

CHEM 101 Day 6

Nicotine has the formula $C_{10}H_{14}N_2$. How many nicotine molecules are in 1.50 mg sample of nicotine?

$$1.50 \text{ mg } C_{10}H_{14}N_2 = 0.00150 \text{ g } C_{10}H_{14}N_2$$

$$MM = (10 \times 12) + (14 \times 1) + (2 \times 14) = 162 \text{ g } C_{10}H_{14}N_2$$

$$0.00150 \text{ g} \times (1 \text{ mol } C_{10}H_{14}N_2 / 162 \text{ g } C_{10}H_{14}N_2) \times (6.02 \times 10^{23} / 1 \text{ mol } C_{10}H_{14}N_2) = 5.56 \times 10^{18} \text{ molec}$$

Methane undergoes combustion. If you begin with 96 g of oxygen, how many grams of CO_2 are produced (methane = CH_4)



$$96 \text{ g } O_2 \times (1 \text{ mol } O_2 / 32 \text{ g } O_2) \times (1 \text{ mol } CO_2 / 2 \text{ mol } O_2) \times (44 \text{ g } CO_2 / 1 \text{ mol } CO_2) = 66 \text{ g } CO_2$$

Limiting Reagent (reactant)

A reagent that runs out, limiting how much product can be made



2 moles N_2 and 3 moles H_2 , which is limiting? H_2 is limiting.



1.78 mol H_2 and 0.821 mol O_2 , which is limiting? O_2 is limiting

$$1.78 \text{ mol } H_2 \times (2 \text{ mol } H_2O / 2 \text{ mol } H_2) = 1.78 \text{ mol}$$

$$0.821 \text{ mol } O_2 \times (2 \text{ mol } H_2O / 1 \text{ mol } O_2) = 1.64 \text{ mol}$$

Theoretical yield is how much can be made according to the balanced equation (1.64 mol H_2O is the theoretical yield)



You begin with 100g each of CaC_2 and H_2O , what is the limiting reagent and what is the theoretical yield in grams of $Ca(OH)_2$?

$$100 \text{ g } CaC_2 \times (1 \text{ mol } CaC_2 / 64.10 \text{ g } CaC_2) \times (1 \text{ mol } Ca(OH)_2 / 1 \text{ mol } CaC_2) = 1.56 \text{ mol } Ca(OH)_2$$

$$100 \text{ g } H_2O \times (1 \text{ mol } H_2O / 18.02 \text{ g } H_2O) \times (1 \text{ mol } Ca(OH)_2 / 1 \text{ mol } H_2O) = 2.78 \text{ mol } Ca(OH)_2$$

CaC_2 is limiting.

$$1.56 \text{ mol} \times (74.1 \text{ g} / 1 \text{ mol}) = 116 \text{ g } Ca(OH)_2 \text{ is the theoretical yield}$$

Percent yield

$$\% \text{ yield} = (\text{actual} / \text{theoretical}) \times 100$$

If the theoretical yield of a product is 42.6 g and the student obtained 40.4 g, what is the percent yield?

$$(40.4 \text{ g}/42.6 \text{ g}) \times 100 = 94.8 \%$$

Give the % yield when 28.16 g of CO_2 are formed from the reaction of 4 mol C_3H_8 and 8 mol O_2



$$8 \text{ mol O}_2 \times (16 \text{ mol CO}_2/25 \text{ mol O}_2) \times (44.01 \text{ g CO}_2/1 \text{ mol CO}_2) = 225.3 \text{ g CO}_2$$

$$\% \text{ yield} = (28.16 \text{ g CO}_2/225.3 \text{ g CO}_2) = 12.50\%$$