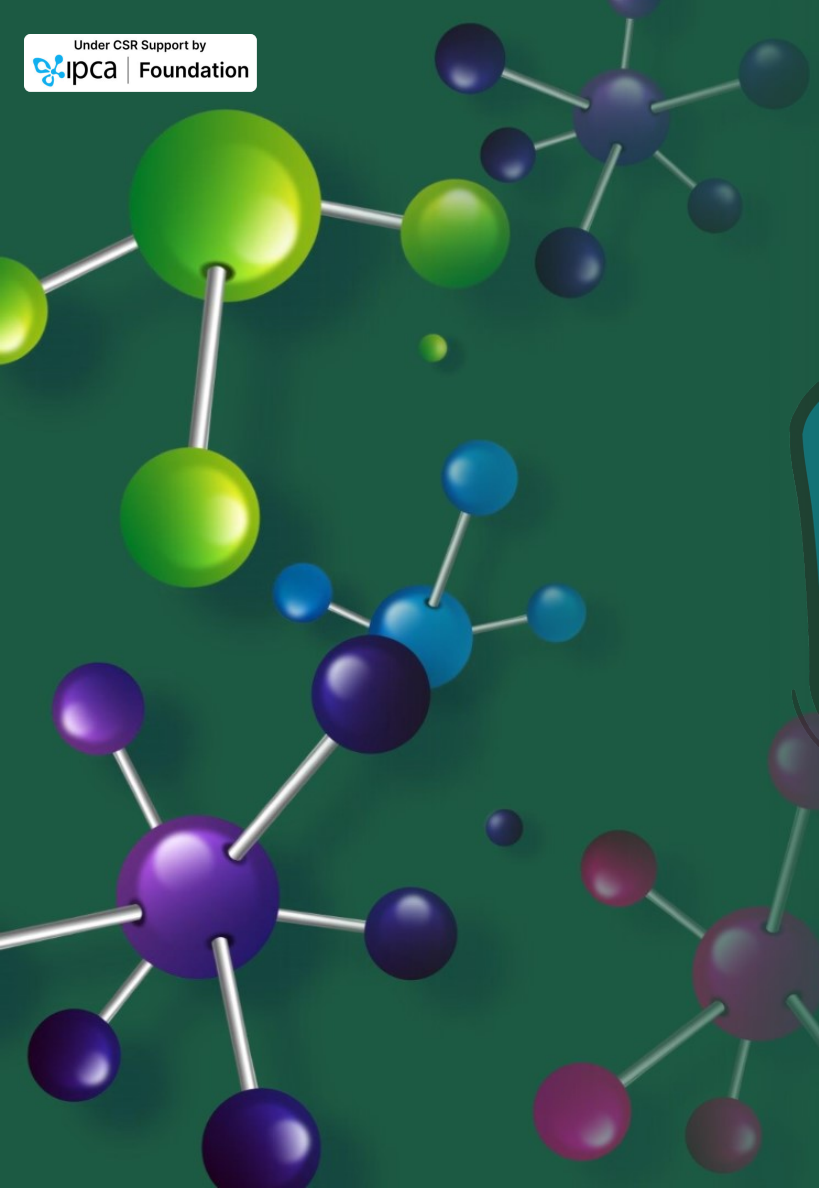
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Class–9

