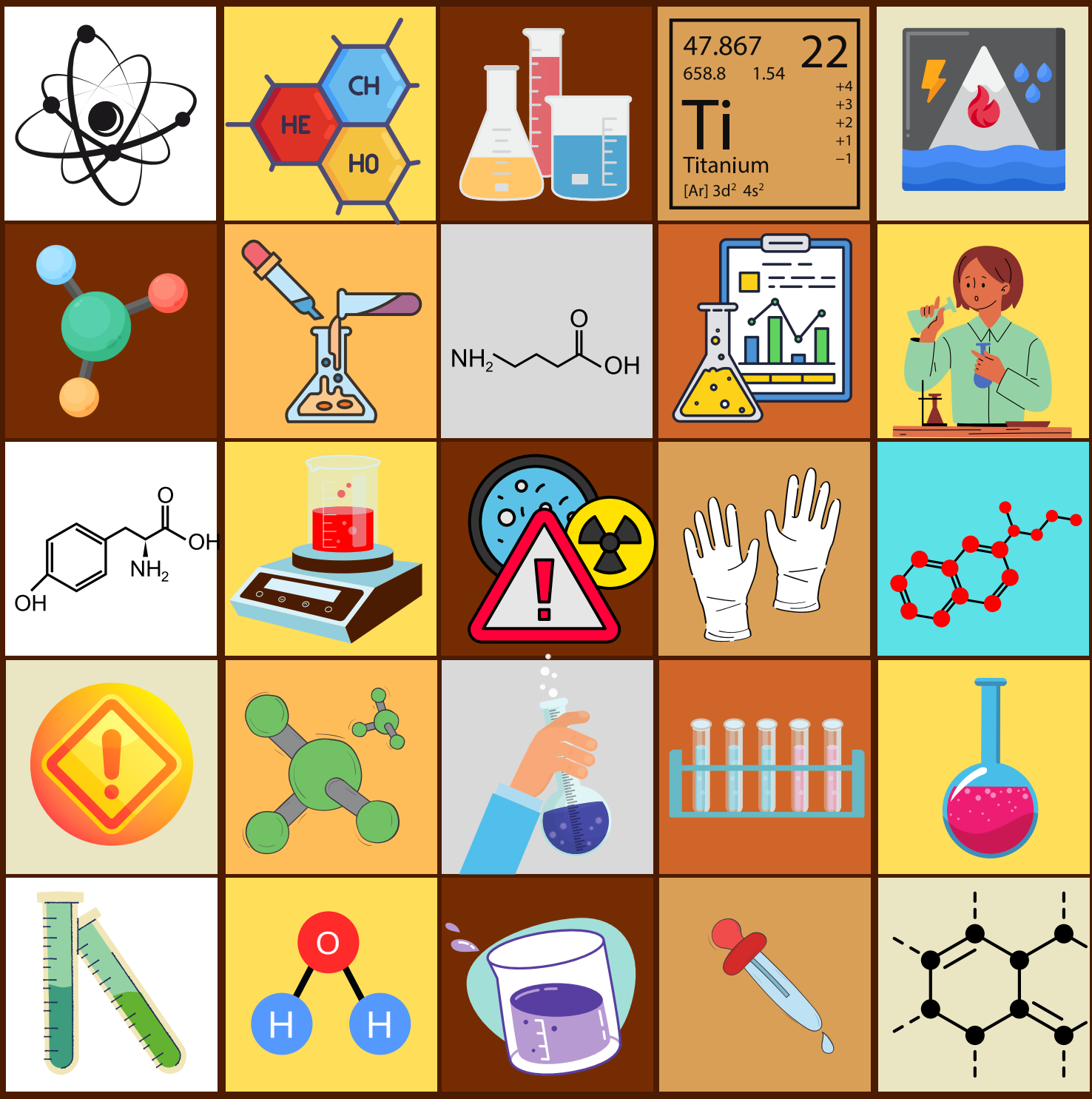


CLASS 9th NOTES

CHEMSITRY

ATOMS AND MOLECULES

PRASHANT KIRAD

Atoms and molecules

Laws of Chemical combination

- **Law of Conservation of Mass -** Mass can neither be created nor be destroyed.
- **Law of Constant properties** - In an chemical substance. the elements are always present in definite proportions by mass.

