CHAPTER 4
SYMBOLS, FORMULAE AND EQUATIONS
SOLUTIONS

TEXTUAL QUESTIONS & ANSWERS

Textual Page No. 55

Let us answer these:

1. **Write down the formula of**
   (i) Aluminium nitrate   (ii) Zinc Sulphide   (iii) Calcium hydroxide   (iv) Aluminium sulphate   (v)   Iron (II) carbonate

   Ans:

   (i)   Aluminium nitrate – Al(NO3)$_3$

   (ii) Zinc Sulphide – ZnS

   (iii) Calcium hydroxide - Ca(OH)$_2$

   (iv) Aluminium sulphate - Al$_2$(SO$_4$)$_3$

   (v) Iron (II) carbonate -   FeCO$_3$

2. **Name the following compounds:**

   Ans:

   (i)   Ca(OH)$_2$ - Calcium hydroxide

   (ii) (ii) FeS – Iron Sulphide (Ferrous Sulphide)

   (iii) Mg$_3$(PO$_4$)$_2$ – Magnesium Phosphate

   (iv) AgNO$_3$- Silver Nitrate

   (v) PbCO$_3$ – Lead Carbonate

   (vi) HgBr$_2$ – Mercuric Bromide

3. **How many atoms are present in a Al$_2$(SO$_4$)$_3$ molecule and CO$_3^{2-}$ ion?**

   Ans:

   (i) Al$_2$(SO$_4$)$_3$ molecule **-17 atoms**
   (ii) CO$_3^{2-}$ ion - **4 atoms**

Textual Page No. 58

Let us answer these:

1. **Calculate the molecular masses of**

    (i) Cl_2 = molecular mass of Cl_2
    $= 2 \times$ atomic mass of Cl
    $= 2 \times 35.5$ u
    $= 71$ u

    (ii) CO_2 = molecular mass of CO_2
    = atomic mass of C + $2 \times$ atomic mass of O
    $= 12 + 2 \times 16$
    $= 12 + 32$
    $= 44$ u

    (iii) CH_4 = atomic mass of C + $4 \times$ atomic mass of H
    $= 12 + 4 \times 1$
    $= 16$ u

    (iv) NH_3 = Molecular mass of NH_3
    = Atomic mass of N + 3 x Atomic mass of H
    $= 14 + 3$ x 1
    $= 17$ u

    (v) C_2H_6 = Molecular mass of C_2H_6
    = 2 x Atomic mass of C + 6 x Atomic mass of H
    $= 2$ x $12 + 6$ x 1
    $= 30$ u

2. **Calculate the formula masses of**

    (i) CaO   = Formula mass of CaO
    = Atomic mass of Ca + Atomic mass of O
    $= 40 + 16$
    $= 56$ u

    (ii) K_2CO_3 = Formula mass of K_2CO_3
    = 2 x Atomic mass of K + Atomic mass of C + 3 x Atomic mass of Oxygen
    $= 2$ x $39 + 12 + 3$ x 16
    $= 78 + 12 + 48$
    $= 138$ u

    (iii) $NaHCO_3$= Formula mass of $NaHCO_3$
    = Atomic mass of Na + Atomic Mass of H + Atomic Mass of C + 3 x Atomic Mass of O
    $= 23 + 1 + 12 + 3 \times 16$
    $= 23 + 1 + 12 + 48$
    $= 84$ u

(iv) H_2SO_4 = Formula mass of H_2SO_4

$\qquad$ = 2xAtomic Mass of H + Atomic Mass of S + 4xAtomic Mass of Oxygen

$\qquad$ = 2x1 + 32 + 4x16

$\qquad$ = 2 +32 + 64

$\qquad$ = 98 u

3. **Calculate the <u>gram molecular mass</u> of $Al_2(SO_4)_3$ (atomic mass of Al = 27, S =32)**

$\quad$ **Soln:** The Gram molecular mass of $Al_2(SO_4)_3$ = 2xAtomic mass of Al + 3xAtomic mass of S + 12xAtomic Mass of O

$\qquad$ = 2x27 + 3x32 + 12x16

$\qquad$ = 54 + 96 + 192

$\qquad$ = 342 g

Textual Page No. 61

Let us answer these:

1. **What mass in grams is represented by**

$\quad$ **Soln:-**

$\quad$ **(a)** 0.44 mole of CO_2

$\quad$ Gram molecular mass of CO_2 = 12 + 32 =44 g

$\quad$ 1 mole of CO_2 contains 44g of it.