SCIENCE

Chapter – 3

ATOMS AND MOLECULES

Part – 3

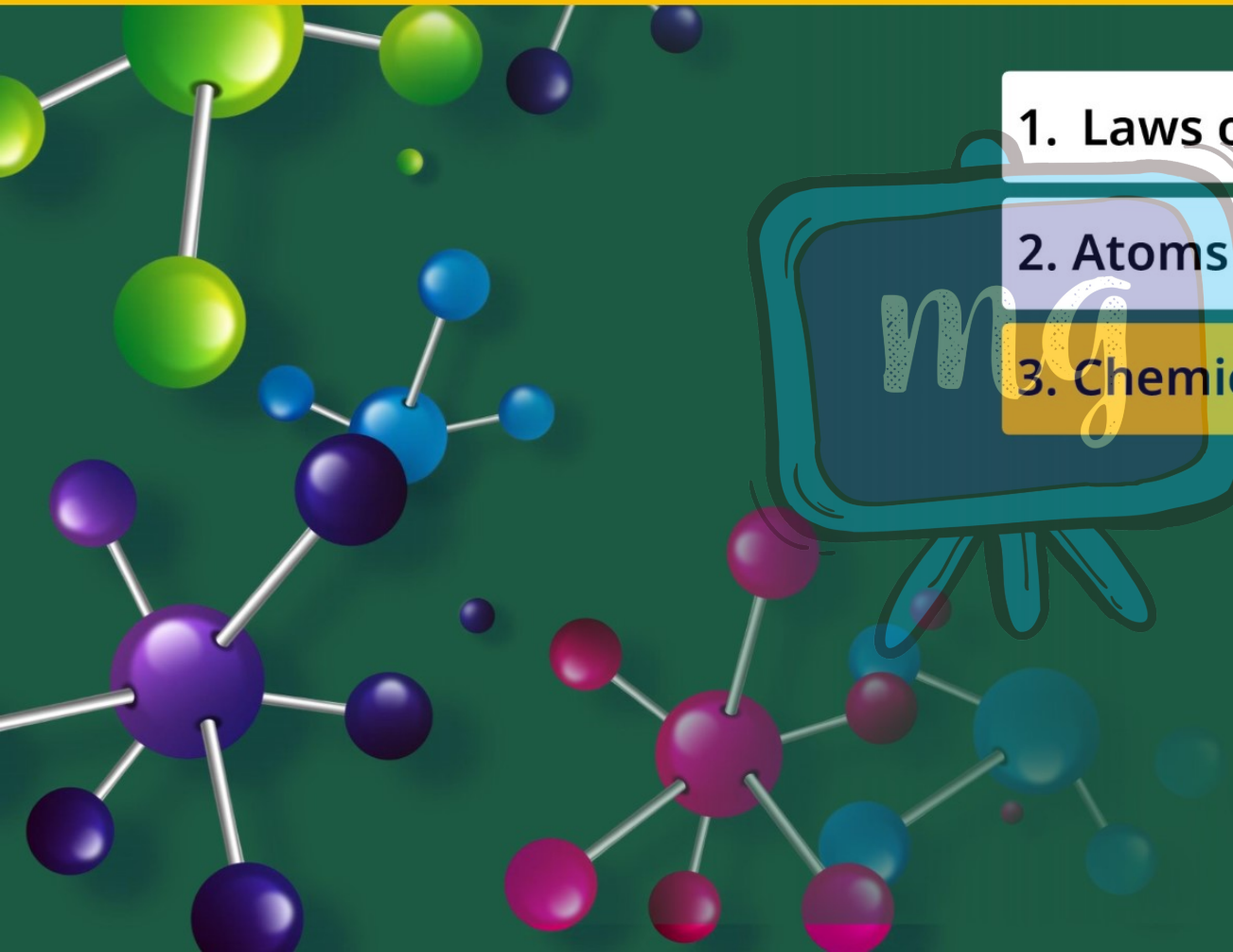
Chemical Formulae

Deeksha Pahilajani

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OVERVIEW

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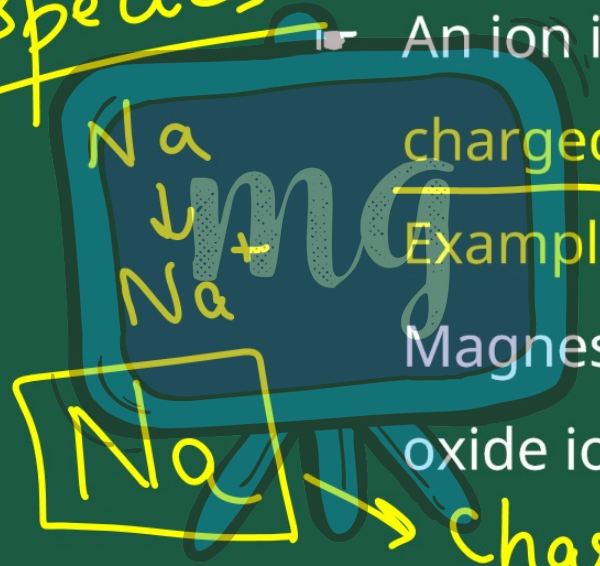
1. Laws of Chemical Combination
2. Atoms and Molecules
3. Chemical Formulae

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charged species

ION



☛ An ion is a positively or negatively charged atom or group of atoms.

Example : Sodium ion, Magnesium ion, chloride ion, oxide ion etc.

