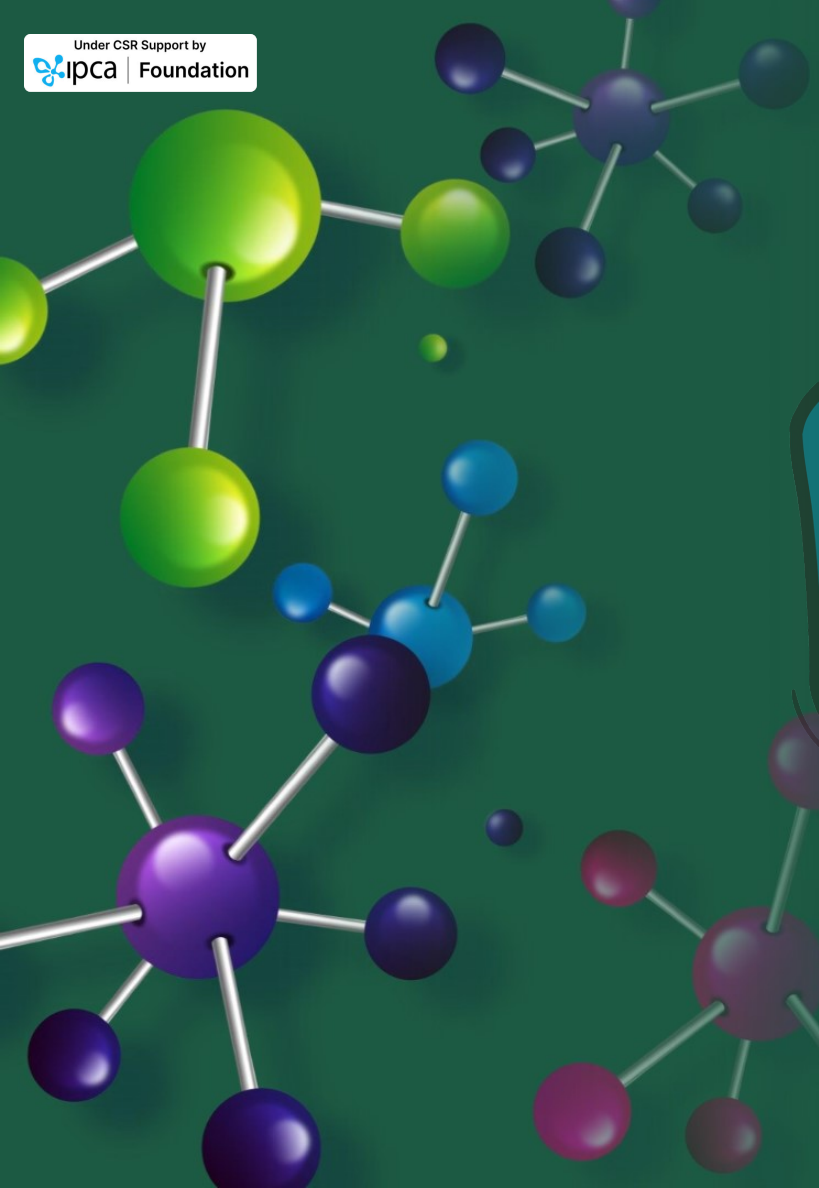
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Class–9