Dalton's atomic theory

Atomos are:

- Tiny particle
- Indivisible
- Identical mass and chemical properties
- Different mass and chemical properties
- Combine in the same ratio

What is atom?

- The smallest particle of an element.
- Each atom shows all the properties of the element.

Atomic radius is measured in nanometers.

$1/10^{9}$ = 1 nm
1m = 10^{9} nm

IUPAC (International Union of Pure and Applied Chemistry) approves names of elements, symbols, and units.
For example - Hydrogen(H), Aluminum(Al), Sodium(Na), etc.

Some elements have symbols according to the first letter of the name and a letter appearing later in the name. E.g., Chlorine (Cl), Zinc(Zn), etc.

Other symbols have been taken from the names of elements in Latin, German or Greek. E.g., Symbol of Iron is Fe from it Latin name Ferrum and symbol of potassium is K from Kalium.

Atomic mass

Mass of an atom equals to 1/12 of mass of C-12 atom.

$$1 \text{ amu or } u = \frac{1}{12} \text{x Mass of an atom of C}$$

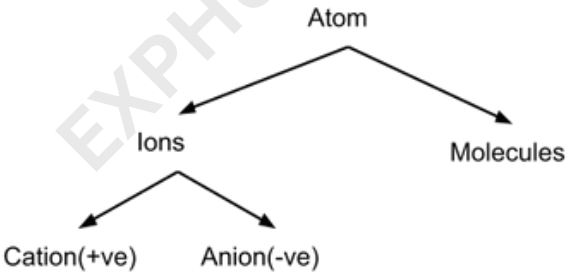
$$1\ u = 1.66 \times 10^{-27} \text{ kg}$$

Atomic Mass of some elements

Element	Symbol	Atomic Mass	Element	Symbol	Atomic Mass
Hydrogen	H	1u	Sodium	Na	23u
Helium	He	4u	Magnesium	Mg	24u
Lithium	Li	7u	Aluminium	Al	27u
Beryllium	Be	9u	Silicon	Si	28u
Boron	B	11u	Phosphorous	P	31u
Carbon	C	12u	Sulphur	S	32u
Nitrogen	N	14u	Chlorine	Cl	35u
Oxygen	O	16u	Potassium	K	39u
Fluorine	F	19u	Calcium	Ca	40u
Neon	Ne	20u	Iron	Fe	56

How do Atoms exist?

- Atoms form of most elements is not able to exist independently.
- Atoms form molecules and ions.



What is a molecule?

Group of two or more atoms that are chemically bonded together, that is tightly held together by attractive forces.

E.g., A molecule of oxygen consists of two atoms of oxygen and hence it is known as a diatomic molecule, O_2.

The number of atoms constituting a molecule is known as its atomicity.

Helium is monoatomic, Ozone(O_3)is triatomic, Phosphorus (P_4) is tetratomic.

Molecules of compounds

Atoms of different elements join together in definite proportions to form molecules of compounds.

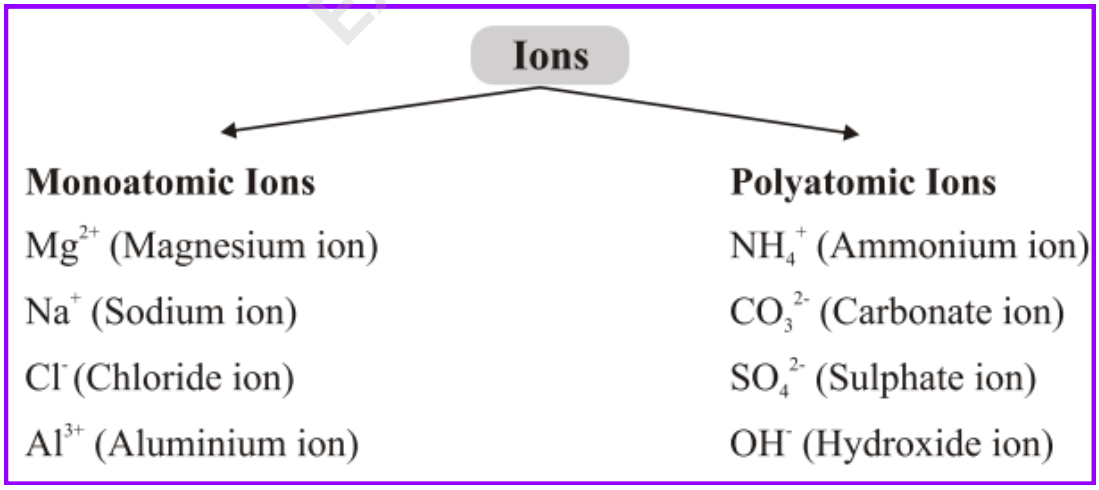
Compound	Combining elements	Ratio by mass
Water (H_2O)	Hydrogen, Oxygen	1:8
Ammonia (NH_3)	Nitrogen, Oxygen	14:3
Carbon dioxide (CO_2)	Carbon, Oxygen	3:8