charged

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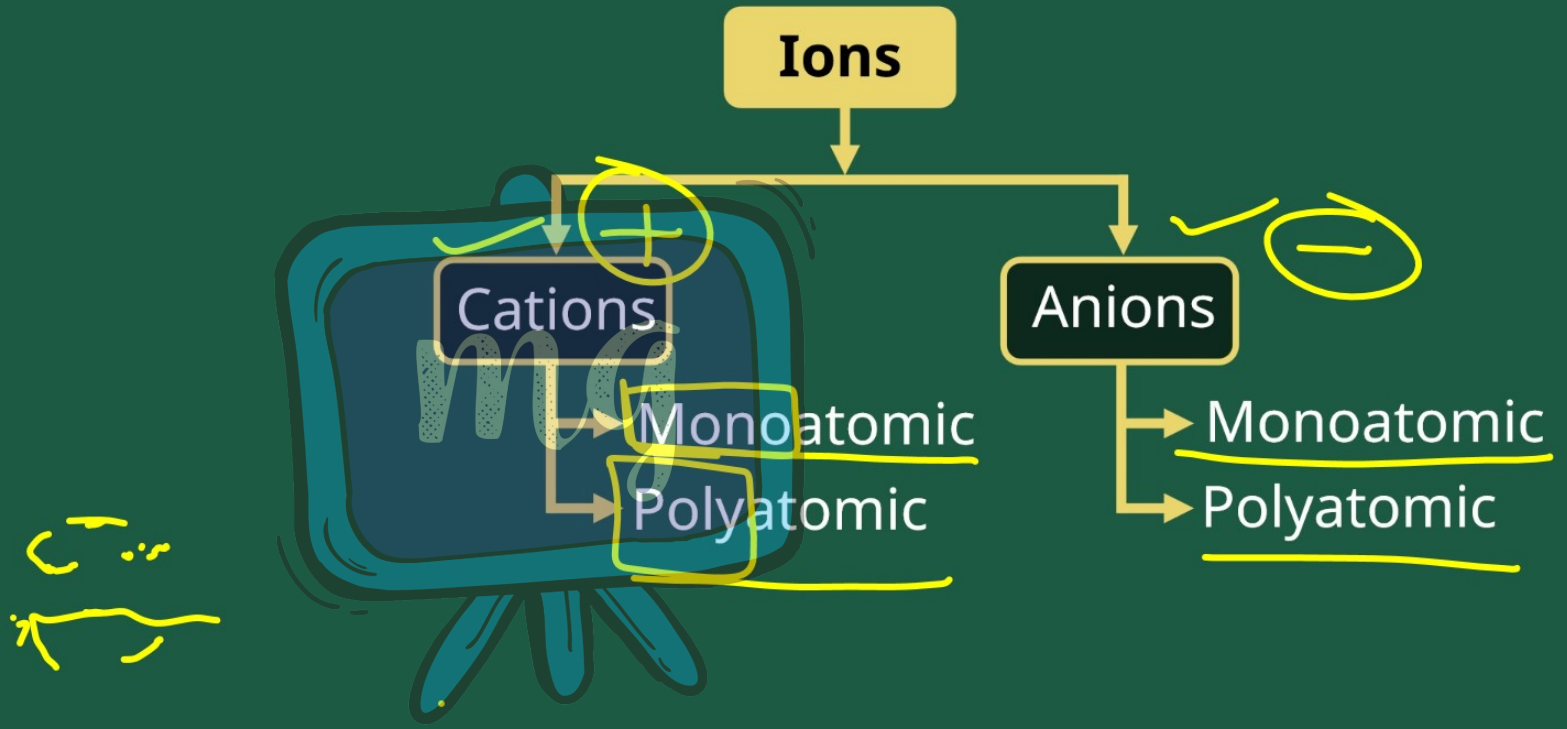
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Types of Ions

1. Cation:
   - A positively charged ion is known as cation.
2. Anion:
   - A negatively charged ion is known as anion.

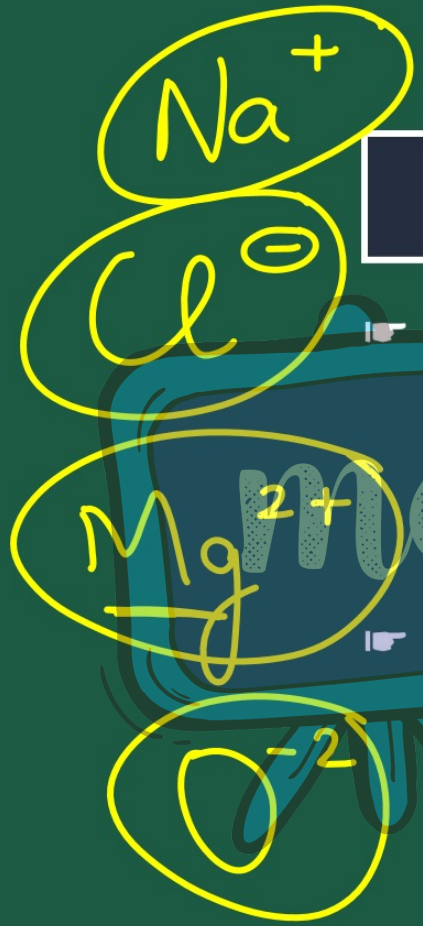
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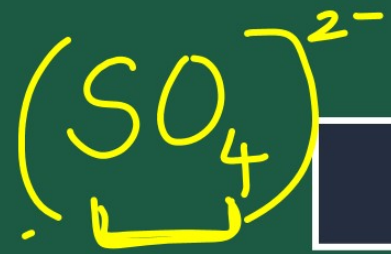
MONOATOMIC IONS

- Ions which are formed from single atoms are called simple ions or monoatomic ions.
- Example : Sodium ion, chloride ion, magnesium ion, aluminium ion, oxide ion etc.

