

Chapter 5

Language of Chemistry

Symbol

- A symbol is the short hand representation for the atom of a specific element.
- Symbol of an element represents an atom of that element.
- Example : H is the symbol of the element Hydrogen .
H represents one atom of Hydrogen.

Molecular Formula of Compounds

A molecular formula of a compound is the symbolic representation of its molecule.

Significance

- It represents one molecule of a compound
- It shows the number of atoms of each element present in it.
- Molecular mass of the compound can be calculated from the molecular formula.

Step by step method or Criss cross method for writing the Molecular formula

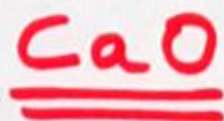
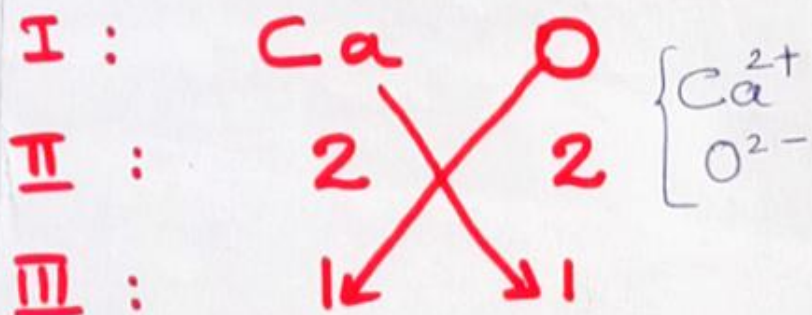
I . Write the symbols

II. Write the valency of the symbols

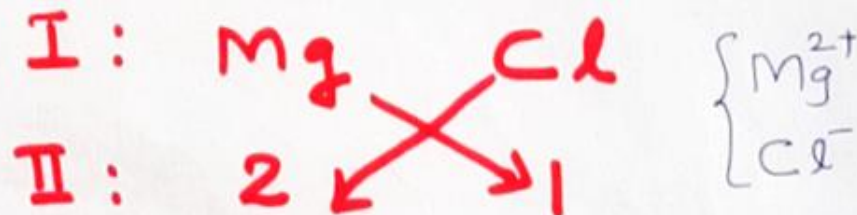
III. Simplify the valencies (if possible)

IV. Cross multiply the valencies and write
the molecular formula of the compound.

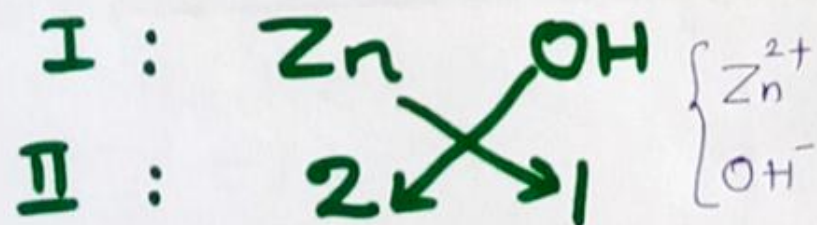
1) Calcium Oxide



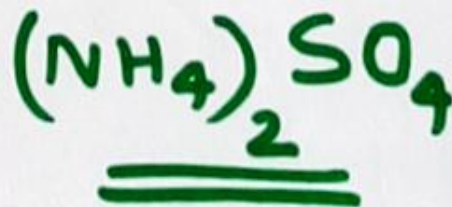
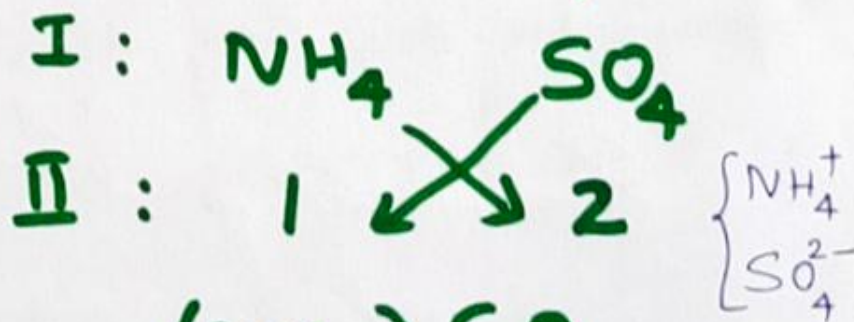
2) Magnesium Chloride



