3

Atoms and Molecules

In the Chapter

- During a chemical reaction, the sum of the masses of the reactants and products remains unchanged. This is known as the Law of Conservation of Mass.
- In a pure chemical compound, elements are always present in a definite proportion by mass. This is known as the Law of Definite Proportions.
- An atom is the smallest particle of the element that can exist independently and retain all its chemical properties.
- A molecule is the smallest particle of an element or a compound capable of independent existence under ordinary conditions. It shows all the properties of the substance.
- A chemical formula of a compound shows its constituent elements and the number of atoms of each combining element.
- Clusters of atoms that act as an ion are called polyatomic ions. They carry a fixed charge on them.
- The chemical formula of a molecular compound is determined by the valency of each element.
- In ionic compounds, the charge on each ion is used to determine the chemical formula of the compound.
- Scientists use the relative atomic mass scale to compare the masses of different atoms of elements. Atoms of carbon-12 isotopes are assigned a relative atomic mass of 12 and the relative masses of all other atoms are obtained by comparison with the mass of a carbon-12 atom.
- The Avogadro constant 6.022×1023 is defined as the number of atoms in exactly 12 g of carbon-12.
- The mole is the amount of substance that contains the same number of particles (atoms/ ions/ molecules/ formula units, etc.) as there are atoms in exactly 12 g of carbon-12.
- Mass of 1 mole of a substance is called its molar mass.

Intext Exercises

Page No. 32-33

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 $\rightarrow$ sodium ethanoate + carbon dioxide + water

Ans. Mass of sodium carbonate = 5.3 g
Mass of ethanoic acid = 6 g
Total mass of reactants = (5.3 + 6) g = 11.3g
Mass of sodium ethanoate = 8.2 g
Mass of carbon dioxide 2.2 g
Mass of water = 0.9 g
Total mass of products = (8.2 + 2.270.9) g
= 11.3 g
$\therefore$ Total mass of reactants = Total mass of products. Thus, the law of conservation of mass is verified.

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. During formation of water (H_2O),
2 g of hydrogen gas reacts completely with 16 g of oxygen.
1 g of hydrogen gas will react completely with 16/2 g = 8 g of oxygen.
$\therefore$ 3 g of hydrogen gas will react completely with 8 × 3 = 24 g of oxygen.

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

Ans. The postulate "Atoms are neither created nor destroyed", is a result of the Law of Conservation of Mass.

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

Ans. The following postulate of Dalton's atomic theory can explain the law of definite proportion.
The relative number and kinds of atoms are constant in a given compound.

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1. Define the atomic mass unit.

Ans. The atomic mass unit is defined as the mass equal to 1/12th the mass of a 12 / 6 C atom. The standard symbol of atomic mass unit is u.

$$1 \text{ atomic mass unit} = \frac{\text{Mass of a } {}^{12}_{6}\text{C atom}}{12}$$

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

Ans. It is not possible to see an atom with naked eye because atoms are very small. They are smaller than anything that we can imagine or compare with.

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1. Write down the formulae of
(i) sodium oxide
(ii) aluminium chloride
(iii) sodium suphide
(iv) magnesium hydroxide

Ans. (*i*) Formula of sodium oxide

Symbol/ Formula	Na	O
Charge	1+	2–

Formula : Na_2O

(*ii*) Formula of aluminium chloride.

Symbol/ Formula	Al	Cl
Charge	3+	1–

Formula : $AlCl_3$

(*iii*) Formula of sodium sulphide

Symbol/ Formula	Na	S
Charge	1+	2–

Formula : Na_2S

(*iv*) Formula of magnesium hydroxide

Symbol/ Formula	Mg	OH
Charge	2+	1–

Formula : $Mg(OH)_2$

2. 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

3. What is meant by the term 'chemical formula'?

Ans. The chemical formula of a compound is a symbolic representation of its composition.

4. How many atoms are present in a
(i) H_2S molecule and
(ii) PO_4^{3-} ion?

Ans. (i) In H_2S molecule, there are three atoms. (Two atoms of hydrogen and one atom of sulphur).
(ii) In PO_4^{3-} ion, there are five atoms. (One atom of phosphorous and four atoms of oxygen.