:

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POLYATOMIC IONS



A group of atoms carrying a charge are called as polyatomic ions.

Example : Sulphate ion, phosphate ion, carbonate ion etc.

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Combining power Imp NH_3 NH_4

Names and symbols of some ions

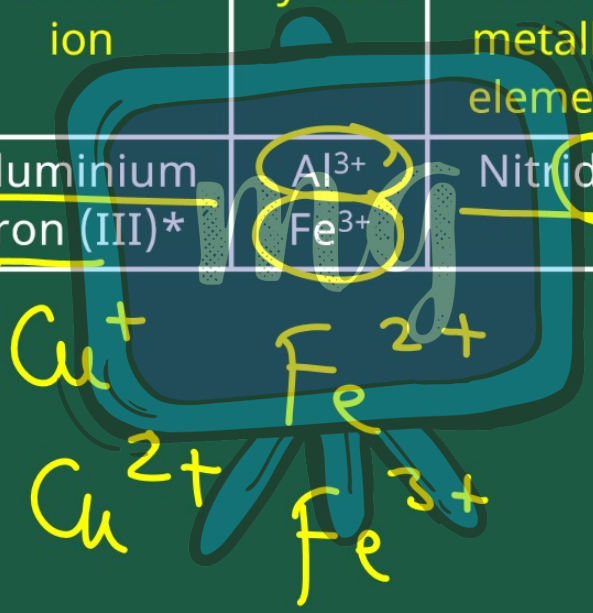
Valency	Name of ion	Symbol	Non-metallic element	Symbol	Polyatomic ions	Symbol
1.	Sodium	Na^+	Hydrogen	H^+	Ammonium	NH_4^+
	Potassium	K^+	Hydride	H^-	Hydroxide	OH^-
	Silver	Ag^+	Chloride	Cl^-	Nitrate	NO_3^-
	Copper (1)*	Cu^+	Bromide	Br^-	Hydrogen carbonate	HCO_3^-
			Iodide	I^-		
2.	Magnesium	Mg^{2+}	Oxide	O^{2-}	Carbonate	CO_3^{2-}
	Calcium	Ca^{2+}	Sulphide	S^{2-}	Sulphite	SO_3^{2-}
	Zinc	Zn^{2+}			Sulphate	SO_4^{2-}
	Iron (II)*	Fe^{2+}				
	Copper (II)*	Cu^{2+}				

ide - no O

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Names and symbols of some ions						
Valency	Name of ion	Symbol	Non-metallic element	Symbol	Polyatomic ions	Symbol
3.	Aluminium	Al^{3+}	Nitride	N^{3-}	Phosphate	PO_4^{3-}
	Iron (III)*	Fe^{3+}				



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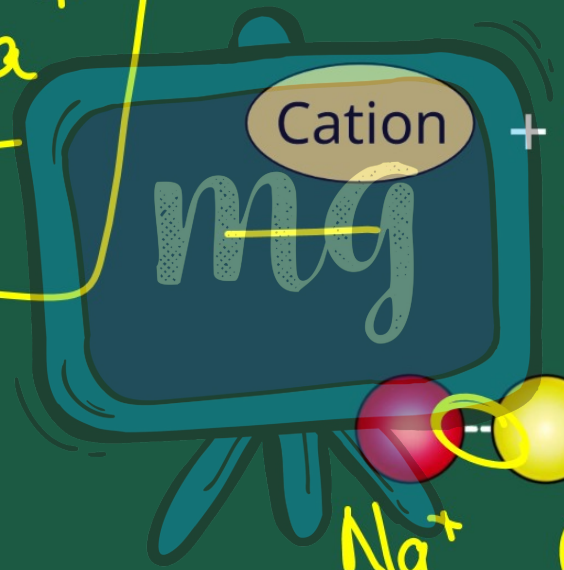
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NaCl ⟹ Table Salt