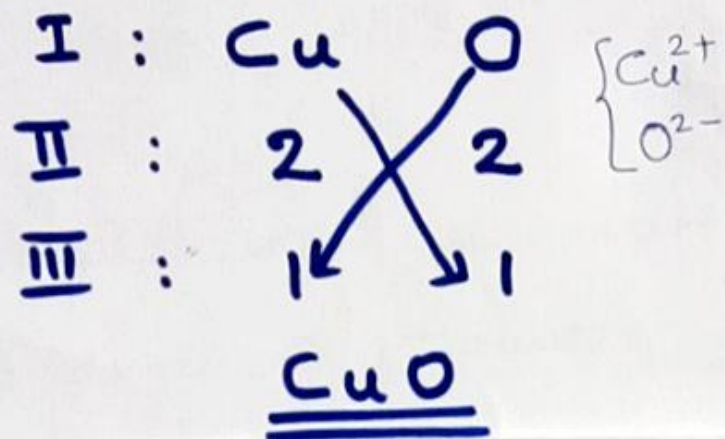
3) Zinc Hydroxide



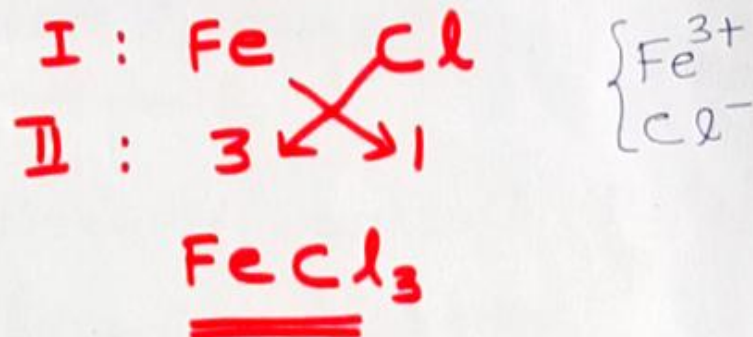
4) Ammonium Sulphate



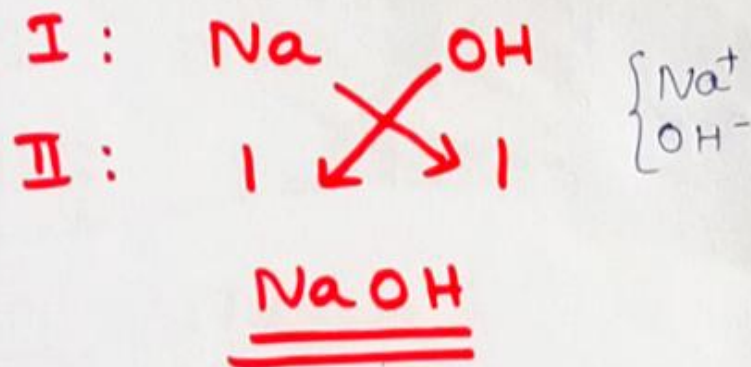
5) Copper(II) Oxide



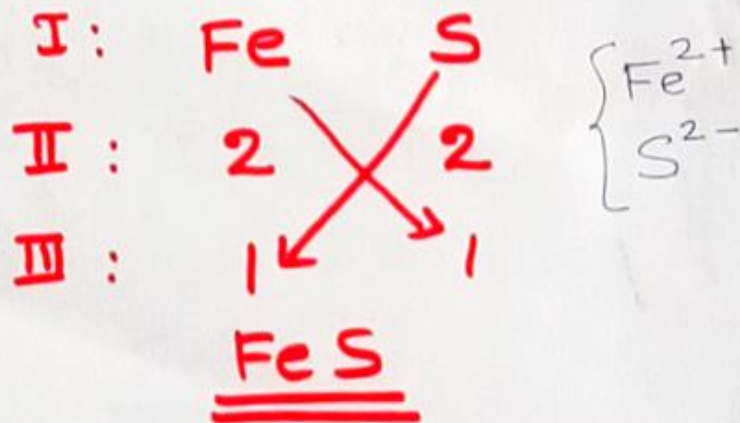
6) Iron(III) Chloride



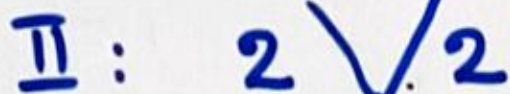
7) Sodium Hydroxide



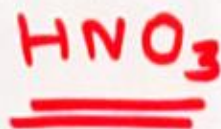