Page No. 40

1. 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. (i) Molecular mass of H_2
$= 2 \times$ Atomic mass of H
$= 2 \times 1u$
$= 2\,u$

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

(iii) Molecular mass of Cl_2
$= 2 \times$ Atomic mass of Cl
$= 2 \text{ x } 35.5u$
$= 71u$

(iv) Molecular mass of CO_2
$=$ Atomic mass of C $+ 2 \times$ Atomic mass of O
$= 12u \times 2 \times 16u$
$= 12u + 32u$
$= 44u$

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

(vi) Molecular mass of C_2H_6
$= 2 \times$ Atomic mass of C $+ 6 \times$ Atomic mass of H
$= 2 \times 12u \times 6 \times 1\,u$
$= 24u + 6u$
$= 30u$

(vii) Molecular mass of C_2H_4
$= 2 \times$ Atomic mass of C $+ 4 \times$ Atomic mass of H
$= 2 \times 12u \times 4 \times 1u$
$= 24u + 4u$
$= 28u$

(viii) Molecular mass of NHa

= Atomic mass of N + 3 × Atomic mass of H

= 14u × 3 × 1u

= 14u + 3u

= 17u

(ix) Molecular mass of CHaOH

= Atomic mass of C + 3 × Atomic mass of H

+ Atomic mass of 0 + Atomic mass of H = 12u + 3 × 1u + 16u × lu

= 12u + 3u + 16u + 1u

= 32u

2. 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. (i) Atomic mass of Zn =65 u

Atomic mass of 0 = 16 u

Formula unit mass of ZnO

= At. mass of Zn + At. mass of 0

= 65 + 16

= 81u

(ii) Atomic mass of Na = 23 u

Atomic mass of 0 = 16 u

Formula unit mass of Na2O

= 2 × At mass of Na + At mass of O

= 2 × 23 + 16

= 46 + 16

= 62 u

(iii) Atomic mass of K = 39 u

Atomic mass of C = 12 u

Atomic mass of O = 16 u

Formula unit mass of K_2CO_3

= 2 × At. mass of K + At. mass of C + 3 × At. mass of O

= 2 × 39 + 12 + 3 × 16

= 78 + 12 + 48

= 138 u

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

Ans. Molar mass (M) of carbon atom = 12 g

Number (N) of particles (atoms) = 1

Avogadro's number (No) = 6.023×10^{23}

Given mass

$$= \frac{\text{Number of particles} \times \text{Molar mass}}{\text{Avogadro's number}}$$

$$m = \frac{N \text{ x } M}{N_0}$$

$$m = \frac{1 \text{ x } 12}{6.023 \text{ x } 10^{23}}$$

$$m = 1.99 \times 10^{-23} \text{ g}$$

2. 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. Given mass (m) of Na atoms = 100 g
Molar mass (M) of Na atoms = 23 g
Avogadro's number (No) = 6.023×10^{23}
Number of particles (atoms)

$$= \frac{\text{Given mass}}{\text{Molar mass}} \times \frac{\text{Avogadro's}}{\text{number}}$$

$$N = \frac{m}{M} \times No$$

$$N = \frac{100}{23} \times 6.023 \times 10^{23}$$

$$N = 26.181 \times 10^{23}$$

Given mass (m) of Fe atoms = 100 g
Molar mass (M) of Fe atoms = 23 g
Avogadro's number (No) = 6.023×10^{23}
Number of particles (atoms)

$$= \frac{\text{Given mass}}{\text{Molar mass}} \times \frac{\text{Avogadro's}}{\text{number}}$$

$$N = \frac{m}{M} \times No$$

$$N = \frac{100}{56} \text{ x } 6.023 \text{ x } 10^{23}$$

$$N = 10.751 \times 10^{23}$$

Hence, 100g of sodium contains more atoms.

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. Percentage of Boron

$$= \frac{\text{Mass of Boron}}{\text{Mass of compound}} \times 100$$

$$= \frac{0.096}{0.024} \times 100$$

$$= 40\%$$

Percentage of Oxygen

$$= \frac{\text{Mass of Oxygen}}{\text{Mass of compound}} \times 100$$

$$= \frac{0.144}{0.24} \times 100$$

$$= 60\%$$

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 combination will govern your answer?