FORMATION OF COMPOUNDS

$Na \rightarrow Na^+$

$Cl \rightarrow Cl^-$

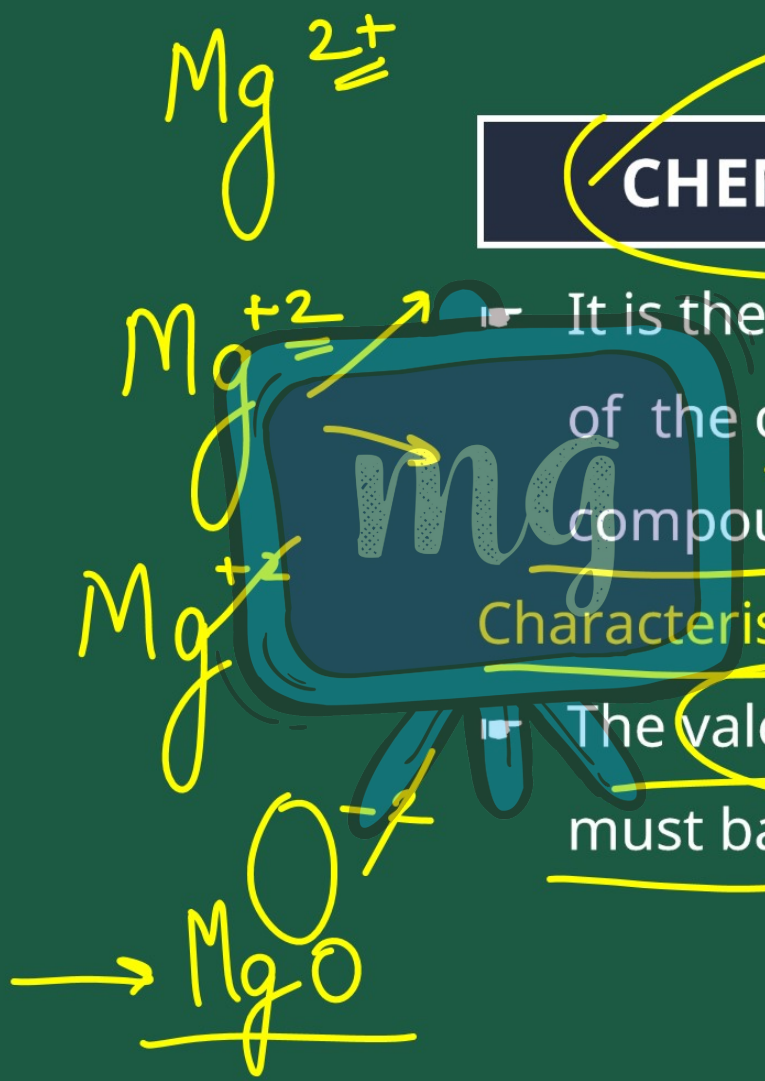


Cation + Anion = Compound



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CHEMICAL FORMULAE

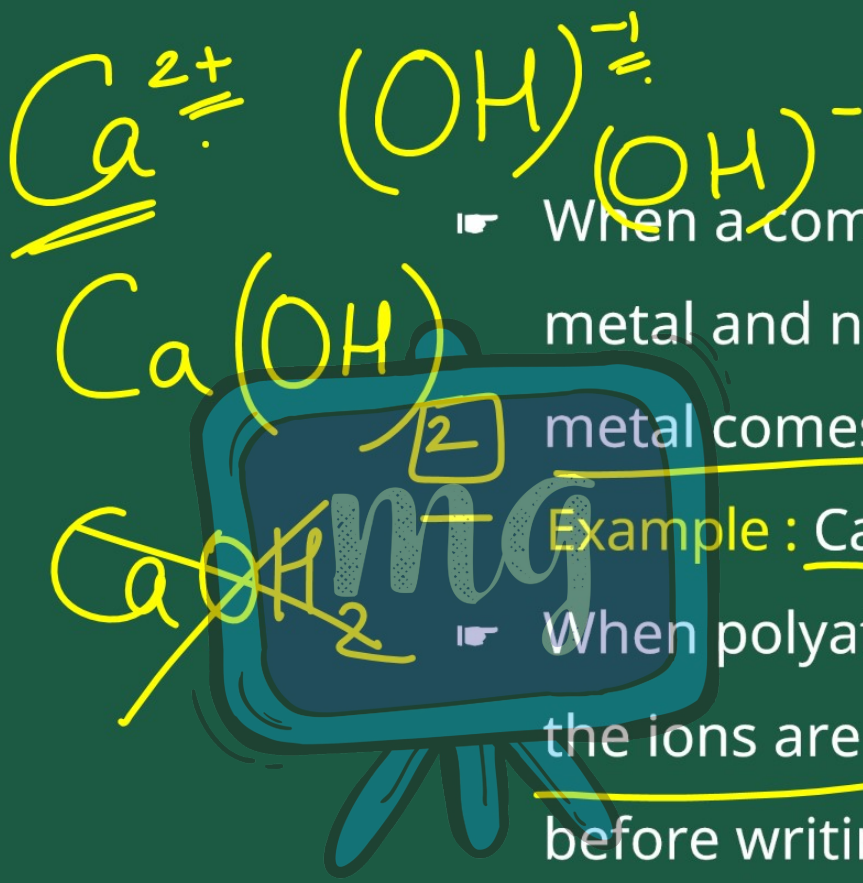
- It is the symbolic representation of the composition of a compound.