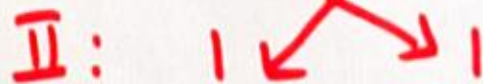
8) Iron (II) Sulphide



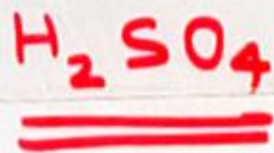
9) Lead (II) oxide



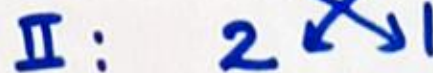
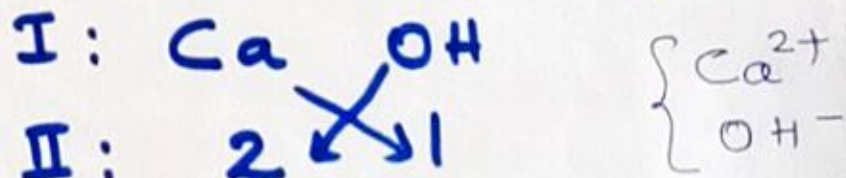
10) Nitric acid (Hydrogen Nitrate)



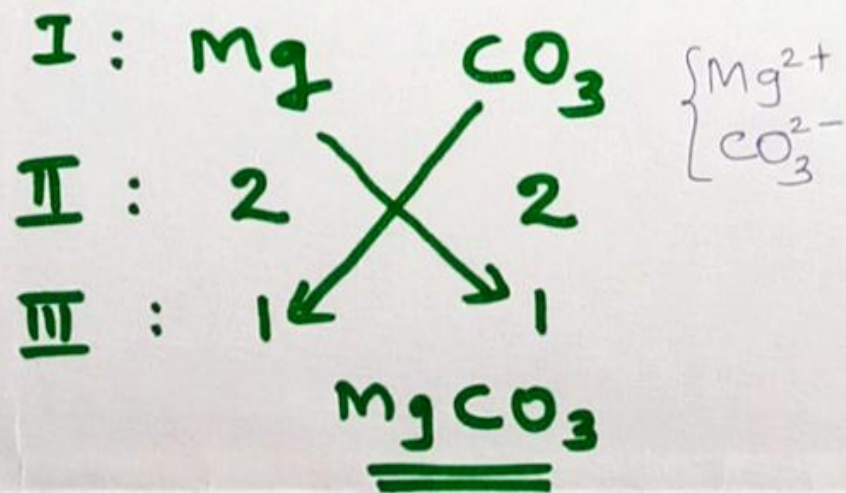
11) Sulphuric acid (Hydrogen Sulphate)