SCIENCE

Chapter – 3

ATOMS AND MOLECULES

Part – 2

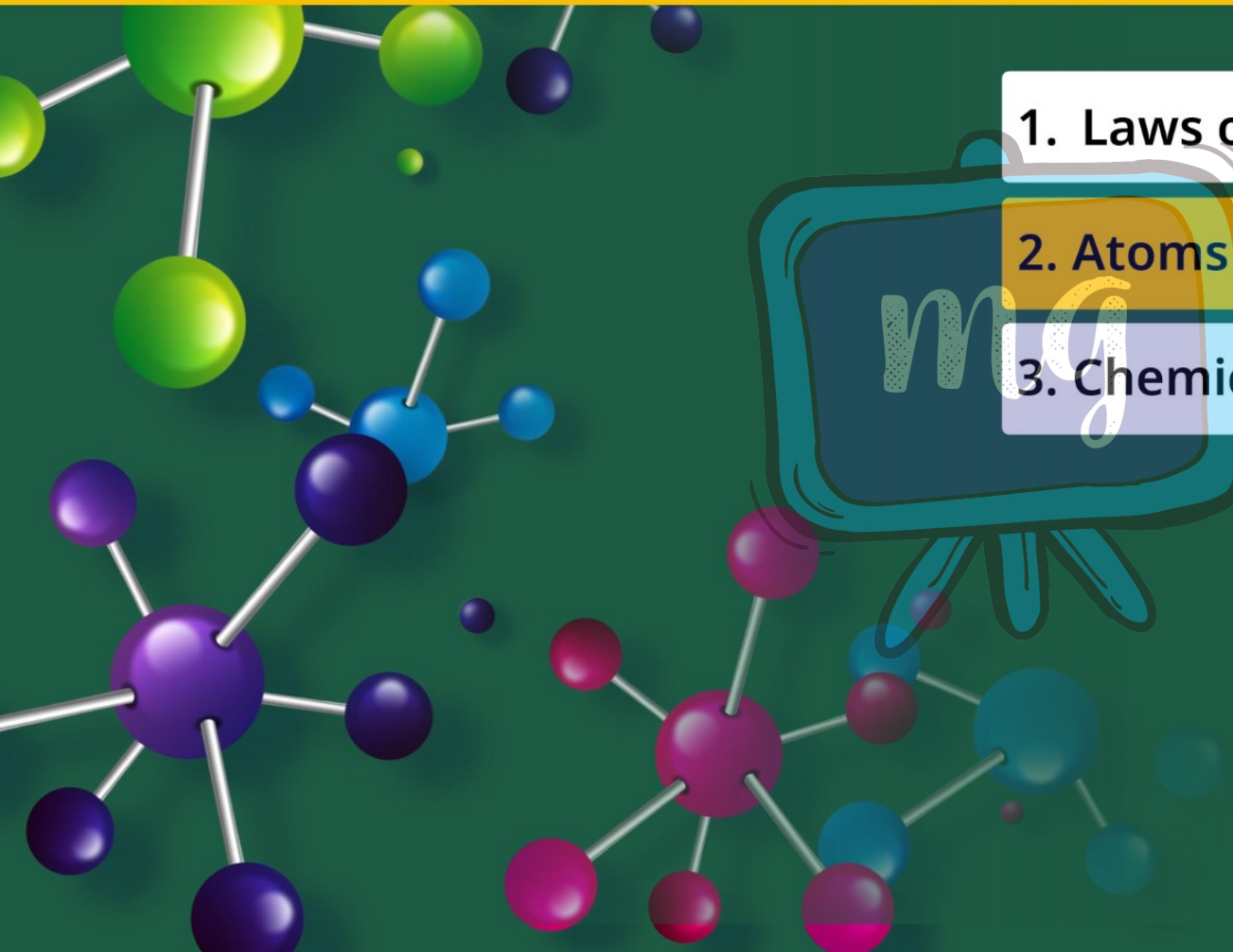
Atoms and Molecules

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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ATOMS

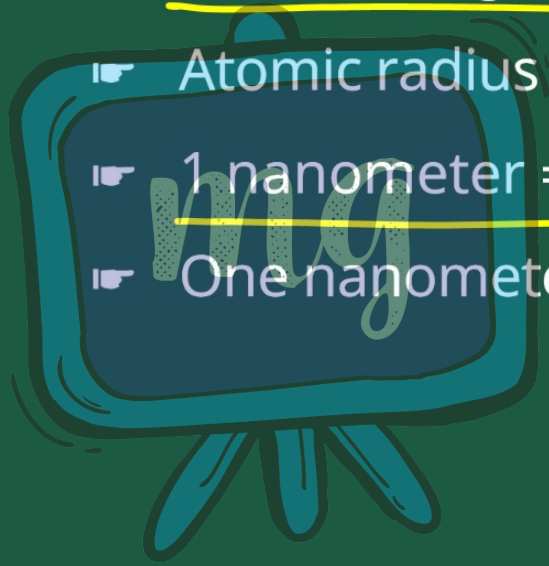
- Atoms are building blocks of all matter.
- According to modern atomic theory, an atom is the smallest particle of an element which takes part in chemical reaction.



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- Atoms are very small and can't be seen even through very powerful microscope.
- Atomic radius is measured in nanometers.
- 1 nanometer = 10^{-9} m.
- One nanometer looks like 0.000000001 m.

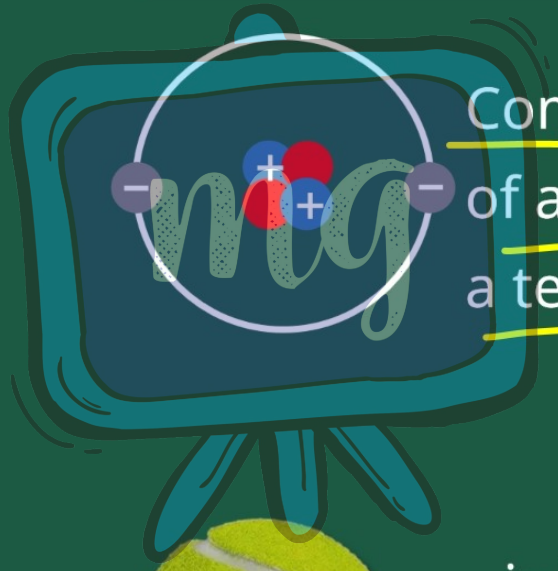


$$\frac{1}{10^9}$$

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Atoms: very small



Comparing the size of a helium atom to a tennis ball...