$\quad$ ∴ 0.44 mole of CO_2 contains 44 x 0.44 g = 19.36 g.

$\quad$ **(b)** 3 mole of NH_3

$\quad$ Gram Molecular Mass of NH_3 = 17g

$\quad$ So, 3 Mole of NH_3 represents 3 x 17 = 51 g

2. **The mass of a single atom M is 3.05×10^{-22}g. What is its atomic mass?**

$\quad$ **Soln:**

$\quad$ Atomic mass = 1 mole of its atom

$\quad$ Since 1 mole of atoms = 6.022×10^{23} atoms

$\quad$ Mass of one atom of M = 3.05×10^{-22} g (given)

$\quad$ Mass of 1 mole of atoms = $3.05 \times 10^{-22} \times 6.022 \times 10^{23}$ = 183.7g

3. **Which has more number of atoms, 50g of sodium or 50g of Ca? (Given atomic mass of Na = 23 u, Ca = 40 u) ?**

$\quad$ **Soln:** 23 g of Na contains 6.022×10^{23} atoms

$\quad$ 50 g of Na will contain = $6.022 \times \frac{50}{23} \times 10^{23}$

$\quad$ = 1.3×10^{24}

$\quad$ 40 g of Ca contains 6.022×10^{23} atoms

$\quad$ 50 g of Ca will contain = $\frac{50}{40} \times 6.022 \times 10^{23}$
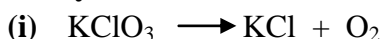
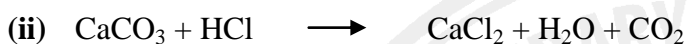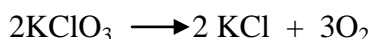$\quad$ = 7.5×10^{23}

$\quad$ ∴ 50g of Na has more atoms.

Textual Page No. 64

Let us answer these:

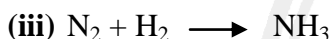1. **Verify whether the following equations are balanced or not? If not, balance it.**

   (i) $KClO_3 \longrightarrow KCl + O_2$

   Ans: Not Balance: the balance equation is

   $2KClO_3 \longrightarrow 2KCl + 3O_2$

   (ii) $CaCO_3 + HCl \longrightarrow CaCl_2 + H_2O + CO_2$

   Ans: Not Balance: the balance equation is

   $CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$

   (iii) $N_2 + H_2 \longrightarrow NH_3$

   Ans: Not Balance: the balance equation is

   $N_2 + 3H_2 \longrightarrow 2NH_3$

2. **Sodium reacts with water to produce sodium hydroxide and hydrogen gas. Write a chemical equation for the reaction.**

   Ans: $2Na + 2H_2O \longrightarrow 2NaOH + H_2 (g)$

TEXTUAL QUESTIONS AND ANSWERS

Textual Question (page 65)

Q1. What is meant by valency of an element?

Ans:- Valency of an element is the number of hydrogen atoms that can combine with or replace (either directly or indirectly) one atom of the element.

          OR

Valency of an element is the combining capacity of an atom of an element to form a molecule.

Q2. What is meant by symbol of an element? Explain with examples.

Ans:- Symbol of an element is the short method of representation of chemical elements using one or two letters. For example, the symbol of iron is Fe, Hydrogen is represented by H, Oxygen by O and Carbon by C etc.

Q3. Give two symbols which have been derived from the Latin name of the elements.

Ans:-

(i) The symbol of iron is Fe from its Latin name Ferrum.
(ii) The symbol of Tin is Sn from its Latin name Stannum.

Q4. What is molecule? Explain with an example.

Ans:- A molecule is the smallest particle in a chemical element or compound that has the chemical properties of that element or compound.

Or

A molecule is a particle made up of two or more atoms that are chemically bonded together.

