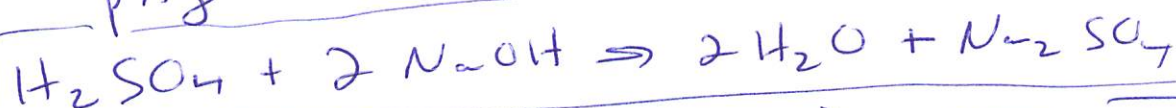


Problem Set page 1



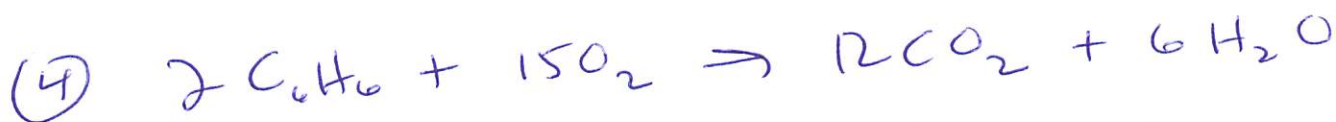
$$1.4 \text{ mol } (\text{NH}_4)_2\text{Cr}_2\text{O}_7 \left(\frac{1 \text{ mol Cr}_2\text{O}_3}{1 \text{ mol } (\text{NH}_4)_2\text{Cr}_2\text{O}_7} \right) = \boxed{1.4 \text{ mol Cr}_2\text{O}_3}$$

page 2



$$(3) \quad 520 \text{ g H}_2\text{SO}_4 \left(\frac{1 \text{ mol H}_2\text{SO}_4}{98.1 \text{ g H}_2\text{SO}_4} \right) \left(\frac{2 \text{ mol NaOH}}{1 \text{ mol H}_2\text{SO}_4} \right) = \boxed{10.6 \text{ mol NaOH}}$$

page 3



$$156.24 \text{ g C}_6\text{H}_6 \left(\frac{1 \text{ mol C}_6\text{H}_6}{78.0 \text{ g C}_6\text{H}_6} \right) \left(\frac{12 \text{ mol CO}_2}{2 \text{ mol C}_6\text{H}_6} \right) \left(\frac{44.0 \text{ g CO}_2}{1 \text{ mol CO}_2} \right) = \boxed{528.8 \text{ g CO}_2}$$

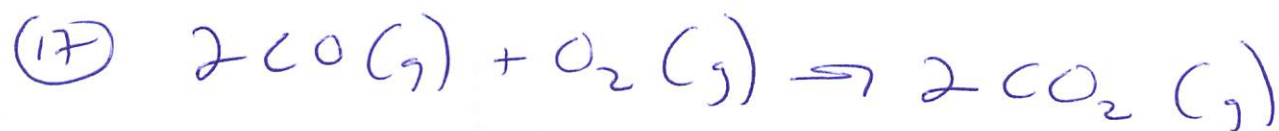
page 4



$$8.5 \text{ mol C}_6\text{H}_6 \left(\frac{12 \text{ mol CO}_2}{2 \text{ mol C}_6\text{H}_6} \right) \left(\frac{6.02 \times 10^{23} \text{ molecules CO}_2}{1 \text{ mol CO}_2} \right) = \boxed{3.07 \times 10^{25} \text{ molecules CO}_2}$$

Volume - Volume Problems

p365



How many liters of oxygen are required to burn 3.86 L carbon monoxide?

2 step

$$\left[3.86 \text{ L CO} \left(\frac{1 \text{ mol CO}}{22.4 \text{ L CO}} \right) \left(\frac{1 \text{ mol O}_2}{2 \text{ mol CO}} \right) = 0.087 \text{ mol O}_2 \right.$$
$$\left. 0.087 \text{ mol O}_2 \left(\frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} \right) = \boxed{1.93 \text{ L O}_2} \right]$$

O₂

one step

$$3.86 \text{ L CO} \left(\frac{1 \text{ mol CO}}{22.4 \text{ L CO}} \right) \left(\frac{1 \text{ mol O}_2}{2 \text{ mol CO}} \right) \left(\frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} \right) = \boxed{1.93 \text{ L O}_2}$$

(25) p 370



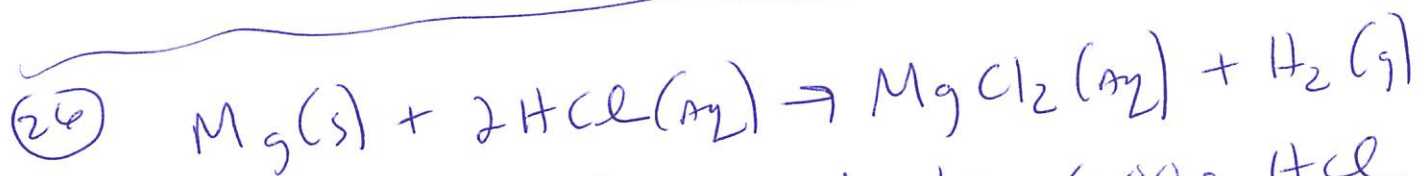
If 2.70 mol C_2H_4 is reacted with 6.30 mol O_2 , identify the limiting reagent.