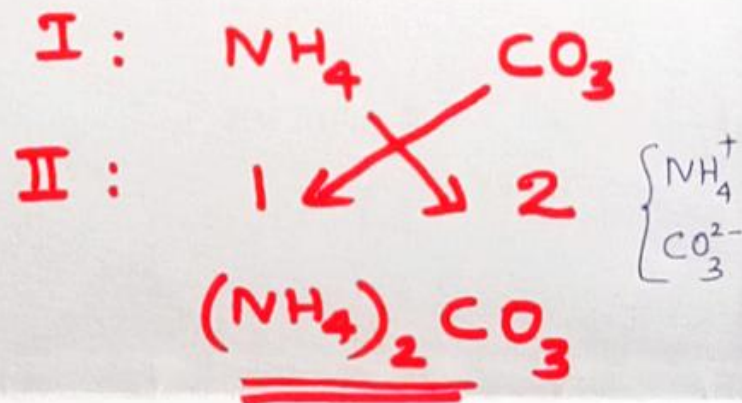
12) Calcium Hydroxide



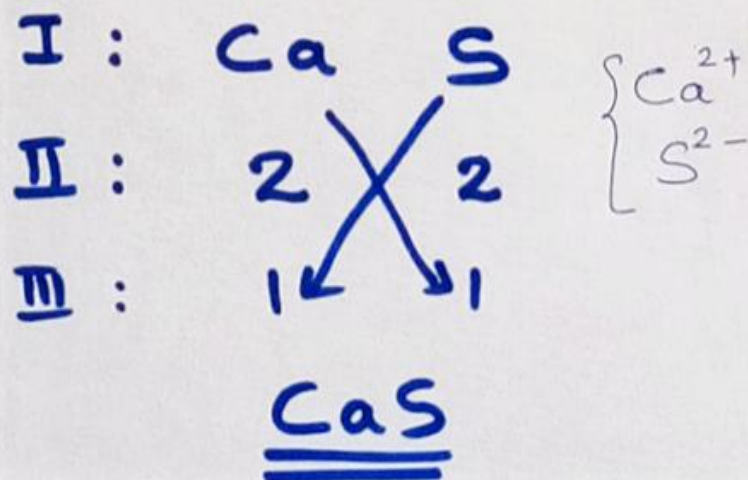
13) Magnesium Carbonate



14) Ammonium Carbonate



15) Calcium sulphide



Home work

Write the molecular formula for the **oxides** and **sulphides** of the following elements :

a) Sodium

b) Hydrogen



a)

i) Sodium oxide

I: Na O

II: 1 $\swarrow \searrow$ 2

$\left\{ \begin{array}{l} \text{Na}^+ \\ \text{O}^{2-} \end{array} \right.$

Na₂O

ii) Sodium sulphide

I: Na S

II: 1 $\swarrow \searrow$ 2

$\left\{ \begin{array}{l} \text{Na}^+ \\ \text{S}^{2-} \end{array} \right.$

Na₂S

b)

i) Hydrogen oxide

I: H O

II: 1 $\swarrow \searrow$ 2

$\left\{ \begin{array}{l} \text{H}^+ \\ \text{O}^{2-} \end{array} \right.$

H₂O

ii) Hydrogen sulphide

I: H[•] S

II: 1 $\swarrow \searrow$ 2

$\left\{ \begin{array}{l} \text{H}^+ \\ \text{S}^{2-} \end{array} \right.$

H₂S

amu

- **amu is atomic mass unit.**
- **Mass of an atom is expressed in amu.**
Example : Atomic mass of oxygen is 16 amu.
- **Carbon** is the most most widely accepted standard unit for the measurement of atomic mass.

Molecular mass

Molecular mass is the sum of the masses of all the atoms present in a given molecule.

Example :

Molecular mass of Sulphur dioxide (SO_2)

[Atomic mass of Sulphur is 32 amu and that of oxygen is 16 amu]

Molecular mass of $\text{SO}_2 = 32 + (2 \times 16) = 64 \text{ amu}$

Question

Write the molecular formula and calculate the molecular mass of the following compounds :

- a) Sulphur trioxide
- b) Iron (II) sulphide
- c) Ammonia

[Atomic masses : S--> 32 amu ,O ---> 16 amu,
Fe ---->56 amu , N --->14 amu, H ----> 1 amu]

a) Sulphur trioxide (SO_3)

Molecular mass = $32 + (3 \times 16) = 80$ amu

b) Iron (II) Sulphide (FeS)

Molecular mass = $56 + 32 = 88$ amu

c) Ammonia (NH_3)

Molecular mass = $14 + (3 \times 1) = 17$ amu

Chemical equations

- A chemical equation is the symbolic representation of a chemical reaction using symbols and formulae of the substances involved in the reaction.
- Substances that undergo the chemical change are called **reactants**.
- The new substances formed in a chemical reaction are called **products**.