Example:- A molecule of oxygen consists of two oxygen atoms (O_2) and molecule of water consists of two hydrogen atom and one oxygen atom (H_2O).

Q5. What is meant by a chemical formula? Write the formula of the three elements and two compounds.

Ans:- A chemical formula is a symbolic representation of the composition of the molecule of a substance. Formulae of three elements are H_2, O_2, N_2.

Formulae of two compounds are H_2O (water) and CO_2 (carbon-dioxide)

Q6. Explain the difference between 2N and N_2.

Ans:- 2N denotes two atoms of nitrogen and N_2 denotes one molecule of nitrogen.

Q7. Define the molecular mass of a substance.

Ans:- Molecular mass of a substance is the sum of all the atomic masses of all the atoms in a molecule of the substance. **Or**

It may be defined as the relative mass of the molecule as compared with the mass of one atom of carbon (C-12) taken as 12 u.

Q8. Calculate the molecular masses of the following.

Ans:-

(a) Ethane, C_2H_6

Molecular mass of ethane, C_2H_6

$C_2H_6 = (12 \times 2) + (1 \times 6)$

$= 24+6$

$= 30u$

(b) Calcium carbonate, $CaCO_3$

Molecular mass of $CaCO_3$

$$= 40 + 12 + (16 \times 3)$$

$$= 40 + 12 + 48$$

$$= 100u$$

(c) Copper sulphate, $CuSO_4$

Molecular mass of $CuSO_4$

$$= 63.5 + 32 + (16 \times 4)$$

$$= 63.5 + 32 + 64$$

$$= 159.5u$$

(d) Ehanol, C_2H_5OH

Molecular mass of C_2H_5OH

$$= (12 \times 2) + (1 \times 5) + 16 + 1$$

$$= 24 + 5 + 16 + 1$$

$$= 46u$$

(e) Acetic acid, CH_3COOH

Molecular mass of CH_3COOH

$$= 12 + (1 \times 3) + 12 + 16 + 16 + 1$$

$$= 12 + 3 + 12 + 16 + 16 + 1$$

$$= 60u$$

(f) Ferrous sulphate (hydrated) $FeSO_4. 7H_2O$

$$FeSO_4. 7H_2O = 56 + 32 + (16 \times 4) + 7(1 \times 2 + 16)$$

$$= 56 + 32 + 64 + 7(2 + 16)$$

$$= 56 + 32 + 64 + 7 \times 18$$

$$= 56 + 32 + 64 + 126$$

$$= 278u$$

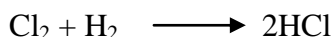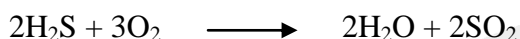**Q9. Translate the following statements into chemical equation and then balance the equations.**

Ans:-

a) Chlorine gas burns in hydrogen gas to give hydrogen chloride.

$$Cl_2 + H_2 \longrightarrow 2HCl$$

b) Hydrogen sulphide gas burns in air to give water and sulphur dioxide.

$$2H_2S + 3O_2 \longrightarrow 2H_2O + 2SO_2$$

c) Hydrogen gas combines with nitrogen to give ammonia, NH_3

$$3H_2 + N_2 \longrightarrow 2NH_3$$
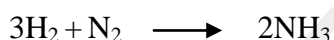
d) Sodium metal reacts with water to give sodium hydroxide and hydrogen gas

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2$$

e) Aluminium metal replaces iron from ferric oxide Fe_2O_3, giving aluminium oxide and iron.

$$Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$$

Q10.   What is the difference between a cation and an anion?

Ans:- Cations are positively charged ions whereas anions are negatively charged ions.

Example of cations are Ca_2^+, Na^+, H^+, K^+, NH_4^+, Al^{3+} etc.

Example of anions are Cl^-, S^{2-}, O^{2-}, PO_4^{3-}, SO_4^{3-}, NO_3^- etc.

Q11.   Name the following compounds, also write the symbols/formulas of the ions present in them.