Ans. $C + C_2 \rightarrow CO_2$

Case I

Mass of carbon = 3g

Mass of oxygen = 8g

$\therefore$ Total mass of reactants = 3 + 8 = 11 g

Mass of product (CO_2) = 11g

Hence, total mass of reactants = Total mass of product

Case II

Mass of carbon = 3 g

Mass of oxygen = 50 g

$\therefore$ Total mass of reactants = 3 + 50 = 53 g

Using law of conservation of mass.

Total mass of reactants = Total mass of product

$\therefore$ Total mass of product (CO_2) = 53 g.

3. What are polyatomic ions? Give examples.

Ans. Clusters of atoms act as an ion and these clusters are called polyatomic ions. They carry a fixed charge on them. For example, Ammonium $(NH_4)^+$, Sulphate $(SO_3)^{2-}$, Phosphate $(PO_4)^{3-}$, etc.

4. Write the chemical formulae of the following.

(a) Magnesium chloride

Ans.

Ions present	Magnesium	Chloride
Symbol	Mg	Cl
Charges	2^+	1^-

$\therefore$ Formula of magnesium chloride = Mg_1Cl_2 or $MgCl_2$

(b) Calcium oxide

Ions present	Calcium	Oxide
Symbol	Ca	O
Charges	2^+	2

∴ Formula of Calcium oxide = $Ca_2\,O_2$ or CaO.

(c) Copper nitrate

Ions present	Copper	Nitrate
Symbol	Cu	NO_3
Charges	1^+	1^-

∴ Formula of Copper Nitrate = $Cu_1\,(NO_3)_4$ or $CuNO_3$

(d) Aluminium chloride

Ions present	Aluminium	Chloride
Symbol	Al	Cl
Charges	3^+	1^-

∴ Formula of aluminium chloride = Al_1Cl_3 or $AlCl_3$.

(e) Calcium carbonate

Ions present	Calcium	Carbonate
Symbol	Ca	CO_3
Charges	2^+	2^-

∴ Formula of Calcium carbonate = $Ca_2(CO_3)_2$ or $CaCO_3$.

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

(a) Quick lime

Ans. CaO = Calcium, Oxygen

(b) Hydrogen bromide

Ans. HBr = Hydrogen, Bromine

(c) Baking powder

Ans. $NaHCO_3$ = Sodium, Hydrogen, Carbon, Oxygen.

(d) Potassium sulphate

Ans. 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. Mass of 1 mole molecule of a substance is called its molar mass.

(a) Atomic mass of carbon = 12 u
Atomic mass of hydrogen = 1 u
Molecular mass of C_2H_2
= 2 × At. mass of C + 2 × At. mass of H
= 2 × 12 + 2 × 1
= 24 + 2 = 26 u
∴ Molar mass of C_2H_2 = 26 g

(b) Atomic mass of sulphur = 32 u
Molecular mass of S_8 = 8 × 32
= 256u
∴ Molar mass of S_8 = 256 g

(c) Atomic mass of phosphorous = 31 u

Molecular mass of P_4 = 4 × 31

= 124 u

∴ Molar mass of P_4 = 124 g

(d) Atomic mass of hydrogen = 1 u

Atomic mass of chlorine = 35.5 u

Molecular mass of HCI

= At mass of H + At. mass of Cl

= 1 + 35.5

= 36.5 u

∴ Molar mass of HCl = 36.5 g

(e) Atomic mass of hydrogen = 1 u

Atomic mass of nitrogen = 14 u

Atomic mass of oxygen = 16 u

Molecular mass of HNO_3

= At. mass of H + At. mass of N + 3 × At mass of O

= 1 + 14 + 3 × 16

= 1 + 14 + 48

= 63 u

∴ Molar mass of HNO_3 = 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) Number of (n) of moles = 1

Molar mass (M) of N atoms = 14 g

Mass = Molar mass × Number of moles

= m = M × n

= m = 14 × 1 = 14 g

(b) Number (n) of moles = 4

Molar mass (M) of aluminium ions

= 27 g (Mass of an ion is same as that of mass of an atom of same element)

