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

1. In a reaction, 5.3 g of sodium carbonate reacted with 6 g of ethanoic acid. The products were 2.2 g of carbon dioxide, 0.9 g water and 8.2 g of sodium ethanoate. Show that these observations are in agreement with the law of conservation of mass.

Sodium carbonate + ethanoic acid → sodium ethanoate + carbon dioxide + water

Ans. In the given reaction, sodium carbonate reacts with ethanoic acid to produce sodium ethanoate, carbon dioxide, and water.

$(Sodium\ \ Carbonate) + (Ethanoic\ \ acid) \rightarrow (Sodium\ \ ethanoate) + (carbon\ \ dioxide) +$ (Water)

Mass of sodium carbonate = 5.3 g (Given)

Mass of ethanoic acid = 6 g (Given)

Mass of sodium ethanoate = 8.2 g (Given)

Mass of carbon dioxide = 2.2 g (Given)

Mass of water = 0.9 g (Given)

Now, total mass before the reaction = (5.3 + 6) g= 11.3 g

And, total mass after the reaction = (8.2 + 2.2 + 0.9) g= 11.3 g

∴Total mass before the reaction = Total mass after the reaction

Hence, the given observations are in agreement with the law of conservation of mass.

2. Hydrogen and oxygen combine in the ratio of 1.8 by mass to form water. What mass of oxygen gas would be required to react completely with 3 g of hydrogen gas?

Ans. It is given that the ratio of hydrogen and oxygen by mass to form water is 1.8.

Then, the mass of oxygen gas required to react completely with 1 g of hydrogen gas is 8 g.

Therefore, the mass of oxygen gas required to react completely with 3 g of hydrogen gas is8×3 g = 24g.

3. Which postulate of Dalton's atomic theory is the result of the law of conservation of mass?

Ans. The postulate of Dalton's atomic theory which is a result of the law of conservation of mass is atoms are indivisible particles, which can neither be created nor destroyed in a chemical reaction.

4. Which postulate of Dalton's atomic theory can explain the law of definite proportions?

Ans. The postulate of Dalton's atomic theory which can explain the law of definite proportion is

the relative number and kind of atoms in a given compound remains constant

5. Define atomic mass unit.

Ans. Mass unit equal to exactly one-twelfth $\left(\frac{1}{12th}\right)$ the mass of one atom of carbon-12 is called one atomic mass unit. It is written as 'u'.

6. Why is it not possible to see an atom with naked eyes?

Ans. The size of an atom is so small that it is not possible to see it with naked eyes. Also, the atom of an element does not exist independently.

7. Write down the formulae of

(i) Sodium oxide (ii) Aluminium chloride

(iii) Sodium sulphide (iv) Magnesium hydroxide

Ans. (i) Sodium oxide →Na_2O (ii) Aluminium chloride → $AlCl_3$

(iii) Sodium sulphide → Na_2S (iv) Magnesium hydroxide → $Mg(OH)_2$

8. Write down the names of compounds represented by the following formulae.

(i) $Al_2(SO_4)_3$ (ii) $CaCl_2$

(iii) K_2SO_4 (iv) KNO_3

(v) $CaCO_3$

Ans. (i) $Al_2(SO_4)_3$ → Aluminium sulphate (ii) $CaCl_2$ → Calcium chloride

(iii) K_2SO_4 → Potassium sulphate (iv) KNO_3 → Potassium nitrate

(v) $CaCO_3$ → Calcium carbonate

9. What is meant by the term chemical formula?

Ans. The chemical formula of a compound means the symbolic representation of the composition of a compound. From the chemical formula of a compound, we can know the number and kinds of atoms of different elements that constitute the compound.

For example, from the chemical formula CO_2 of carbon dioxide, we come to know that one carbon atom and two oxygen atoms are chemically bonded together to form one molecule of the compound, carbon dioxide.

10. How many atoms are present in a

(i) H_2S molecule and (ii) PO_4^{3-} ion?