Ans:

Symbol/ Formula	Compound name	Cation	Anion
$CuSO_4$	Copper sulphate	Cu^{2+} (copper ion)	SO_4^{2-} (Sulphate ion)
Na_2SO_4	Sodium sulphate	Na^+ (sodium ion)	SO_4^{2-} (Sulphate ion)
NH_4NO_3	Ammonium nitrate	NH_4^+ (ammonium ion)	NO_3^- (nitrate ion)
Na_2CO_3	Sodium carbonate	Na^+ (sodium ion)	CO_3^{2-} (carbonate ion)
$CaCl_2$	Calcium chloride	Ca^{2+} (calcium ion)	Cl^- (chloride ion)

Q12. **Calculate the formula masses of the following compounds.**

(a) Calcium Chloride.
Atomic mass of Ca is 40 and At. mass of Cl is 35.5
Formula mass of $CaCl_2$
$= 40 + (35.5 \times 2)$
$= 40 + 71$
$= 111u$

(b) Sodium hydrogen carbonate.
Formula mass of $NaHCO_3$ is
$= 23 + 1 + 12 + (16 \times 3)$
$= 23 + 1 + 12 + 48$
$= 84u$

Q13. **If the valency of carbon is 4 and that of sulphur is 2. Work out the formula of the compound of carbon and sulphur. Name the compound.**
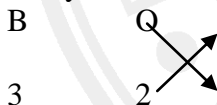
Ans:- Symbol   C   S

       Valency   4   2

Formula C_2S_4 or CS_2, the name of compound is carbondisulphide

Q14. **An element B shows valencies 2 and 3. Write the formula of its two oxides.**
Ans:-
a) When valency of an element B is 2, the formula of its two oxides is BO.
b) When the valency of an element B is 3, the formula of its two oxides is

      B   O

      3   2

So the formula is B_2O_3

Q15. **If the aluminium salt of an anion X is A_2X_3, What is the valency of X? What will be the formula of magnesium salt of X?**
Ans:- The valency of X is 2 The formula of the magnesium salt of X is MgX

Q16. **Define mole.**
Ans:- The mole is the amount of substance in SI which contains as many particles(atoms, molecules, ions or electrons) as there are atoms in exactly 12g of carbon atom.

Q17. **How many atoms are there is 0.24 mole of oxygen O_2.**

Soln. 1 mole of oxygen $(O_2) = 6.022 \times 10^{23}$ molecules.

Therefore 0.24mole of oxygen $(O_2) = 6.022 \times 10^{23} \times 0.24$ molecules

$= 1.445 \times 10^{23}$ molecules

Since, one molecule of oxygen contains two atoms of oxygen, total number of oxygen atom is $1.445 \times 10^{23} \times 2 = 2.89 \times 10^{23}$ atoms.

Q18. **Convert into mole:**

a. **12g of nitrogen gas.** **b. 15g of water.** **c. 22g of carbon dioxide**

a. $No.\,of\,moles = \frac{mass\,in\,gram}{molar\,mass} = \frac{12g}{28g\,mol^{-1}} = 0.428\,mol$

b. $No.\,of\,moles = \frac{mass\,in\,gram}{molar\,mass} = \frac{15g}{18g\,mol^{-1}} = 0.83\,mol$

c. $No.\,of\,moles = \frac{mass\,in\,gram}{molar\,mass} = \frac{22g}{44g\,mol^{-1}} = 0.5\,mol$

Q19. **What is the mass of:**

(a) **0.2 mole of chlorine (Cl_2)** **(b)** **0.5 mole of water molecule**

Soln.

(a) 1 mole of chlorine (Cl_2) gas $= 35.5 \times 2 = 71g$

Therefore 0.2 mole of $Cl_2 = 71 \times 0.2g = 14.2g$

(b) 1 mole of water (H_2O) $= (1 \times 2) + 16 = 18g$

Therefore 0.5 mole of water $= 18 \times 0.5 = 9g$

Q20. **Calculate the number of potassium ion present in 7.45g of potassium oxide. (at. mass of K = 39u)**

Ans:- Formula of potassium oxide is K_2O.