Examples:

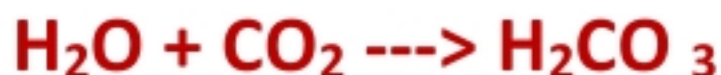


- An unbalanced chemical equation is known as **skeletal equation**.



- In a **balanced chemical reaction** , the number of atoms of each element on the reactant side is equal to the number of atoms of that element in the product side .

Examples:



Question

Why it is necessary to balance a chemical equation ?

Answer

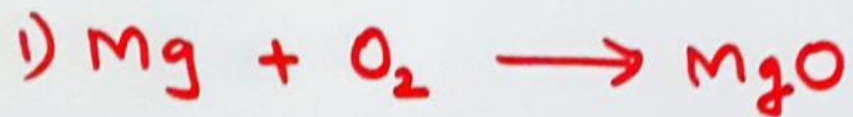
A chemical equation needs to be balanced inorder to make the number of atoms of the reactants equal to the number of atoms of the products.

This is because a chemical reaction is just a rearrangement of atoms.

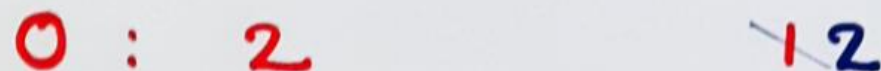
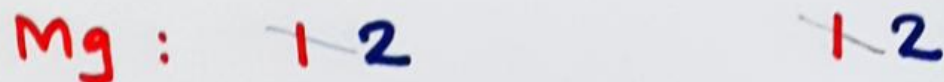
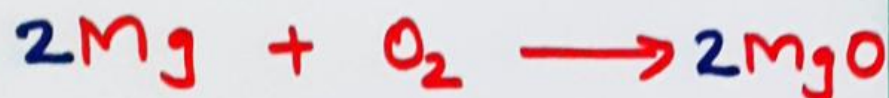
Significance of balanced chemical equation

- It gives information about the reactants and products.
- It shows both the number of molecules and the number of atoms involved in the reaction.
- It makes the study of chemistry universally standardized.

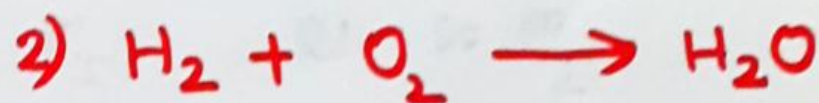
Balance the following chemical equations :



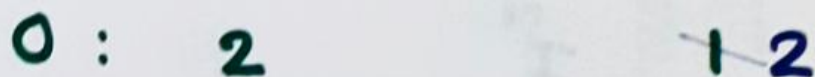
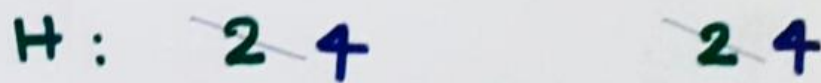
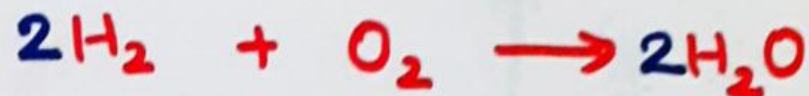
Given equation is,



