



**SpeedLabs**  
**Science**

**CBSE 9<sup>th</sup>**

**TEEVRA EDUTECH PVT. LTD.**

# Atoms and Molecules Exercise

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.** Mass of boron = 0.096 g (Given)

Mass of oxygen = 0.144 g (Given)

Mass of sample = 0.24 g (Given)

Thus, percentage of boron by weight in the compound =  $\frac{0.096}{0.24} \times 100\% = 40\%$

And, percentage of oxygen by weight in the compound =  $\frac{0.144}{0.24} \times 100\% = 60\%$

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.** Carbon + Oxygen → Carbon dioxide

3 g of carbon reacts with 8 g of oxygen to produce 11 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.

3. What are polyatomic ions? Give examples?

**Ans.** A polyatomic ion is a group of atoms carrying a charge (positive or negative). For example, ammonium ion ( $\text{NH}_4^+$ ), hydroxide ion ( $\text{OH}^-$ ), carbonate ion ( $\text{CO}_3^{2-}$ ), sulphate ion ( $\text{SO}_4^{2-}$ ).

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) Magnesium chloride →  $\text{MgCl}_2$

(b) Calcium oxide →  $\text{CaO}$

(c) Copper nitrate →  $\text{Cu}(\text{NO}_3)_2$

(d) Aluminium chloride →  $\text{AlCl}_3$

(e) Calcium carbonate →  $\text{CaCO}_3$

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

- (a) Quick lime (b) Hydrogen bromide  
(c) Baking powder (d) Potassium sulphate

Ans.

Compound	Chemical formula	Elements present
Quick lime	CaO	Calcium, Oxygen
Hydrogen bromide	HBr	Hydrogen, Bromine
Baking powder	NaHCO <sub>3</sub>	Sodium, Hydrogen, Carbon, Oxygen
Potassium sulphate	K <sub>2</sub> SO <sub>4</sub>	Potassium, Sulphur, Oxygen

6. Calculate the molar mass of the following substances.

- (a) Ethyne, C<sub>2</sub>H<sub>2</sub> (b) Sulphur molecule, S<sub>8</sub>  
(c) Phosphorus molecule, P<sub>4</sub> (atomic mass of phosphorus = 31)  
(d) Hydrochloric acid, HCl (e) Nitric acid, HNO<sub>3</sub>

- Ans. (a) Molar mass of ethyne, C<sub>2</sub>H<sub>2</sub> = 2 × 12 + 2 × 1 = 26 g  
(b) Molar mass of sulphur molecule, S<sub>8</sub> = 8 × 32 = 256 g  
(c) Molar mass of phosphorus molecule, P<sub>4</sub> = 4 × 31 = 124 g  
(d) Molar mass of hydrochloric acid, HCl = 1 + 35.5 = 36.5 g  
(e) Molar mass of nitric acid, HNO<sub>3</sub> = 1 + 14 + 3 × 16 = 63 g

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<sub>2</sub>SO<sub>3</sub>)?

- Ans. (a) The mass of 1 mole of nitrogen atoms is 14 g.  
(b) The mass of 4 moles of aluminium atoms is (4 × 27) g = 108 g  
(c) The mass of 10 moles of sodium sulphite (Na<sub>2</sub>SO<sub>3</sub>) is  
10 × [2 × 23 + 32 + 3 × 16] g = 10 × 126 g = 1260 g

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 =  $\frac{12}{32}$  mole = 0.375 mole

(b) 18 g of water = 1 mole Then, 20 g of water =  $\frac{20}{18}$  mole = 1.11 moles (approx)

(c) 44 g of carbon dioxide = 1 mole Then, 22 g of carbon dioxide =  $\frac{22}{44}$  mole = 0.5 mole

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 =  $0.2 \times 16\text{g} = 3.2\text{ g}$

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

Then, mass of 0.5 mole of water molecules =  $0.5 \times 18\text{ g} = 9\text{ g}$

10. Calculate the number of molecules of sulphur ( $\text{S}_8$ ) present in 16 g of solid sulphur.

**Ans.** 1 mole of solid sulphur ( $\text{S}_8$ ) =  $8 \times 32\text{ g} = 256\text{ g}$

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

Then, 16 g of solid sulphur contains =  $\frac{6.022 \times 10^{23}}{256} \times 16$  molecules =  $3.76 \times 10^{22}$  molecules (approx)

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.** 1 mole of aluminium oxide ( $\text{Al}_2\text{O}_3$ ) =  $2 \times 27 + 3 \times 16 = 102\text{ g}$

i.e., 102 g of  $\text{Al}_2\text{O}_3$  =  $6.022 \times 10^{23}$  molecules of  $\text{Al}_2\text{O}_3$

Then, 0.051 g of  $\text{Al}_2\text{O}_3$  contains =  $\frac{6.22 \times 10^{23}}{102} \times 0.051$  molecules =  $3.011 \times 10^{20}$  molecules of  $\text{Al}_2\text{O}_3$

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

Therefore, the number of aluminium ions ( $\text{Al}^{3+}$ ) present in  $3.011 \times 10^{20}$  molecules (0.051 g) of aluminium oxide ( $\text{Al}_2\text{O}_3$ ) =  $2 \times 3.011 \times 10^{20} = 6.022 \times 10^{20}$ .