Molar mass of $K_2O = (39 \times 2) + 16 = 78 + 16 = 94g\,mol^{-1}$

No. of moles of K_2O = mass in gram/molar mass = $7.45g/94g\,mol^{-1} = 0.079$ mol

But 1 mole of K_2O contains 6.022×10^{23} molecules

Therefore, 0.079 mole of K_2O contains $= 6.022 \times 10^{23} \times 0.079$ molecules.

$$= 0.476 \times 10^{23} \text{molecules.}$$

One formula unit of K_2O contains two potassium ions (K^+),

Therefore, total number of potassium ion is given by $4.76 \times 10^{22} \times 2 = 9.52 \times 10^{22}$ ions

EXTRA QUESTIONS AND ANSWERS

Q1. Give the name of the Scientist who use the symbols of element for the first time in a very specific sense?

Ans:- John Dalton.

Q2. List some element with symbol derived from their Latin name.

Ans:-

Name of the element	Latin name	Symbol
Antimony	Stibium	Sb
Copper	Cuprum	Cu
Gold	Aurium	Au

(For more, refer to Page 50, Table 4.3)

Q3. What are the significances of symbol of element? Explain with examples.

Ans:- The significances of symbol of element are

i. Name of the element.
ii. One atom of the element
iii. Mass of an atom of the element

Example: The symbol 'N' represents:

i. The name of the element is Nitrogen.
ii. An atom of Nitrogen.
iii. Mass of one atom of Nitrogen is 14u

Q4. What is a chemical formula? What are the significance of a chemical formula?

Ans:- A chemical formula is a symbolic representation of the composition of the molecule of a substance. Significance of a chemical formula (molecular formula)

(i) It signifies the total number of elements presence in the molecule (Chemical formula).
(ii) It represents the total mass of the compound (Chemical formula).
(iii) It represents the fixed ratio by mass of the compound.

Q5. What are the steps which are involved in writing the chemical formula? Explain with examples.

Ans:- Steps which are involved in writing the chemical formula are

i. Write the symbols of the constituent elements.
ii. Put the valencies under each symbol.
iii. Take out the common factor if there is any.
iv. Cross over the valency of the combining atoms.
v. In case of polyatomic ions, the ions must enclose in a bracket before writing the number.

Example:

i. Formula of Hydrogen Chloride

Symbol   H $\longrightarrow$ Cl

Valency   1 $\longrightarrow$ 1

Formula   HCl

ii. Formula of Ammonium sulphate

Symbol NH_4 $\longrightarrow$ SO_4

Charge 1^+ $\longrightarrow$ 2^-

Formula $(NH_4)_2 SO_4$ *(Ref page 54 for more examples)*

Q6. Write down the formula of the following compounds.

Ans:- Compound   **Formula**

(i)   Aluminium Chloride $AlCl_3$
(ii) Zinc sulphide ZnS
(iii) Calcium hydroxide $Ca(OH)_2$
(iv) Aluminium sulphate $Al_2(SO_4)_3$
(v)   Iron (ii) Carbonate $FeCO_3$

Q7. Define valency. How does it differ from variable valency?

Ans:- The combining capacity of an atom of an element to form a molecule is called valency.

E.g valency of aluminium is 3, calcium is 2.   *(Ref, page 52 for more examples)*

Variable valency

If an element possesses more than one valency then, it is said to possess variable valency.

E.g. copper has valency of 1 and 2, iron has a valency of 2 and 3 etc.

Q8. What do you understand by Ferrous chloride ($FeCl_2$) and Ferric chloride ($FeCl_3$)?

Ans:- Ferrous Chloride($FeCl_2$) and (Ferric chloride)$FeCl_3$ are the compounds formed when iron combines with chlorine. In $FeCl_2$, valency of iron is 2 and in $FeCl_3$ the valency of iron is 3. When metallic element form two compound with another element, the name of the metal in its lower valency state ends with a suffix "ous" like ferrous chloride and that element in the compound and that element in the compound of its higher valency state ends with a suffix "ic" like ferric chloride.

Q9. Define the following terms. Give examples.

Ans:-

(i) Ions:- An atom or a group of atoms carrying either positive or negative charges are called ions.

E.g. Na^+, Ca^{2+}, K^+, S^{2-}, H^- etc.

(ii) Cations:- The positively charged ions are called Cations.

E.g. K^+, Cu^+ etc.

