Board – CBSE	Class –9th	Topic – Atom and Molecules

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 by mass.

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 (NH_4^+), hydroxide ion (OH^-), carbonate ion(CO_3^{2-}), sulphate ion(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 → $MgCl_2$ (b) Calcium oxide → CaO

(c) Copper nitrate → $Cu(NO_3)_2$ (d) Aluminium chloride → $AlCl_3$

(e) Calcium carbonate → $CaCO_3$

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	$NaHCO_3$	Sodium, Hydrogen, Carbon, Oxygen
Potassium sulphate	K_2SO_4	Potassium, Sulphur, Oxygen

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, $C_2H_2 = 2 \times 12 + 2 \times 1 = 26$ g

(b) Molar mass of sulphur molecule, $S_8 = 8 \times 32 = 256$ g

(c) Molar mass of phosphorus molecule, $P_4 = 4 \times 31 = 124$ g

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

(e) Molar mass of nitric acid, $HNO_3 = 1 + 14 + 3 \times 16 = 63$ 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_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 (4×27) g = 108 g

(c) The mass of 10 moles of sodium sulphite (Na_2SO_3) is

$10 \times [2 \times 23 + 32 + 3 \times 16]$ 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 moles

(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 × 16g = 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

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 $=\frac{6.022\times10}{256}$ ×16 molecules = 3.76×10^{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 (Al_2O_3) = 2 × 27 + 3 × 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 $=\frac{6.22\times10^{23}}{102}\times0.051\ molecules$ = 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 3.011×10^{20} molecules (0.051 g) of aluminium oxide (Al_2O_3) = $2 \times 3.011 \times 10^{20} = 6.022 \times 10^{20.}$