Mass = Molar mass × Number of moles

= m = M × n

= m = 27 × 4 = 108 g

(c) Number (n) of moles = 10

Molar mass (M) of Na_2SO_3

= 2 × 23 + 32 + 3 × 16

= 46 + 32 + 48

= 126 g

Mass = Molar mass × Number of moles

= m = M × n

= m = 126 × 10 = 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) Atomic mass of oxygen gas = 32 u

$\therefore$ Molar mass (M) of O_2 = 32 g
Given mass (m) of oxygen = 12 g

$$\text{Numbers of moles} = \frac{\text{Given mass of element}}{\text{Molar mass}}$$

$$= n = \frac{n}{M}$$

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

(b) Molecular mass of water = 18 u
Molar mass (M) of water = 18 g
Given mass (m) of water = 20 g

$$\text{Number of moles} = \frac{\text{Given mass of Compound}}{\text{Molar mass}}$$

$$= n = \frac{n}{M}$$

$$= n = \frac{20}{18} = 1.11$$

(c) Molecular mass of carbon-dioxide = 44 u
Molar mass (M) of carbon-dioxide = 44 g
Given mass (m) of carbon-dioxide =22 g

$$\text{Number of moles} = \frac{\text{Given mass of Compound}}{\text{Molar mass}}$$

$$= n = \frac{n}{M}$$

$$= n = \frac{22}{44} = 0.5$$

9. What is the mass of:
(a) 0.2 mole of oxygen atoms?
(b) 0.5 mole of water molecules?

(a) Number (n) of moles = 0.2
Atomic mass of oxygen = 16 u
Molar mass (m) of oxygen atoms = 16 g
Mass = Molar mass × Number of moles
= $m = M \times n$
= $m = 16 \times 0.2 = 3.2$ g
(b) Number (m) of moles = 0.5
Molecular mass of water = 18 u
Molar mass (M) of water = 18 g
Mass = Molar mass × Number of moles
= $m = M \times n$
= $m = 18 \times 0.5 = 9$ g

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

Ans. Atomic mass of sulphur = 32 u

Molar mass (M) of S_8 molecule = 32 × 8 = 256 g
Given mass (m) of S_8 molecule = 16 g
Avogadro's number (N_0) = 6.023×10^{23}
Number (N) of particles (molecules)

$$= \frac{\text{Given mass}}{\text{Molar mass}} \times \frac{\text{Avogadro's}}{\text{number}}$$

$$= N = \frac{m}{M} \times N_0$$

$$= N = \frac{16}{256} \times 6.023 \times 10^{23}$$

$= N = 0.3764 \times 10^{23} = 2.764 \times 10^{22}$

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)

Molecular mass of aluminium oxide (Al_2O_3)
= 2 × 27 + 3 × 16
= 54 + 48
= 102 u

Molar mass (M) of Al_2O_3 = 102g
Given mass (m) of Al_2O_3 = 0.051g
Avogadro's number (No) = 6.023×10^{23}
Number (N) of particles (ions)

$$= \frac{\text{Given mass}}{\text{Molar mass}} \times \frac{\text{Avogadro's}}{\text{number}}$$

$$= N = \frac{m}{M} \times No$$

$$= N = \frac{0.051}{102} \times 6.023 \times 10^{23}$$

$= N = 0.0030 \times 10^{23}$

Since each molecule of Al_2O_3 contains two aluminium ions, so number of aluminium ions
$= 2 \times 0.0030 \times 10^{23}$
$= 0.006 \times 102^{3}$
$= 6 \times 10^{20}$

Additional Questions

1. Name the two laws of chemical combination.

Ans. (a) Law of conservation of mass.
(b) Law of constant proportions.

2. Name two Indian philosophers who studied about the particles of matter.

Ans. Maharishi Kanad and Pakudha Katyayama studied about the particles of matter.

3. What name was given to the smallest particles of matter by Maharishi Kanad?

Ans. The smallest particles of matter were named "Parmanu" by Maharishi Kanad.

