

STOICHIOMETRY

Acetylene gas (C_2H_2) undergoes combustion to produce 75.0 L carbon dioxide and water vapor at STP. Determine $[A_r C = 12.0, O = 16.0, H = 1.0]$

- How many liters of C_2H_2 are required to produce the CO_2 ?
- What mass of H_2O is produced?

Equation

Make sure the equation is balanced.



Convert to mole

Given 75.0 L CO_2 (convert vol(L) to mole)

$$n_{CO_2} = \frac{\text{volume } CO_2}{\text{molar volume}}$$

At STP, molar volume of gas = 22.4 L

$$= \frac{\boxed{} \text{ L}}{\boxed{} \text{ L}} = \boxed{} \text{ mol } CO_2$$

At 4 decimal places

Value given in the question

Compare

Write the stoichiometry.

From equation, (theoretically)



a) compared only CO_2 and C_2H_2



so, (given in the question)

$$\boxed{} \text{ mol } CO_2 = \frac{\boxed{} \times \boxed{}}{\boxed{}} \\ = \boxed{} \text{ mol } C_2H_2$$

b) compared only CO_2 and H_2O



so, (given in the question)

$$\boxed{} \text{ mol } CO_2 = \frac{\boxed{} \times \boxed{}}{\boxed{}} \\ = \boxed{} \text{ mol } H_2O$$

Convert to mass/volume

convert to volume.

$$V_{C_2H_2} = n_{C_2H_2} \times \text{molar volume}_{(stp)} \\ = \boxed{} \times \boxed{} \\ = \boxed{} \text{ L} *$$

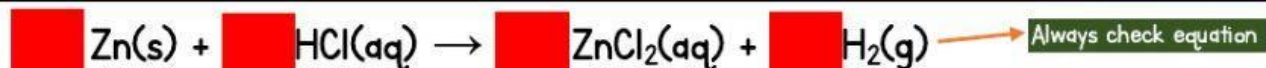
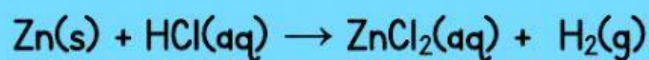
convert to mass.

$$\text{mass } H_2O = n_{H_2O} \times M_r H_2O \\ = \boxed{} \times \boxed{} \\ = \boxed{} \text{ g} *$$

PRACTICE 2

How many grams of ZnCl_2 can be obtained using 5.0 grams of zinc metal?

[$A_r \text{ Zn} = 65.35$, $\text{Cl} = 35.5$, $\text{H} = 1.0$]



Given zinc metal,

$$n = \frac{\text{mass}}{M_r} = \frac{\text{mass}}{\text{Mr}} = \text{mol}$$

overall stoichiometry,



From equation,

$$\text{mol Zn} \equiv \text{mol ZnCl}_2$$

thus,

$$\text{mol Zn} = \frac{\text{mol ZnCl}_2}{\text{mol Zn}} = \text{mol ZnCl}_2$$

$$\text{mass ZnCl}_2 = \text{mol ZnCl}_2 \times M_r \text{ ZnCl}_2$$

$$= \text{g}$$

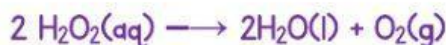
$$M_r \text{ ZnCl}_2 = \text{g/mol}$$

EXERCISE :

SOLVE THIS QUESTION IN A TEST PAD.



1. Hydrogen peroxide, H_2O_2 , decomposes to produce water and oxygen as in the following equation:



What would be the volume of O_2 released from the decomposition of 250 mL of 2.0 M H_2O_2 at STP ?

5.6 L

2. Assume that 5.60 L of hydrogen gas at STP reacts with copper (II) oxide according to the following balanced equation. [$A_r \text{ Cu} = 63.5$]



a) How many moles of H_2 react? 0.25 mol

b) How many grams of copper are produced? 15.875g

3. Assume that 13.5 g of solid aluminum react with HCl according to the following balanced equation at STP. [$A_r \text{ Al} = 27.0$, $\text{Cl} = 35.5$, $\text{H} = 1.0$]



a) How many moles of Al react? 0.5 mol

b) How many gram of HCl reacted ? 54.75g

d) How many liters of H_2 are produced ? 16.8g

4. The complete combustion of copper(I) sulphide is according to the following equation: [$A_r \text{ Cu} = 63.5$, $\text{S} = 32.0$, $\text{O} = 16.0$]



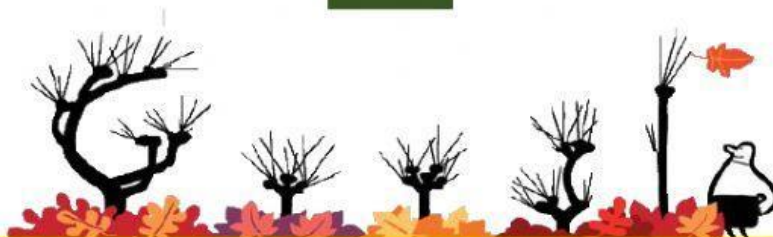
If the mass of Cu_2S in the mixture is 14.0 g, calculate

a) the number of molecules of oxygen gas reacted.

7.9955×10^{22} molecules

b) the mass of SO_2 gas produced. 5.64g

c) the volume of SO_2 gas at STP. 1.97 L



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