Characteristics of chemical formulae

- The valencies or charges on ion must balance.

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- When a compound is formed of metal and non-metal, symbol of metal comes first.

  Example : CaO, NaCl, CuO.

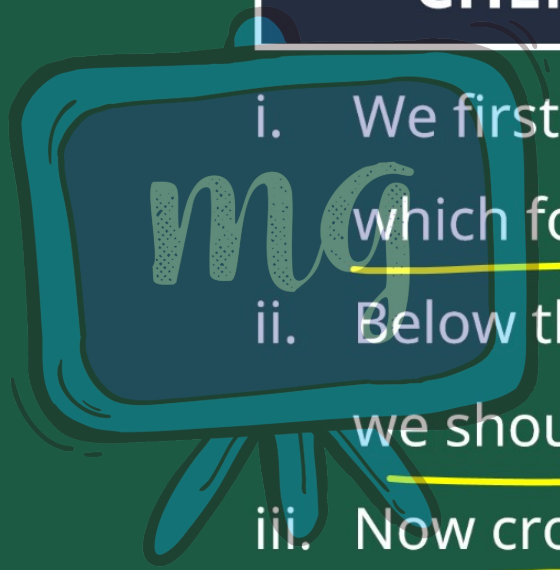
- When polyatomic ions are used, the ions are enclosed in brackets before writing the number to show the ratio.

  Example : $Ca(OH)_2$, $(NH_4)_2SO_4$

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RULES FOR WRITING CHEMICAL FORMULAE



i. We first write symbols of elements which form compound.

ii. Below the symbol of each element, we should write their valency.

iii. Now cross over the valencies of combining atoms.

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iv. With first atom, we write the valency of second atom (as a subscript).

v. With second atom, we write the valency of first atom (subscript).

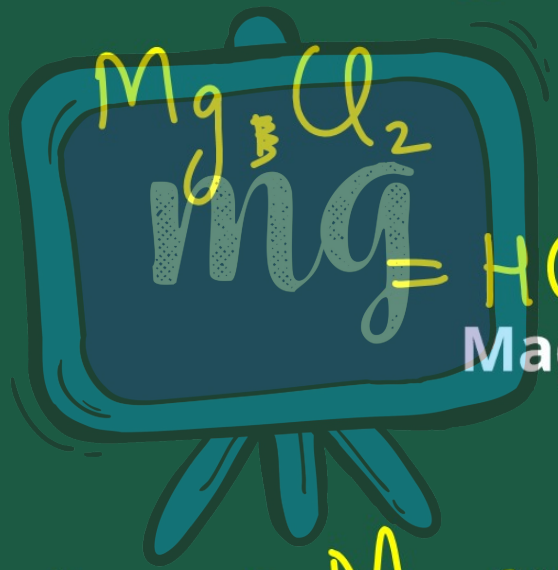


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H_2Cl_2

Hydrogen Chloride



H +1 — Cl −1

$= HCl$

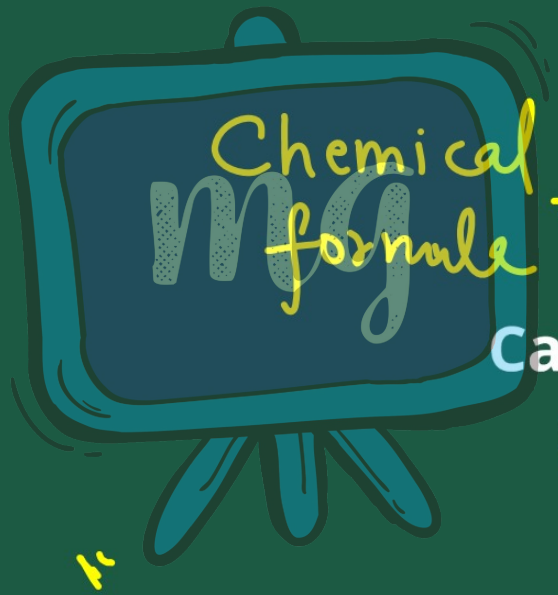
Magnesium Chloride

$\therefore \Rightarrow MgCl_2$

Mg +2 — Cl −1

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Sodium Nitrate

$Na^{+1} \times NO_3^{-1} \Rightarrow NaNO_3$

Calcium Hydroxide

$Ca^{+2} \times OH^{-1} \Rightarrow Ca(OH)_2$

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Ammonium Sulphate

NH_4 (+1) SO_4 (−2)

$(NH_4)_2SO_4$

Calcium Hydroxide

Ca (+2) OH (−1)

