

CHAPTER 3

ATOMS AND MOLECULES

Exercise

1. A 0.24g sample of compound of oxygen and boron was found by analysis to contain 0.096 g of boron and 0.144 g of oxygen. Calculate the percentage composition of the compound by weight,

Answer 1. Percentage of Boron= (Mass of Boron/Total Mass of Sample) x100

$$\%=(0.096\text{g}/0.24\text{g})\times 100$$

$$=40\%$$

Percentage of Oxygen= (Mass of Oxygen/Total Mass of Sample) x100

$$\%=(0.144\text{g}/0.24\text{g})\times 100$$

$$=60\%$$

2. When 3.0 g of carbon is burnt in 8.0 g of oxygen, 11.00 g of carbon dioxide is produced. What mass of carbon dioxide will be formed when 3.00 g of carbon is burnt in 50.00 g of oxygen? What law of chemical combination will govern your answer?

Answer 2. This is law of constant proportion which states that the chemical compound always contains its component elements in a fixed ratio by mass. 12gms of carbon combines with 32 gm of oxygen to give 44 gms of CO_2 ($12:32::3:8$ AS $4\times 3=12$ AND $4\times 8=32$). Therefore carbon and oxygen always combine in 3:8 mass ratio, Law of conservation of Mass. Mass can neither be created or destroyed. 3 g of carbon and 8 g of oxygen gives 11g of carbon dioxide.

Carbon acts as limiting reagent and adding more oxygen does not change the amount of product produced.

It means that burning 3 g of carbon in 50g of oxygen would still produce 11 g of CO_2 as only 3 g of carbon would combine with 8 g of oxygen and 42 g of oxygen would be left unreacted.

3. What are polyatomic ions? Give Examples

Answer 3. A polyatomic ion is a covalently bonded group of two or more atoms that carries a net electrical charge. They either gain or lose electrons during a chemical reaction making them a charged unit.

Ion Name	Chemical Formula	Charge	Type
Ammonium	NH ₄ ⁺	+1	Cation
Hydroxide	OH ⁻	-1	Anion

4. Write down the chemical formula of the following:

a Magnesium Chloride

Ans: MgCl₂

b Calcium oxide

Ans: CaO

c Copper Nitrate

Ans: Cu(NO₃)₂

d Aluminum Chloride

Ans (AlCl₃)

e Calcium Carbonate

Ans: CaCO₃

5. Give the names of the elements present in the following compounds

a) Quick Lime

Ans: Calcium Oxide (CaO)

b) Hydrogen Bromide

Ans: HBr

c) Baking Powder

Ans Baking Powder does not have a specific formula. The formula for Baking soda is NaHCO₃

d) Potassium Sulphate

Ans: K₂SO₄

6. Calculate the molar mass of the following substances

a) Ethyne C₂H₂

Ans: carbon=12(12*2=24) +Hydrogen=1(1*2=2);24+2=26

b) Sulphur S_8

Ans Atomic mass of sulphur=32(multiply by number of atoms; in S_8 there are 8 atoms hence $32 \times 8 = 256$)

c) Phosphorous molecule P_4 (Atomic mass of phosphorus is 31)

Ans: Atomic mass of Phosphorous=31(multiply by number of atoms; in P_4 there are 4 atoms hence $31 \times 4 = 124$)

d) Hydrochloric Acid

Ans: Atomic Mass of Hydrogen=1 and Chlorine=35.5($35.5 + 1 = 36.5$)

e) Nitric Acid HNO_3

Ans: Atomic Mass of Hydrogen =1; Nitrogen=14; Oxygen=16(Multiply by number of atoms; $1 + 14 + 16 \times 3 = 1 + 14 + 48 = 63$)