

How to Stoichiometry

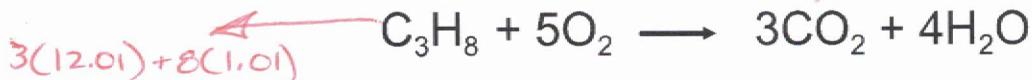
Remember steps: 1) balance

2) given/unknown

3) molar mass \rightarrow mass of 1 mole from P.Table

4) mole ratio

1) If 60.0g of propane (C_3H_8) is burned in a stove, carbon dioxide (CO_2) and water (H_2O) are produced as shown in the balanced equation below:



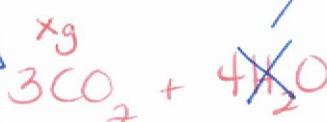
What mass of CO_2 will be released into the environment?

2. given/unknown: 60.0g

1. balance: $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

3. molar mass 44.11g

4. mole ratio 1 : 3



3

- start with what you have, move to what you need

$$60.0 \text{ g } C_3H_8 \times \frac{1 \text{ mol } C_3H_8}{44.11 \text{ g } C_3H_8} \times \frac{3 \text{ mol } CO_2}{1 \text{ mol } C_3H_8} \times \frac{44.01 \text{ g } CO_2}{1 \text{ mol } CO_2} = 179.5919$$

stop when you have the units you are looking for

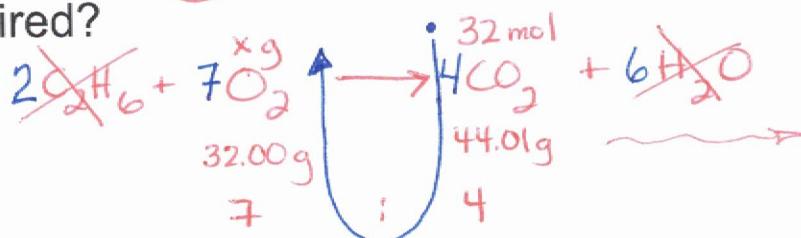
$180 \text{ g } CO_2$

(15)

need oxygen: combustion reaction!

- 2) Burning ethane (C_2H_6) in air containing oxygen (O_2) produces carbon dioxide (CO_2) and water (H_2O). You are to produce 32 moles of CO_2 . What mass of oxygen is required?

2. given/unknown
1. balance
3. molar mass
4. mole ratio

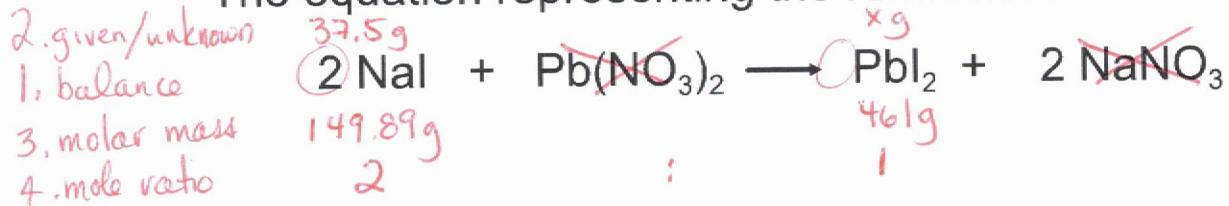


$$32 \text{ mol } CO_2 \times \frac{7 \text{ mol } O_2}{4 \text{ mol } CO_2} \times \frac{32.00 \text{ g } O_2}{1 \text{ mol } O_2} = 1792 \text{ g}$$

$\boxed{1800 \text{ g } O_2}$

- 3) Sodium iodide (NaI) reacts with a solution of lead nitrate ($Pb(NO_3)_2$) to form a lead iodide precipitate (PbI_2) and a solution of sodium nitrate ($NaNO_3$). When a scientist adds 37.5g of NaI to enough $Pb(NO_3)_2$ solution, all of the NaI reacts. What is the mass of the PbI_2 formed?

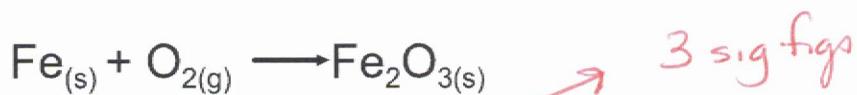
The equation representing the reaction is:



$$37.5 \text{ g } NaI \times \frac{1 \text{ mol } NaI}{149.89 \text{ g } NaI} \times \frac{1 \text{ mol } PbI_2}{2 \text{ mol } NaI} \times \frac{461 \text{ g } PbI_2}{1 \text{ mol } PbI_2} = 57.667$$

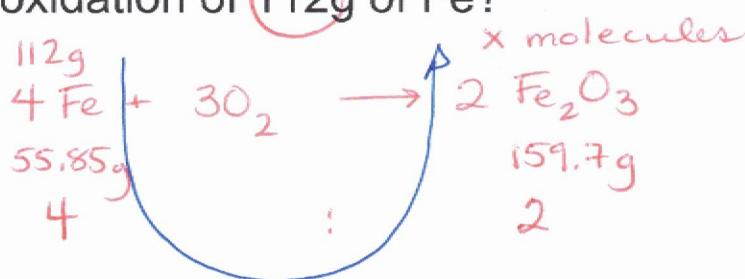
$\boxed{57.7 \text{ g}}$

4) The following equation describes the oxidation of iron:



How many molecules of Fe_2O_3 are formed by the complete oxidation of 112g of Fe?

2. given/unknown
1. balance
3. molar mass
4. mole ratio



no need to go to grams, we can compare moles with molecules

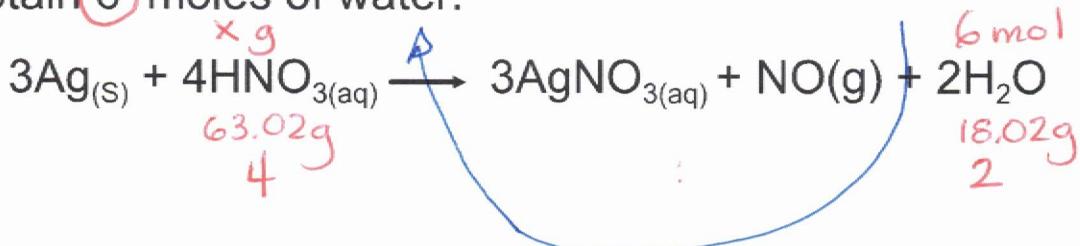
$$112\text{g Fe} \times \frac{1 \text{ mol Fe}}{55.85\text{g Fe}} \times \frac{2 \text{ mol Fe}_2\text{O}_3}{4 \text{ mol Fe}} \times \frac{6.02 \times 10^{23} \text{ molecules Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} =$$

$6.036 \times 10^{23} \text{ molecules}$

$6.04 \times 10^{23} \text{ molecules}$

5) Use the following balanced equation to determine what mass of nitric acid (HNO_3) is necessary to obtain 6 moles of water.

2. given/unk
1. balance
3. molar mass
4. mole ratio



$$6 \text{ mol H}_2\text{O} \times \frac{4 \text{ mol HNO}_3}{2 \text{ mol H}_2\text{O}} \times \frac{63.02 \text{ g HNO}_3}{1 \text{ mol HNO}_3} = 756.24 \text{ g}$$

800g