(iii) Anions:- The negatively charged ions are called Anions.

E.g. Br^-, O^{2-}, NO^-_3 etc.

(iv) Ionic compounds:- The compounds which are made up of ions are called ionic compounds.

E.g. NaCl (Sodium Chloride) consist of positively charged sodium ion (Na^+) and negatively charged Chloride ion (Cl^-).

(v) Polyatomic ions:- A group of atom carrying a charged is called polyatomic ions.
E.g. NH_4^+, NO_3^- etc.

Q10. Define is molecular mass? What is its S.I. unit?

Ans:- Molecular mass of a substance is the total sum of all the atomic masses of all the atoms in a molecule of the substance. Its S.I. unit is unified mass (u).

Q11. Calculate

(i) **Molecular mass of CO_2**
(ii) **Percentage (%) of Carbon (C) in CO_2**
(iii) **Percentage (%) of Oxygen (O) in CO_2**

Ans:-

(i) Molecular mass of CO_2 is $12+(2\times16)$

$$=12+32 = 44u$$

(ii) Percentage (%) of Carbon (C) in $CO_2 = \frac{parts\ of\ carbon\ (C)by\ mass}{Molecular\ mass\ of\ CO2}\times100$

$$=\frac{12}{44} \times 100$$

$$= 27.3\%$$

(iii) Percentage (%) of Oxygen (O) in $CO_2 = \frac{parts\ of\ osygen\ (O)by\ mass}{Molecular\ mass\ of\ CO2}\times100$

$$=\frac{32}{44} \times 100$$

$$= 72.7\%$$

Q12. Calculate the mass of Carbon present in 24g of CO_2.

Ans:- Molecular mass of $CO_2=(1\times12)+(2\times16)$

$$= 12+32 =44u$$

Mass of C in 24g of $CO_2 = \frac{parts\ of\ carbon\ (C)by\ mass}{Molecular\ mass\ of\ CO2}\times24$

$$=\frac{12}{44} \times 24$$

$$= 6.5g$$

Q13. **Define gram molecular mass? Give an example.**

Ans:- The molecular mass of a substances (element or compound) expressed in grams is called gram molecular mass of a substances. For example, molecular mass of CO_2 is 44u. Hence, the gram molecular mass of CO_2 is 44g.

Molecular mass of H_2O = 2 x 1 + 1 x 16

= 2 + 16

= 18 (u)

$\therefore$ gram molecular mass of H_2O = 18 g.

Q14. **Calculate gram molecular mass of NH_3.**

Ans:- Molecular mass of NH_3 = 14+(3×1)

= 14+3 =17u

Therefore gram molecular mass of NH_3 is 17g

Q15. **What is meant by mole of a substance?**

Ans:- Mole is the specific number in which the number of particles present in atoms, molecules, ions or electrons remains the same. The specific number is 6.022×10^{23}.

E.g. 1 mole of atom = 6.022×10^{23} atom

1 mole of molecule = 6.022×10^{23} molecules

1 mole of ions = 6.022×10^{23} ions etc.

Q16. **Why mole is so significant?**

Ans:- Besides being related to a number, a mole has one more advantage over other number like dozen or gross.

The advantage is that mass of 1 mole of a particular substance is also fixed.

The mass of 1 mole of a substance is equal to its relative atomic or molecular mass in grams (gram` atomic or molecular mass).

Q17. **Convert into mole. A) 12 g of Nitrogen gas**

Ans:-

Molecular mass of N_2 = 2×14 = 28u

So, gram molecular mass = 28g

Hence 28g of N_2 molecule contains 1mole of N_2 molecules.

So, 1g of N_2 molecule contains 1/28 moles of molecules.

Therefore 12g of N_2 molecule contain = $\frac{1}{28} \times 12$ mole of N_2 molecule

= $\frac{3}{7}$ mole of N_2 molecule

= 0.43 mole of N_2 molecule

Q18. What is chemical equation? Give example.

Ans:- A chemical equation is the symbolic representation of an actual chemical reaction with the help of symbol and formulas of reactants and products.

e.g. $2Mg + O_2 \longrightarrow 2MgO$
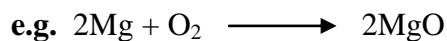
This chemical equation shows that Magnesium react with Oxygen to form magnesium oxide as products.