4. During which century did the scientists recognize the difference between elements and compounds ?

Ans. By the end of the eighteenth century, scientists recognized the difference between elements and compounds.

5. Name the scientist who laid the foundation of chemical sciences by establishing two important laws of chemical combination.

Ans. Antoine L. Lavoisier laid the foundation of chemical sciences by establishing two important laws of chemical combination.

6. Write the postulate given by the Indian philosopher Maharishi Kanad.

Ans. Indian philosopher Maharishi Kanad postulated that if we go on dividing matter (padarth), we shall get smaller and smaller particles.

He said that a time will come when we will come across smallest particles beyond which further division will not be possible.

7. (i) What was the Indian philosopher Pakudha Katyayama's contribution to Maharishi Kanad's postulate?

(ii) What was the suggestion given by the Greek philosophers Democritus and Leucippus regarding matter?

Ans. (i) Pakudha Katyayama elaborated Kanad's doctrine and said that these particles normally exist in a combined form, which gives us various forms of matter.

(ii) The Greek philosophers Democritus and Leucippus suggested that if we go on dividing matter, a stage will come when particles obtained cannot be divided further.

Democritus called these indivisible particles 'atoms' (meaning indivisible).

8. In which year was the idea of divisibility of matter considered in India?

Ans. The idea of divisibility of matter was considered in India around 500 B.C.

9. Which philosophers had always wondered about the unknown and unseen form of matter?

Ans. Ancient Indian and Greek philosophers had always wondered about the unknown and unseen form of matter.

10. Name the scientist who stated the Law of Constant Proportions.

Ans. Joseph Louis Proust stated the Law of Constant Proportions.

11. If 9 g of water is decomposed, how many grams of hydrogen and oxygen are obtained ?

Ans. If 9 g of water is decomposed, 1 g hydrogen and 8 g of oxygen are always obtained.

12. How can Dalton's atomic theory explain the law of Constant Proportions ?

Ans. According to Dalton's atomic theory, atoms of the same element are alike.

Also, atoms combine in simple whole number ratios.

This mean that the atoms of different elements can combine with each other only in a simple fixed ratio to form molecules (compound atoms).

13. Explain the law of constant proportion taking example of ammonia.

Ans. In NH_3, mass ratio of N : H is 14 : 3 ammonia, nitrogen and hydrogen, they are always present in the ratio 14 : 3 by mass.

14. What is the building block of all matter?

Ans. The building block of all matter is an atom. It is the smallest characteristic particle of a given element.

15. How big are atoms?

Ans. Atoms are very small. They are smaller than anything we can compare with.

16. What is the unit for measuring atomic radius ?

Ans. Atomic radius is measured in nanometres (nm).

17. Why are Dalton's symbol not used in chemistry?

Ans. Dalton's symbols are not used in Chemistry because these are difficult to draw and inconvenient to use.

18. The symbol of sodium is written as Na and not as S. Given reason.

Ans. The symbol of Na for sodium is derived from its Latin name 'Natrium'.

19. Can the absolute mass of the atom be measured?

Ans. No, because atomic masses are very small.

20. Why did Dalton's theory prompt the scientists to measure the atomic mass of an atom ?

Ans. This is because Dalton's theory could explain the law of constant proportions very well.

21. During the formation of carbon monoxide (CO), 3 g of carbon combines with how many grams of oxygen?

Ans. During the formation of CO, 3 g of carbon combines with 4 g of oxygen.

22. In 1961, for a universally accepted atomic mass unit, which element was chosen as the standard reference for measuring atomic masses?

Ans. For a universally accepted atomic mass unit, carbon-12 isotope was chosen as the standard reference for measuring atomic masses.

23. (i) Why didn't the scientists determine the mass of an individual atom?
(ii) How was the relative atomic mass determined?

Ans. (i) Determining the mass of an individual atom was a relatively difficult task.
(ii) Relative atomic masses were determined using the laws of chemical combinations and the compounds formed.

24. (i) Define the relative atomic mass of an element.
(ii) What is one atomic mass unit?

Ans. (i) The relative atomic mass of the atom of an element is defined as the average mass of the atom, as compared to 1/12th the mass of one carbon-12 atom.
(ii) One atomic mass unit is a mass unit equal to exactly one twelfth (l/12th) the mass of one atom of carbon-12.

