

Q. 1. A 0.24 g 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.

Ans. : Total mass of compound = 0.24 g (Given)

Mass of boron = 0.096 g (Given)

Mass of oxygen = 0.144 g (Given)

Thus, percentage of boron by weight in the compound = $0.096 / 0.24 \times 100\% = 40\%$
And, percentage of oxygen by weight in the compound = $0.144 / 0.24 \times 100\% = 60\%$

Q. 2 When 3.0 g of carbon is burnt in 8.00 g 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? Which law of chemical combinations will govern your answer?

Ans. : 3.0 g of carbon combines with 8.0 g of oxygen to give 11.0 g of carbon dioxide.

If 3 g of carbon is burnt in 50 g of oxygen, then 3 g of carbon will react with 8 g of oxygen. The remaining 42 g of oxygen will be left un-reactive. In this case also, only 11 g of carbon dioxide will be formed. The above answer is governed by the law of constant proportions.

81 Sol.

Total mass of Compound = 0.321 g

Mass of Boron = 0.096 g

Mass of Oxygen = 0.144 g

Percentage of Boron by weight = $\frac{0.096 \times 100}{0.321 \times 100}$
= 40%

Percentage of oxygen by weight =

$$= \frac{0.144}{0.321} \times \frac{100}{100}$$

$$= 60\% \text{ A}$$

Q. 3. What are polyatomic ions? Give examples.

Ans. : A polyatomic ion is a group of atoms carrying a charge (positive or negative). For example : Nitrate (NO_3^-), hydroxide ion (OH^-).

Q. 4. Write the chemical formulae of the following :

- (a) Magnesium chloride (b) Calcium oxide (c) Copper nitrate
(d) Aluminium chloride (e) Calcium carbonate

Ans. : (a) Element symbol Mg Cl (b) Element symbol

Charge +2 -1

Charge

Ca O
+2 -2

Formula MgCl_2

Formula

CaO

(c) Element symbol

Cu NO₃

Charge

Al Cl
+3 -1

Formula

$\text{Cu}(\text{NO}_3)_2$

Formula

AlCl_3

(e) Element symbol

Ca CO₃
+2 -2

Formula

CaCO_3

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

(a) Quicklime

(b) Hydrogen bromide

(c) Baking powder

(d) Potassium sulphate

Ans. : (a) Calcium and oxygen (CaO)

(b) Hydrogen and bromine (HBr)

(c) Sodium, hydrogen, carbon, and oxygen (NaHCO_3)

(d) Potassium, sulphur, and oxygen (K_2SO_4)

Q. 6. Calculate the molar mass of the following substances :

(a) Ethyne, C_2H_2

(b) Sulphur molecule, S_8

(c) Phosphorus molecule, P_4 (atomic mass of phosphorus = 31)

(d) Hydrochloric acid, HCl (e) Nitric acid, HNO_3

Ans. : (a) Molar mass of ethyne, $\text{C}_2\text{H}_2 = 2 \times 12 + 2 \times 1 = 26 \text{ g}$

(b) Molar mass of sulphur molecule, $\text{S}_8 = 8 \times 32 = 256 \text{ g}$

(c) Molar mass of phosphorus molecule, $\text{P}_4 = 4 \times 31 = 124 \text{ g}$

(d) Molar mass of hydrochloric acid, $\text{HCl} = 1 + 35.5 = 36.5 \text{ g}$

(e) Molar mass of nitric acid, $\text{HNO}_3 = 1 + 14 + 3 \times 16 = 63 \text{ g}$

Q. 7. What is the mass of :

(a) 1 mole of nitrogen atoms?

(b) 4 moles of aluminium atoms (atomic mass of aluminium = 27)?

(c) 10 moles of sodium sulphite (Na_2SO_3)?

Ans. : (a) The mass of 1 mole of nitrogen atoms is 14 g.

(b) The mass of 4 moles of aluminium atoms is $(4 \times 27) \text{ g} = 108 \text{ g}$

(c) The mass of 10 moles of sodium sulphite (Na_2SO_3) is
 $10 \times [2 \times 23 + 32 + 3 \times 16] \text{ g} = 10 \times 126 \text{ g} = 1260 \text{ g}$

Q. 8. Convert into mole :

- (a) 12 g of oxygen gas (b) 20 g of water (c) 22 g of carbon dioxide

Ans. : (a) 32 g of oxygen gas = 1 mole

Then, 12 g of oxygen gas = $12/32$ mole = 0.375 mole

(b) 18 g of water = 1 mole, then, 20 g of water = $20 / 18$ mole = 1.111 mole

(c) 44 g of carbon dioxide = 1 mole, then, 22 g of carbon dioxide = $22 / 44$ mole = 0.5 mole

Q. 9. What is the mass of :

- (a) 0.2 mole of oxygen atoms? (b) 0.5 mole of water molecules?

Ans. : (a) Mass of one mole of oxygen atoms = 16 g, then, mass of 0.2 mole of oxygen atoms = 0.2×16 g = 3.2 g

(b) Mass of one mole of water molecule = 18 g

Then, mass of 0.5 mole of water molecules = 0.5×18 g = 9 g

Q. 10. Calculate the number of molecules of sulphur (S_8) present in 16 g of solid sulphur.

Ans. : 1 mole of solid sulphur (S_8) = 8×32 g = 256 g

i.e., 256 g of solid sulphur contains = 6.022×10^{23} molecules

Then, 16 g of solid sulphur contains = $\frac{6.022 \times 10^{23}}{256} \times 16$ molecules = 3.76375×10^{22} molecules.

Q. 11. Calculate the number of aluminium ions present in 0.051 g of aluminium oxide. (Hint : The mass of an ion is the same as that of an atom of the same element. Atomic mass of Al = 27 u)

Ans. : Mole of aluminium oxide (Al_2O_3) = $2 \times 27 + 3 \times 16 = 102$ g

i.e., 102 g of Al_2O_3 = 6.022×10^{23} molecules of Al_2O_3

Then, 0.051 g of Al_2O_3 contains = $\frac{6.022 \times 10^{23}}{102} \times 0.051$ molecules = 3.011×10^{20} molecules of Al_2O_3

The number of aluminium ions (Al^{3+}) present in one molecule of aluminium oxide is 2.

Therefore, the number of aluminium ions (Al^{3+}) present in 0.051 g of aluminium oxide (Al_2O_3) = $2 \times 3.011 \times 10^{20} = 6.022 \times 10^{20}$ molecules.