Q19. What are the rules to be followed while writing chemical equations?

Ans:- Rules to be followed while writing chemical equation are

(i) The reactants are placed on the left hand side separated by plus(+) sign which means "reacts with".

(ii) The products are placed on the right hand side separated by (+) sign which means "along with"

(iii) The reactants and products are separated by an arrow pointing towards the product ($\longrightarrow$) or the sign of equality (=) which means 'to produce'

(iv) Above the arrow, the reaction conditions such as catalyst, temperature, pressure etc. may be indicated.

(v) If the product is a gas, it indicated by an upward arrow ($\uparrow$) and if the product is a precipitate, it is indicated by a downward arrow ($\downarrow$).

(vi) Sometimes the physical state of reactants and products are also indicated in a chemical reaction.

Eg: $Zn + 2HCl \longrightarrow ZnCl_2 + H2$

Q20. What are the qualitative and quantitative significance of chemical equation.

Ans:- The qualitative and quantitative significance of chemical equation are

Qualitatively, it represents

(i) What are the reactants and what are the products,

(ii) The composition of reactants and products

Quantitatively, it represents

(i) The relative of each kind of the molecules and atoms

(ii) The relative masses of the reactants and products

(iii) The number of moles of the reactants and products

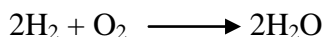**(iv)** The volumes of gaseous substance involved.

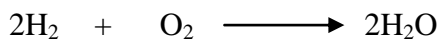**Q21.** **Interprete the following equation**

$$2H_2 + O_2 \longrightarrow 2H_2O$$

Ans:-

$$2H_2 \quad + \quad O_2 \longrightarrow 2H_2O$$

2 mole or 4g   1mole or 32g   2mole or 36 g

This chemical equation can be interpreted as

i. Hydrogen and Oxygen combined to form water
ii. 2 molecules of Hydrogen react with 1 molecule of Oxygen to produced 2 molecules of water.
iii. 32 parts by mass of oxygen reacts with 4 parts by mass of Hydrogen to produce 36 parts by mass of water
iv. 2 moles of Hydrogen molecule react with 1 mole of Oxygen molecule to produce 2 mole of water.

PROBABLE QUESTIONS FROM TEXTBOOK

Q1. **Give the name of the Scientist who use symbol of elements for the first time in a very specific sense.**

Ans: John Dalton

Q2. **Define symbol of an element. What are the significances of symbols?**

Ans: Symbol of an element is the accepted abbreviation of the name of the element.

A symbol signifies

(a) Name of the element.
(b) An atom of the element.
(c) The mass of an atom of the element.
(d) Atomic number of the element.

Q3. **Write the rules associated for writing the modern symbols of elements by giving suitable examples.**

Ans:

(i) Using of first letter of the name of the element in capital letter. (Berzerllius)

e.g. Hydrogen —— H   Oxygen —— O   Carbon ——C

(ii) Using of two letter Combination: The first letter of the symbol should be capital and the second letter should be in small.

e.g. Calcium — Ca   Chlorine — Cl   Palladium —— Pd

(iii) Using of Latin language, name of Scientist or country.

e.g. Gold —— Aurum — Au , Silver —— Argentum —— Ag, Tungsten —— W —— Wolfram (Name of scientist).

Q4. Write the Latin names and symbols of the following elements.

(a) Iron   (b) Copper   (c) Gold   (d) Silver   (e) lead   (f) Sodium
(g) Potassium   (h) Mercury   (i) Tin   (j) Antimony   (k) Tungsten

Ans:

Name of Element	Symbol	Latin Name
(a) Iron	Fe	Ferrum.
(b) Copper	Cu	Cuprum
(c) Silver	Ag	Argentum
(d) Sodium	Na	Natrium
(e) Potassium	K	Kalium
(f) Mercury	Hg	Hydrargyrum
(g) Tin	Sn	Stannum
(h) Tungsten	W	Wolfram

Q5. What are the rules associated for writing chemical formula of a compound?

