) If 58.26 g of iodine reacts with excess aluminum, what is the theoretical yield of aluminum iodide? The reaction is $2 \text{Al} + 3 \text{I}_2 \longrightarrow 2 \text{AlI}_3$.
- b) If 56.11 g of aluminum iodide is actually formed in the reaction in part a, what is the percent yield of aluminum iodide?

4.1 Solution (a)

5 Topic A Problem 16

A chemist mixes 16.00 g of HCl with 10.00 g of Mg and obtains an 81.3% yield of MgCl_2 . What mass of MgCl_2 did the chemist obtain? The chemical reaction is:



5.1 Solution

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