$Ca(OH)_2$

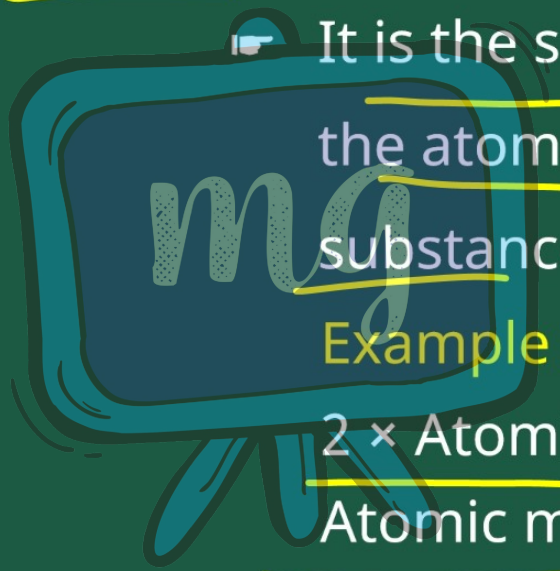
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H = 1u

O = 16u

MOLECULAR MASS



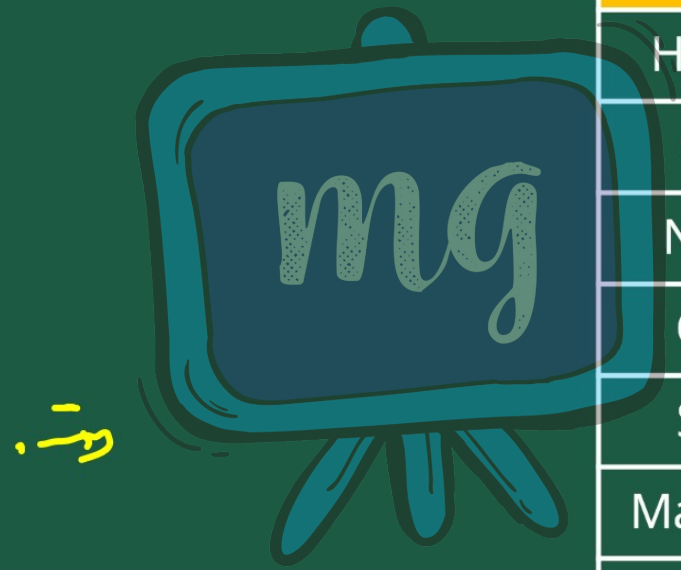
- It is the sum of atomic masses of all the atoms in a molecule of that substance.

  Example : Molecular mass of H_2O = 2 × Atomic mass of Hydrogen + 1 × Atomic mass of Oxygen

- So, Molecular mass of H_2O = 2 × 1 + 1 × 16 = 18 u

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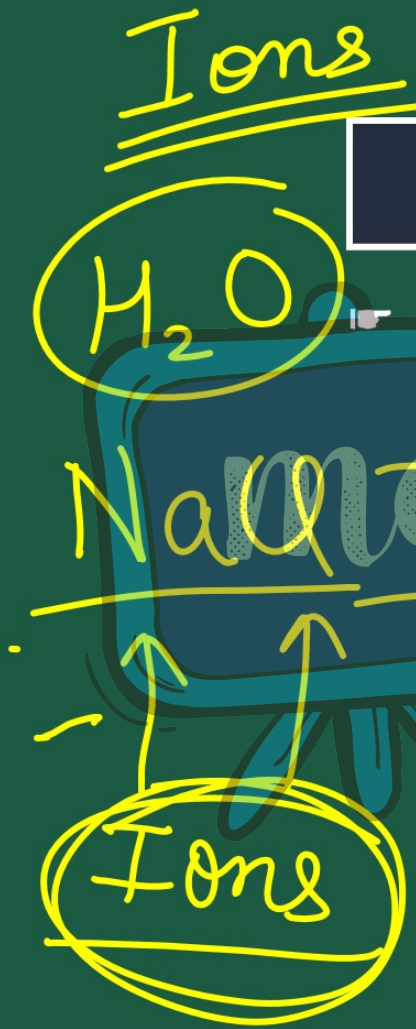
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Element	Atomic Mass (u)
Hydrogen	1
Carbon	12
Nitrogen	14
Oxygen	16
Sodium	23
Magnesium	24
Sulphur	32
Chlorine	35.5
Calcium	40

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FORMULA UNIT MASS

It is the sum of atomic masses of all the atoms present in a formula unit of a compound.