Ans:

(i) When a compound consists of a metal and non-metal, the name or symbol of the metal should be written first and following by the ion formed by the non-metal.
   e.g. NaCl → Sodium Chloride.

(ii) When the compound consist of non-metals only, the name of the non-metal which has less electronegativity

(iii) Should be written first and followed by the name of the ion formed by the non-metal which has less electronegativity.
   e.g. CO_2 → Carbon dioxide ; PN → Phosphorous nitride.

(iv) When writing the chemical formula ,the valencies of the elements should be written with the symbols and they must be cross wise and if there is equal fractions (common factors), they should be cancelled .

(v) In compounds formed with polyatomic ions, the ion is enclosed in a bracket before writing

   the number to indicate the ratio.

Q6. What is formula unit mass?

Ans:- It is the total sum of the atomic masses of the atoms present in the different ions in a compound (molecules) having opposite ions .

Q7. Differentiate between molecular mass and formula (unit) mass. Give example.

Ans: molecular mass is the total sum of the atomic masses of all the atom in a molecule of a substance.

Formula (unit) mass is the total sum of the atomic masses of the atoms presence in the opposite ions (constituent ions) in a compound.

e.g. **Molecular mass of CO_2**

CO_2 (C=12 ; O=16)

$= 1 \times C + 2 \times O = 1 \times 12 + 2 \times 16 = 12 + 32 = 44u.$

Formula mass of NaCl

$$Na^+ + Cl^- \longrightarrow NaCl$$

$$23u \quad 35.5u$$

$= 23 + 35.5 = 58.5u$

Q8. What is molar mass? What is its unit?

Ans:- It is define as the mass of 1 mole of any substance. It is always expressed in gram. It is also known as gram atomic mass or gram molecular mass.

Q9. What is the information conveyed by a chemical formula?

Ans:- A chemical formula conveys the following information:

(a) **Qualitatively it represents-**
   (i) The name of the compound.
   (ii) The elements presents in the compound.
(b) **Quantitatively it represents-**
   (i) One molecule of the substance.
   (ii) The number of atoms of various elements which constitute one molecule of the substance.
   (iii) The molecular mass of the one molecule of the substance.
   (iv) The number of parts by mass of the elements present in the molecule.
   (v) One mole of the substance.

Q10. **What is chemical equation? What is the information conveyed by chemical equations.**

Ans:- A chemical equation is the symbolic representation of an actual chemical reaction with the help of symbols and formulae of respective reactants and products.
Informations conveys by a chemical equation:-

(a) Qualitatively it represents:-

(i) The name and chemical formulae of the reactants and products.
(ii) The composition elements of the reactants and products.

(b) Quantitatively it represents:-

(i) The relative number of each kind of molecules and atoms.
(ii) The relative masses of the reactants and products.
(iii) The number of moles of the reactants and products.
(iv) The volume of gaseous substances involved.

Q11. **What are the rules associated for writing a chemical equation?**

Ans:-

(i) The symbols or formula of the reactant should be placed on the left hand side separated by plus (+) sign which means "reacts with)".
(ii) The products should be placed on the right hand side separated by plus (+) sign which means "along with".
(iii) The reactants and products are separated by an arrow pointing towards the product ($\rightarrow$) or the sign of equality (=) which means "to produce".
(iv) Above the arrow, the reaction conditions such as catalyst, temperature, pressure, etc. may be indicated.
(v) If the product is a gas, it is indicated by an upward arrow ($\uparrow$) or (g) and if the product is a precipitate, it is indicated by a downward arrow ($\downarrow$) or (s).
(vi) Sometimes the physical state of reactants and products are also indicated in a chemical equation.

Q12. **When an element is said to possess variable valency? What are the suffixes uses for the variable valencies?**

Ans:- If an element possesses more than one valency, then it is said to possess variable valency. When a metallic element forms two compounds with another element, the name of the metal in its lower valency state ends with a suffix "ous" and that in the compound of its higher valency state ends with suffix "ic";
E.g. $Fecl_2 \rightarrow$ Ferrous chloride, $\qquad Fecl_3 \rightarrow$ Ferric chloride.

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