25. (i) While searching for various atomic mass units, scientists initially took 1/16th of the mass of an atom of naturally occurring oxygen. Why was this considered relevant ?
(ii) What was the problem in taking oxygen as the reference?

Ans. (i) This was considered relevant due to two reasons: .
(a) Oxygen reacted with a large number of elements and formed compounds.
(b) This atomic mass unit gave masses of most of the elements as whole numbers.
(ii) All the atoms of oxygen do not have the same mass.
Naturally occurring oxygen was later found to be composed of a mixture of atoms of slightly different masses called isotopes.

26. Can atoms of elements exist independently?

Ans. No, atoms of most elements are not able to exist independently.

27. What is meant by "relative atomic mass" ?

Ans. Relative atomic mass of the atom of an element is the average mass of the atom as compared to one-twelfth (1/12) the mass of an atom of carbon -12.

28. State the postulate of Dalton's atomic theory which explains the law of conservation of mass.

Ans. Atoms can neither be created nor destroyed in a chemical reaction.

29. State the law of constant composition.

Ans. Law of Constant Composition: In a pure chemical substance, the same elements are always present in a definite proportion by mass.

30. Calculate the formula unit mass of Na_2CO_3.
(Atomic mass of Na = 23 u, C = 12 u, 0= 16 u)

Ans. Formula unit mass of Na_2CO_3

$= 2 \times 23 + 12 + 3 \times 16$
$= 46 + 12 + 48$
$= 106$ u.

31. Write the chemical name of the compounds represented by the following formulae :
(i) Al_2O_3 (ii) KNO_3

Ans. (i) Aluminium oxide, (ii) Potassium nitrate.

32. Write the names of the following compounds :
(i) NH_4Cl (ii) $Zn(OH)_2$

Ans. (i) Ammonium chloride, (ii) Zinc hydroxide.

33. Write the formula of the following compounds :
(i) Potassium carbonate, (ii) Magnesium chloride

Ans. (i) K_2CO_3 (ii) $MgCl_2$

34. How many atoms are present in one molecule of ozone?

Ans. Three.

35. Define the law of conservation of mass in a chemical reaction.

Ans. Law of Conservation of Mass : Mass can neither be created nor be destroyed in a chemical reaction.

Multiple Choice Questions

1. Which of the following statement is not true about atoms ?
(a) Atoms can never exist independently.
(b) Atoms are the basic units from which molecules and ions are formed.
(c) Atoms are always neutral in nature.
(d) Atoms aggregate the large numbers to form the matter that we can see, feel or touch.

Ans. (a)

2. Which of the following have maximum number of atoms?
(a) 18g of H_2O (b) 32 g of O_2
(c) 22 g of CO_2 (d) 32 g of CH_2

Ans. (d)

3. How many times of an atom of sulphur is heavier than an atom of carbon?
(a) 32 times (b) 12 times
(c) 8/3 times (d) 12/32 times

Ans. (c)

4. Percentage of calcium in calcium carbonate is
(a) 40 (b) 30
(c) 23 (d) 36

Ans. (a)

5. Number of moles of 0.6 g SO2 is
(a) 100 (b) 10
(c) 0.01 (d) 0.1

Ans. (c)

6. The value of Avogadro's constant is
(a) 6.0×10^{24} (b) 6.01×10^{22}
(c) 6.022×10^{23} (d) 6.022×10^{-23}

Ans. (c)

7. What mass of carbon dioxide (CO_2) will contain 3.011 × 1023 molecules?

(a) 11.0g (b) 22.0g
(c) 4.4g (d) 44.0g

Ans. (b)

8. The chemical symbol of Nitrogen gas is

(a) Ni (b) N_2
(c) N^+ (d) N

Ans. (b)

9. The chemical symbol for sodium is

(a) So (b) Sd
(c) NA (d) Na

Ans. (d)

10. A change in the physical state can be brought about

(a) only when energy is given to the system
(b) only when energy is taken out from the system
(c) when energy is either given to, or taken out from the system
(d) without any energy change

Ans. (c)