Example : In NaCl

Na = 23 u

Cl = 35.5 u

So, Formula unit mass

= 1 × 23 + 1 × 35.5 = 58.5 u

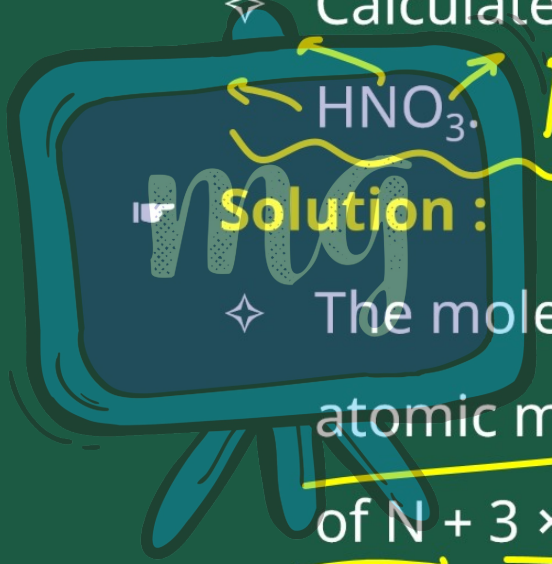
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☛ **Example :**

✧ Calculate the molecular mass of HNO_3.

Nitric acid



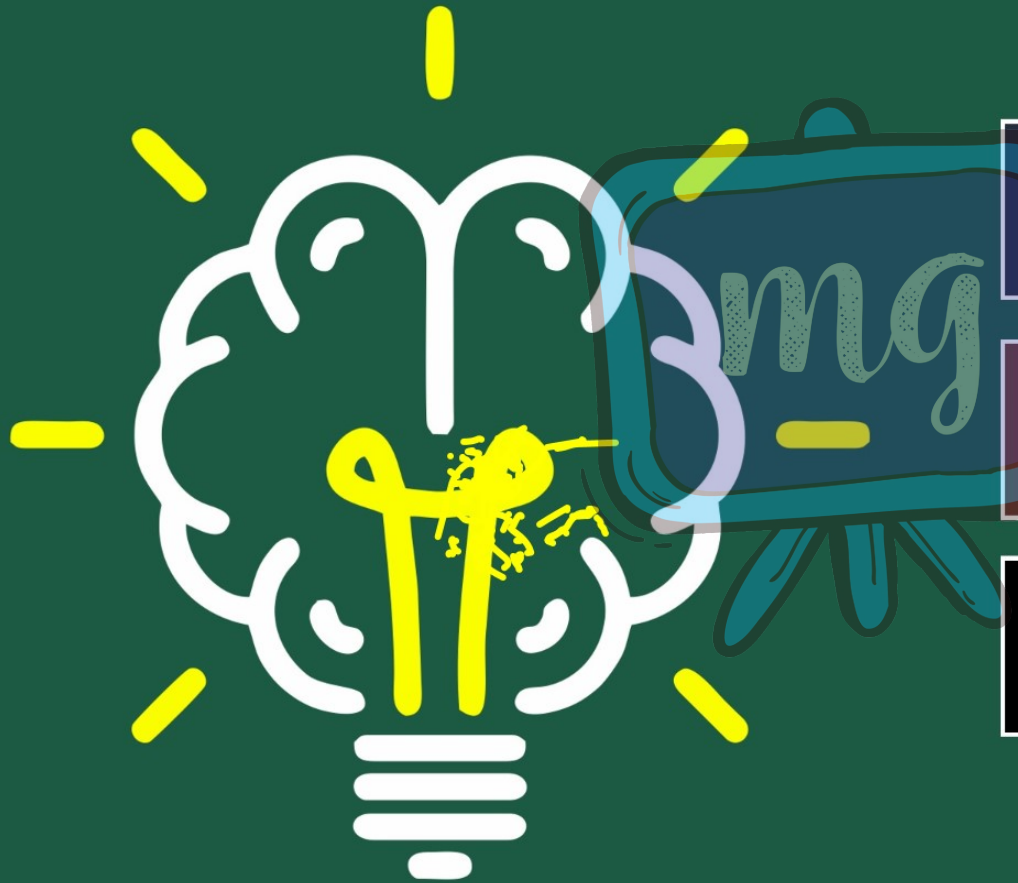
☛ **Solution :**

✧ The molecular mass of HNO_3 = the atomic mass of H + the atomic mass of N + 3 × the atomic mass of O = 1 + 14 + 48 = 63 u

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LEARNING OUTCOMES

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1. Ions
2. Writing chemical formulae
3. Molecular and formula unit mass

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ASSESSMENT

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1 | Sulphide ion, S^{2-} is a-

A monoatomic cation

B monoatomic anion

C polyatomic cation

D polyatomic anion

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ASSESSMENT

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NH_3

2 The symbol for ammonium ion is—

A OH^-

B CO_3^{2-}

C NH_4^+

D Ag^+

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ASSESSMENT

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3 | An element Z has a valency of 3. What is the formula of oxide of Z?

A ZO_3

B Z_2O_3

C Z_3O_2

D Z_3O