$$2.70 \text{ mol C}_2\text{H}_4 \left(\frac{3 \text{ mol O}_2}{1 \text{ mol C}_2\text{H}_4} \right) =$$

8.1 mol O_2 needed

6.3 mol O_2 given

So... O_2 is limiting



What is the limiting reagent when 6.00 g HCl reacts with 5.00 g Mg ?

$$6.00 \text{ g HCl} \left(\frac{1 \text{ mol HCl}}{36.5 \text{ g HCl}} \right) \left(\frac{1 \text{ mol Mg}}{2 \text{ mol HCl}} \right) =$$

0.082 mol Mg needed

~~5.00~~ mol Mg given
0.206

$$5.00 \text{ g Mg} \left(\frac{1 \text{ mol Mg}}{24.3 \text{ g Mg}} \right) \left(\frac{2 \text{ mol HCl}}{1 \text{ mol Mg}} \right) =$$

0.412 mol HCl needed

~~0.206~~ mol HCl given
0.164 g

Mg is excess
 HCl is limiting

(27) p371



If 2.70 mol C_2H_4 is reacted with
6.30 mol O_2

a) identify limiting

b) calculate moles of water produced

a) $2.70 \text{ mol C}_2\text{H}_4 \left(\frac{2 \text{ mol O}_2}{1 \text{ mol C}_2\text{H}_4} \right) =$ 5.40 mol O_2 needed
6.30 mol O_2 given

$\Downarrow$
 O_2 in excess

$$6.30 \text{ mol O}_2 \left(\frac{1 \text{ mol C}_2\text{H}_4}{2 \text{ mol O}_2} \right) = 3.15 \text{ mol C}_2\text{H}_4$$

3.15 mol C_2H_4 needed
2.70 mol C_2H_4 given

$\Downarrow$
 C_2H_4 is limiting

b) using the limiting reactant

$$2.70 \text{ mol C}_2\text{H}_4 \left(\frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol C}_2\text{H}_4} \right) =$$
 5.40 mol H_2O

(28)



How many grams of water can be produced by the reaction of 2.40 mol C₂H₂ with 7.40 mol O₂?

FIRST - who is limiting?

$$2.40 \text{ mol C}_2\text{H}_2 \left(\frac{5 \text{ mol O}_2}{2 \text{ mol C}_2\text{H}_2} \right) = \boxed{\begin{array}{l} 6 \text{ mol O}_2 \text{ needed} \\ 7.40 \text{ mol O}_2 \text{ given} \end{array}}$$

$\Downarrow$
O₂ in excess

$$7.40 \text{ mol O}_2 \left(\frac{2 \text{ mol C}_2\text{H}_2}{5 \text{ mol O}_2} \right) = \boxed{\begin{array}{l} 2.96 \text{ mol C}_2\text{H}_2 \text{ needed} \\ 2.40 \text{ mol C}_2\text{H}_2 \text{ given} \end{array}}$$

$\Downarrow$
C₂H₂ is limiting

So...

$$2.40 \text{ C}_2\text{H}_2 \left(\frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol C}_2\text{H}_2} \right) \left(\frac{18.0 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} \right) = \boxed{43.2 \text{ g H}_2\text{O}}$$

Theoretical Yield

- the maximum amount of product that will form during a reaction

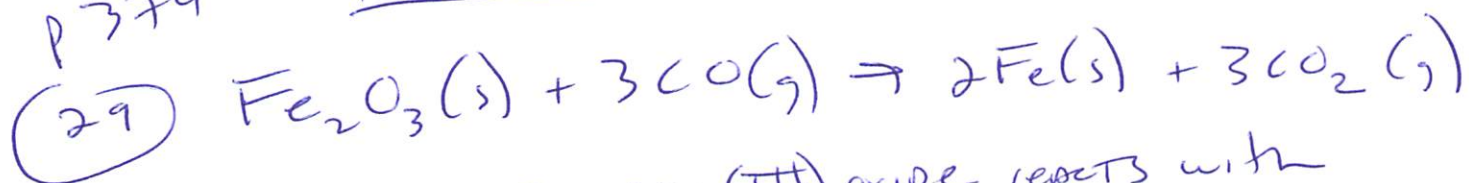
Actual Yield

- the amount of product that ACTUALLY forms when the reaction is carried out in a laboratory.

$$\text{Percent Yield} = \frac{\text{ACTUAL YIELD}}{\text{Theoretical Yield}} \times 100\%$$

Theoretical Yield Problems

p 374



When 84.8 g iron(III) oxide reacts with an excess of carbon monoxide, what is the TY of iron produced?

