

# 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

$$= \frac{\boxed{\phantom{00}} \text{ L}}{\boxed{\phantom{00}} \text{ L}} = \boxed{\phantom{00}} \text{ mol } CO_2$$

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)

$$\boxed{\phantom{00}} \text{ mol } CO_2 = \frac{\boxed{\phantom{00}} \times \boxed{\phantom{00}}}{\boxed{\phantom{00}}} \\ = \boxed{\phantom{00}} \text{ mol } C_2H_2$$

b) compared only  $CO_2$  and  $H_2O$



so, (given in the question)

$$\boxed{\phantom{00}} \text{ mol } CO_2 = \frac{\boxed{\phantom{00}} \times \boxed{\phantom{00}}}{\boxed{\phantom{00}}} \\ = \boxed{\phantom{00}} \text{ mol } H_2O$$

Convert to mass/volume

convert to volume.

$$V_{C_2H_2} = n_{C_2H_2} \times \text{molar volume}_{(stp)} \\ = \boxed{\phantom{00}} \times \boxed{\phantom{00}} \\ = \boxed{\phantom{00}} \text{ L} *$$

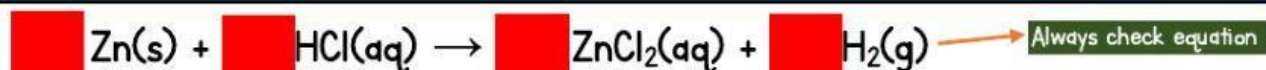
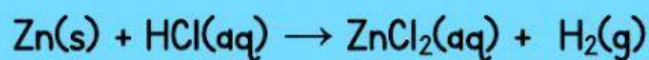
convert to mass.

$$\text{mass } H_2O = n_{H_2O} \times M_r H_2O \\ = \boxed{\phantom{00}} \times \boxed{\phantom{00}} \\ = \boxed{\phantom{00}} \text{ g} *$$

## PRACTICE 2

How many grams of  $\text{ZnCl}_2$  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,

$$n = \frac{\text{mass}}{M_r} = \frac{\text{g}}{\text{g/mol}} = \text{mol}$$

overall stoichiometry,



From equation,  $\text{mol Zn} \equiv \text{mol ZnCl}_2$

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

$= \text{mol ZnCl}_2$

$$\text{mass ZnCl}_2 = \text{mol} \times \text{g/mol}$$

$$= \text{g} *$$

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

## EXERCISE :

### SOLVE THIS QUESTION IN A TEST PAD.



1. Hydrogen peroxide,  $\text{H}_2\text{O}_2$ , decomposes to produce water and oxygen as in the following equation:



What would be the volume of  $\text{O}_2$  released from the decomposition of 250 mL of 2.0 M  $\text{H}_2\text{O}_2$  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  $\text{H}_2$  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  $\text{H}_2$  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  $\text{Cu}_2\text{S}$  in the mixture is 14.0 g, calculate

a) the number of molecules of oxygen gas reacted.

$7.9955 \times 10^{22}$  molecules

b) the mass of  $\text{SO}_2$  gas produced. 5.64g

c) the volume of  $\text{SO}_2$  gas at STP. 1.97 L



BY MADAM ZIL