Ans. (i) In an H_2S molecule, three atoms are present; two of hydrogen and one of sulphur.

(ii) In a PO_4^{3-} ion, five atoms are present; one of phosphorus and four of oxygen.

11. Calculate the molecular masses of H_2, O_2, Cl_2, CO_2, CH_4, C_2H_6, C_2H_4, NH_3, CH_3OH.

Ans. Molecular mass of $H_2 = 2 \times$ Atomic mass of H$= 2 \times 1 = 2$ u

Molecular mass of $O_2 = 2 \times$ Atomic mass of O$= 2 \times 16 = 32$ u

Molecular mass of $Cl_2 = 2 \times$ Atomic mass of Cl$= 2 \times 35.5 = 71$ u

Molecular mass of CO_2 = Atomic mass of C $+ 2 \times$ Atomic mass of O$= 12 + 2 \times 16 = 44$ u

Molecular mass of CH_4 = Atomic mass of C $+ 4 \times$ Atomic mass of H$= 12 + 4 \times 1 = 16$ u

Molecular mass of $C_2H_6 = 2 \times$ Atomic mass of C $+ 6 \times$ Atomic mass of H$= 2 \times 12 + 6 \times 1 = 30$ u

Molecular mass of $C_2H_4 = 2 \times$ Atomic mass of C $+ 4 \times$ Atomic mass of H$= 2 \times 12 + 4 \times 1 = 28$ u

Molecular mass of NH_3 = Atomic mass of N $+ 3 \times$ Atomic mass of H$= 14 + 3 \times 1 = 17$ u

Molecular mass of CH_3OH = Atomic mass of C $+ 4 \times$ Atomic mass of H + Atomic mass of O

$= 12 + 4 \times 1 + 16 = 32$ u

12. Calculate the formula unit masses of ZnO, Na_2O, K_2CO_3, given atomic masses of Zn = 65 u, Na = 23 u, K = 39 u, C = 12 u, and O = 16 u.

Ans. Formula unit mass of ZnO = Atomic mass of Zn + Atomic mass of O

$= 65 + 16 = 81$ u

Formula unit mass of $Na_2O = 2 \times$ Atomic mass of Na + Atomic mass of O

$= 2 \times 23 + 16 = 62$ u

Formula unit mass of $K_2CO_3 = 2 \times$ Atomic mass of K + Atomic mass of C $+ 3 \times$ Atomic mass of O

$= 2 \times 39 + 12 + 3 \times 16 = 138$ u

13. If one mole of carbon atoms weighs 12 gram, what is the mass (in gram) of 1 atom of carbon?

Ans. One mole of carbon atoms weighs 12 g (Given)

i.e., mass of 1 mole of carbon atoms = 12 g

Then, mass of 6.022×10^{23} number of carbon atoms = 12 g

Therefore, mass of 1 atom of carbon $= \frac{12}{6.022 \times 10^{23}}$ g $= 1.9926 \times 10^{-23}\ g$

14. Which has more number of atoms, 100 grams of sodium or 100 grams of iron (given, atomic mass of Na = 23 u, Fe = 56 u)?

Ans. Atomic mass of Na = 23 u (Given)

Then, gram atomic mass of Na = 23 g

Now, 23 g of Na contains = 6.022×10^{23} number of atoms

Thus, 100 g of Na contains = $\frac{6.022\times10^{23}}{23}\times100$ number of atoms = 2.6182×10^{24} number of atoms

Again, atomic mass of Fe = 56 u (Given)

Then, gram atomic mass of Fe = 56 g

Now, 56 g of Fe contains = 6.022×10^{23} number of atoms

Thus, 100 g of Fe contains = $\frac{6.022\times10^{23}}{56}\times100$ number of atoms = 1.0753×10^{24} number of atoms

Therefore, 100 grams of sodium contain more number of atoms than 100 grams of iron.