What is an ion?

Compounds composed of metals and non-metals contain charged species.

The charged species are of two types:

- Anion - Negatively charged ion
- Cation - Positively charged ion



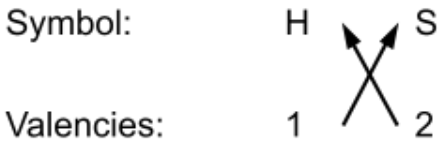
Chemical formulae

Symbolic representation of the composition of a compound.

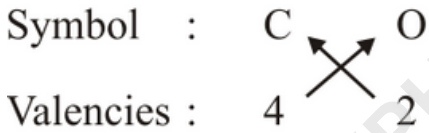
Characteristics of chemical formulae:

- The valencies or charges on ion must balance.
- When a compound is formed of metal and non-metal, symbol of metals comes first. E.g., CaO, NaCl, CuO.
- When polyatomic ions are used, the ions are enclosed in brackets before writing to show that ratio. E.g., $Ca(OH)_2$, $(NH_4)_2SO_4$

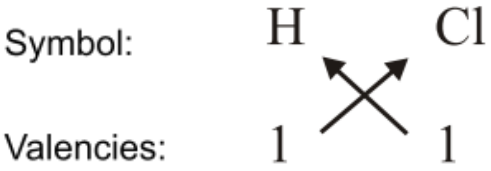
Examples:



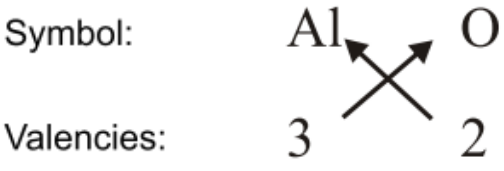
H_2S_1 or H_2S (Hydrogensulphide)



C_2O_4 or CO_2 (Carbon dioxide)



H_1Cl or HCl



Al_2O_3

Chemical formulae

For ions:

Sodium carbonate

Symbol: Na CO_3

Valencies: 1+ 2-

Na_2CO_3

Aluminium sulphate

Symbol: Al SO_4

Valencies: 3+ 2-

$Al_2(SO_4)_3$

Molecular mass

The sum of atomic masses of all the atoms in a molecule of that substance. E.g., Molecular mass of H_2O = 2 x Atomic mass of Hydrogen + 1 x Atomic mass of Oxygen.

Formal unit mass

The sum of the atomic mass of ions and atoms present in formula for a compound.

In NaCl, N = 23 amu, Cl = 35.5 amu

So, Formal unit mass = 1 x 23 + 1 x 35.5 = 59.5 u

Molar mass

The molar mass of a substance is the mass of 1 mole of that substance. It is equal to the 6.022×10^{23} atoms of that element/substance.

E.g., Atomic mass of hydrogen is 1 and its molar mass is 1 g/mol

Mole concept

A group of 6.022×10^{23} particles (atoms, molecules, or ions) of a substance is called a mole of that substance.

	1 mole of atoms	$= 6.022 \times 10^{23}$ atoms
	1 mole of molecules	$= 6.022 \times 10^{23}$ molecules
Example,	1 mole of oxygen	$= 6.022 \times 10^{23}$ oxygen atoms

6.022×10^{23} is Avogadro Number

Important formulae

i. Number of moles (n) = Given mass/Molar mass = m/M

ii. Number of moles (n) = Given number of particles/Avogadro's number = N/No

iii. Percentage of any atom in given compound =

(Mass of element x 100)/Mass of compound