... is like comparing a tennis ball to the Earth.

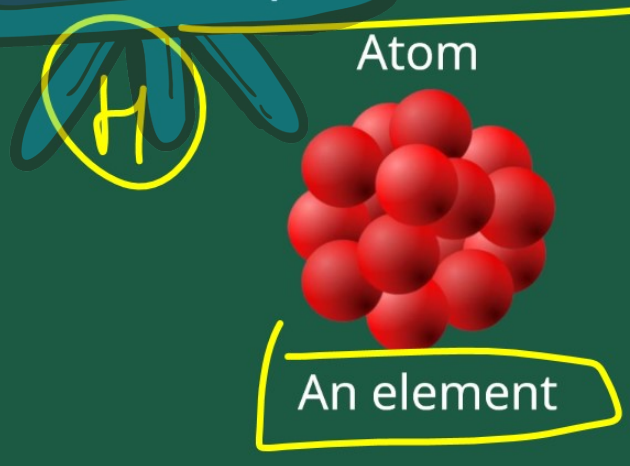


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ELEMENTS

An element is a substance that is made from one kind of atom only. It cannot be broken down into simpler substance.



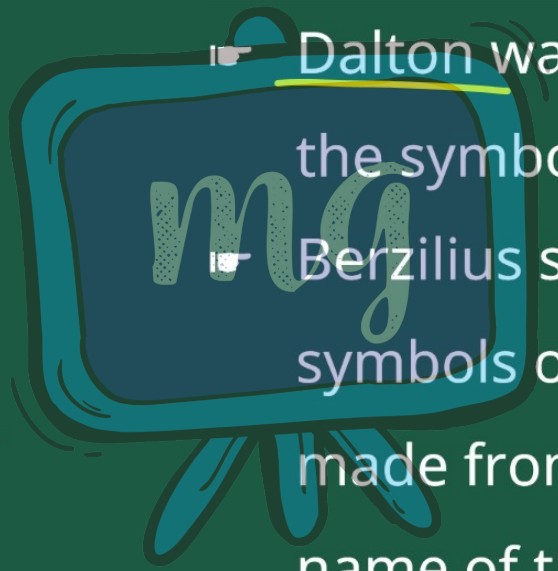
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Symbols for Elements

- Dalton was the first scientist to use the symbols for elements.
- Berzilius suggested that the symbols of elements should be made from one or two letters of the name of the element.