Fe_2O_3 is limiting

$$84.8 \text{ g Fe}_2\text{O}_3 \left(\frac{1 \text{ mol Fe}_2\text{O}_3}{159.6 \text{ g Fe}_2\text{O}_3} \right) \left(\frac{2 \text{ mol Fe}}{1 \text{ mol Fe}_2\text{O}_3} \right) \left(\frac{55.8 \text{ g Fe}}{1 \text{ mol Fe}} \right) =$$

59.3 g Fe

p 374



when 5.00 g Cu reacts with excess silver nitrate, what is the TY of Silver?

First, Cu is limiting

$$5.00 \text{ g Cu} \left(\frac{1 \text{ mol Cu}}{63.5 \text{ g Cu}} \right) \left(\frac{2 \text{ mol Ag}}{1 \text{ mol Cu}} \right) \left(\frac{107.9 \text{ g Ag}}{1 \text{ mol Ag}} \right) = \boxed{17.0 \text{ g Ag}}$$

p. 375

no field Problems



First, SiO_2 is limiting because they said you have an excess of carbon

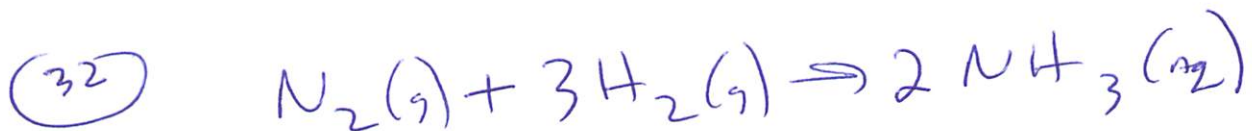
$$50.0 \text{ g SiO}_2 \left(\frac{1 \text{ mol SiO}_2}{60.1 \text{ g SiO}_2} \right) \left(\frac{1 \text{ mol SiC}}{1 \text{ mol SiO}_2} \right) \left(\frac{40.1 \text{ g SiC}}{1 \text{ mol SiC}} \right) = \boxed{33.4 \text{ g SiC}}$$

~~THEORETICAL~~
YIELD

$$\text{TY} = 33.4 \text{ g SiC}$$

$$\text{AT} = 27.9 \text{ g SiC}$$

$$= \frac{27.9}{33.4} = \boxed{83.5\% \text{ yield SiC}}$$



First, determine limiting.

$$15.0g N_2 \left(\frac{1 \text{ mol } N_2}{28.0g N_2} \right) \left(\frac{3 \text{ mol } H_2}{1 \text{ mol } N_2} \right) = 1.61 \text{ mol } H_2 \text{ needed}$$

$$15.0g H_2 \left(\frac{1 \text{ mol } H_2}{2.0g H_2} \right) = 7.5 \text{ mol } H_2 \text{ given}$$

so H_2 is excess
and N_2 is limiting

$$15.0g N_2 \left(\frac{1 \text{ mol } N_2}{28.0g N_2} \right) \left(\frac{2 \text{ mol } NH_3}{1 \text{ mol } N_2} \right) \left(\frac{17.0g NH_3}{1 \text{ mol } NH_3} \right) = 18.2g NH_3$$

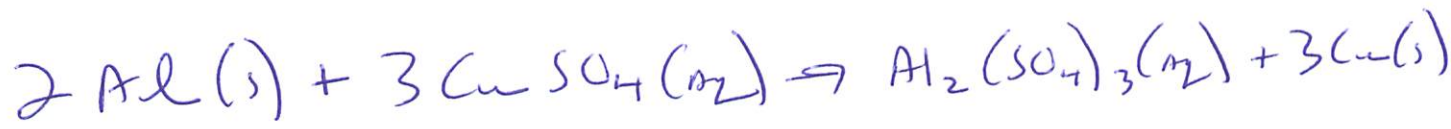
TY

10.5g NH_3 ACTUAL YIELD

$$\frac{10.5g}{18.2g} = 57.7\% \text{ yield}$$

p 375

(35) What is the % yield if 4.65 g of copper is produced when 1.87 g of aluminum reacts with an excess of copper (II) sulfate?



First, CuSO_4 is excess so Al is limiting.

$$1.87 \text{ g Al} \left(\frac{1 \text{ mol Al}}{27.0 \text{ g Al}} \right) \left(\frac{3 \text{ mol Cu}}{2 \text{ mol Al}} \right) \left(\frac{63.5 \text{ g Cu}}{1 \text{ mol Cu}} \right) = \boxed{6.6 \text{ g Cu.}} \\ \text{TY}$$

$$\text{Actual Yield} = \frac{4.65 \text{ g Cu}}{6.6 \text{ g Cu}} = \boxed{70.5 \% \text{ Yield}}$$