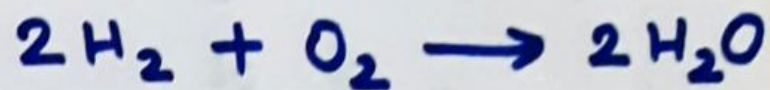
Balanced equation is,



Given equation is,

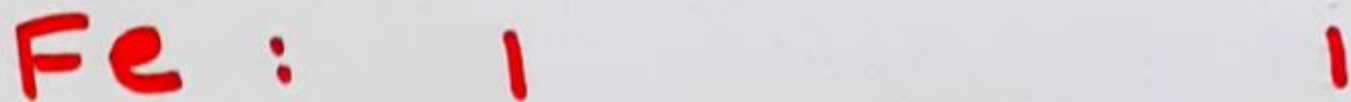


Balanced equation is,





Given equation is,



Balanced equation is,



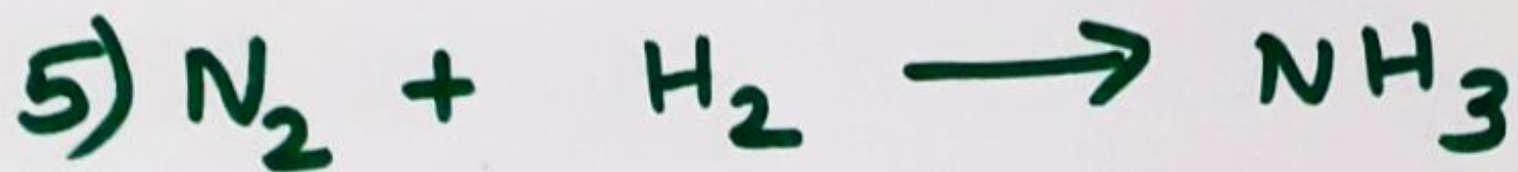


Given equation is,



Zn	1	1
H	2	2
S	1	1
O	4	4

Number of atoms of each element is the same on both sides, hence the above equation is a balanced chemical equation.



Given equation is,



N 2

~~1~~ 2

H ~~2~~ 6

~~3~~ 6

Balanced equation is,



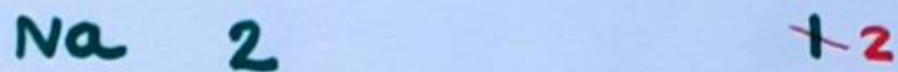
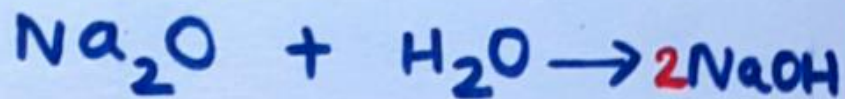
Homework

Balance the following chemical equations :

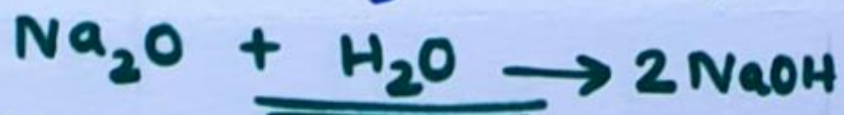


Homework - Answers:

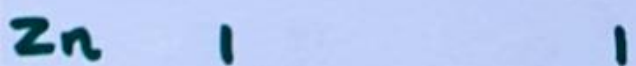
1) Given equation is,



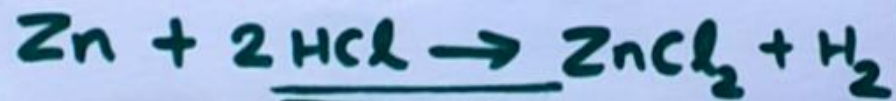
Balanced equation is,



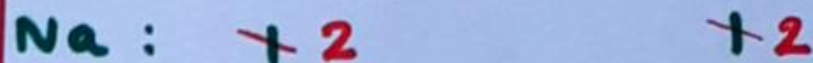
2) Given equation is,



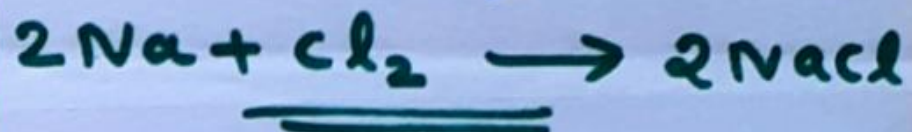
Balanced equation is,



3) Given equation is,



Balanced equation is,

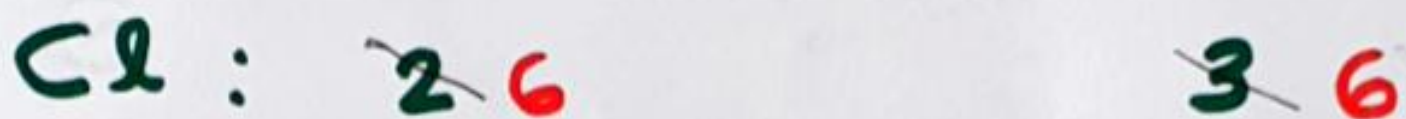


Question

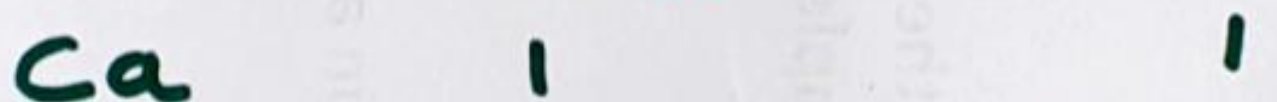
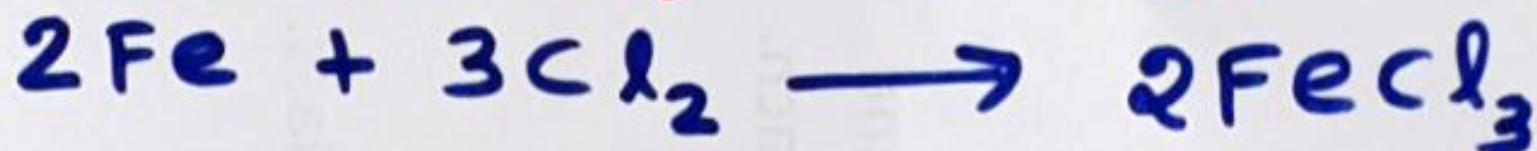
Write balanced chemical equations for the following word equations:

a) Iron + Chlorine ----->Iron (III) chloride

b) Calcium oxide + water ----->Calcium Hydroxide



Balanced equation is,



Above equation is a
balanced chemical equation

Limitations of a chemical equation

It does not inform about

- Physical state of the reactants and products.
- The time taken for the completion of the reaction.
- The rate of the reaction
- The conditions like temperature, pressure, catalyst etc. which affect the reaction.

Question

What are the ways by which a chemical equation can be made more informative ?

Answer

- The physical state of the reactants and products can be indicated by putting (s) for solid , (l) for liquid ,(g) for gas and (aq) for aqueous state.
- Temperature , pressure and catalyst can be indicated above the the arrow of the chemical reaction.
- Evolution or absorption of heat , can be denoted by adding the **heat** term.

- Write the symbols and valencies of the following radicals :

a)Hydroxide b) Chloride c) Carbonate
d) Ammonium e) Nitrate

Answer

Hydroxide : OH^- , valency 1

Chloride : Cl^- , valency 1

Carbonate : CO_3^{2-} , valency 2

Ammonium : NH_4^+ , valency 1

Nitrate : NO_3^- , valency 1

- The valency of aluminium is 3. Write the valency of other radicals present in the following compounds .

a) Aluminium chloride

b) Aluminium oxide

c) Aluminium nitride

d) Aluminium sulphate.

Answer

Chloride : valency 1

Oxide : valency 2

Nitride: valency 3

Sulphate : valency 2

Question

What information do you get from the following chemical equation:



Answer:

Solid form of Zn reacts with 2 molecules of dilute hydrochloric acid to form aqueous form of zinc chloride and hydrogen gas.