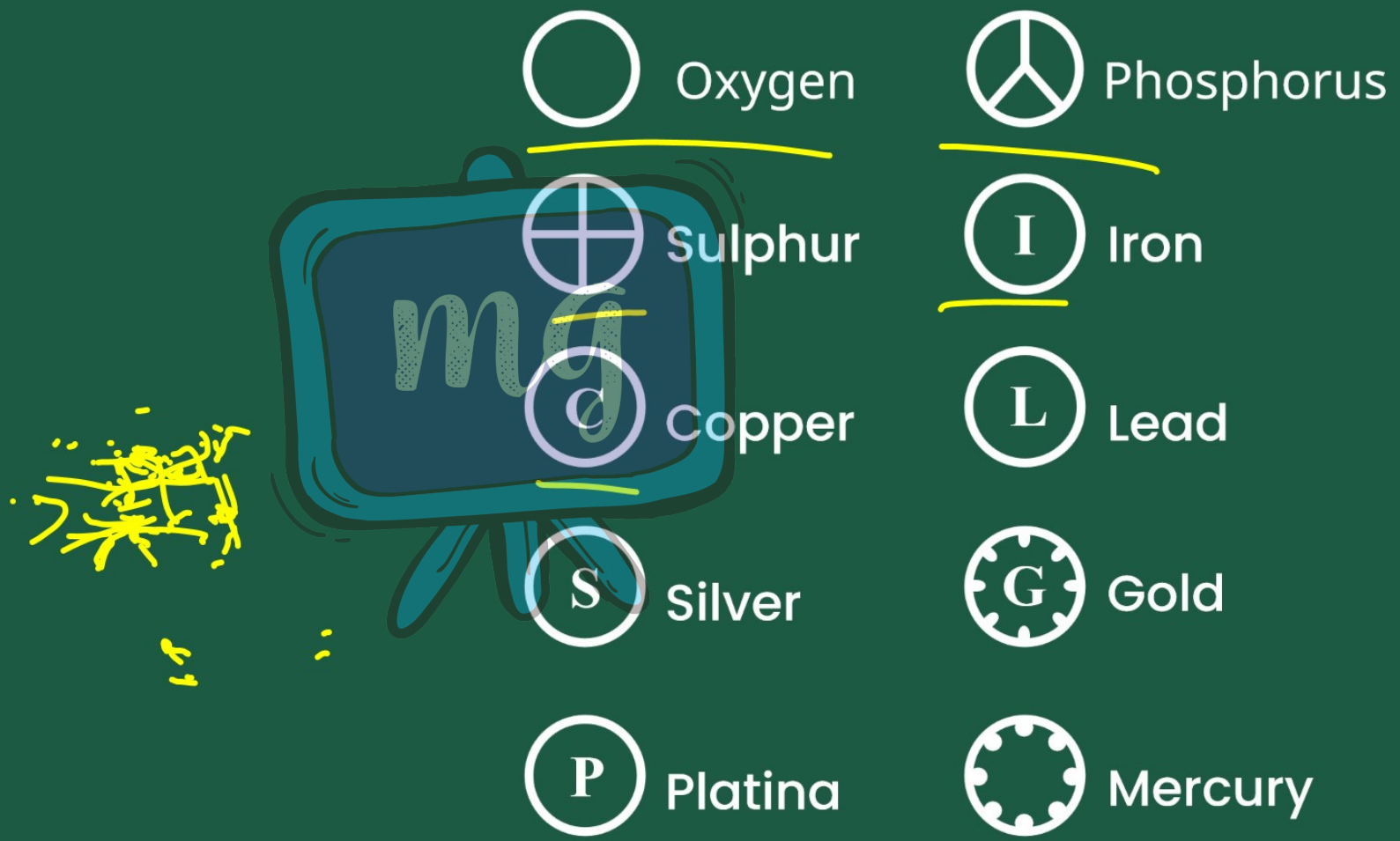
Hydrogen



Carbon

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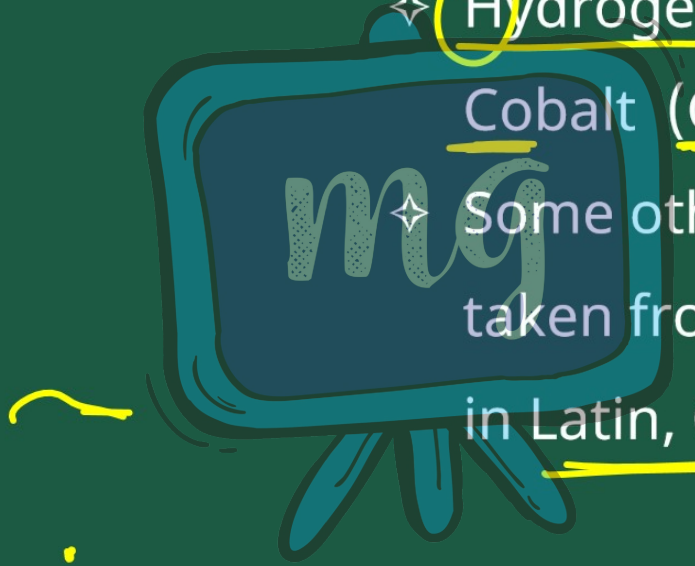
Modern Day Symbols of Elements



- IUPAC (International Union of Pure and Applied Chemistry) approves names of elements.
- The first letter of a symbol is always written as a capital letter (uppercase) and the second letter as a small letter (lowercase).

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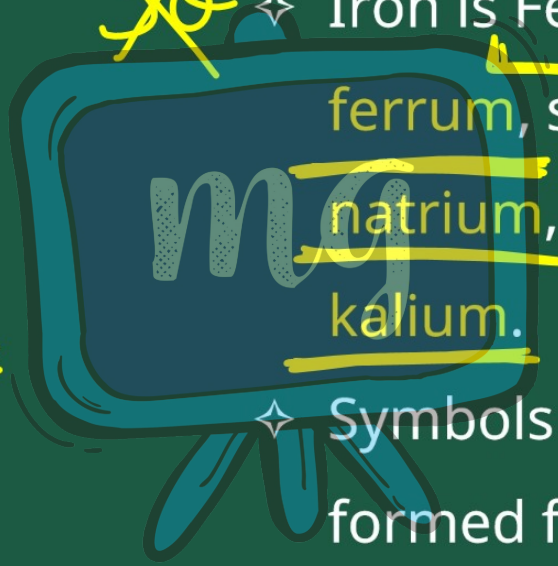


☛ **For example :**

- Hydrogen (H), Aluminium (Al), Cobalt (Co).
- Some other symbols have been taken from the names of elements in Latin, German or Greek.

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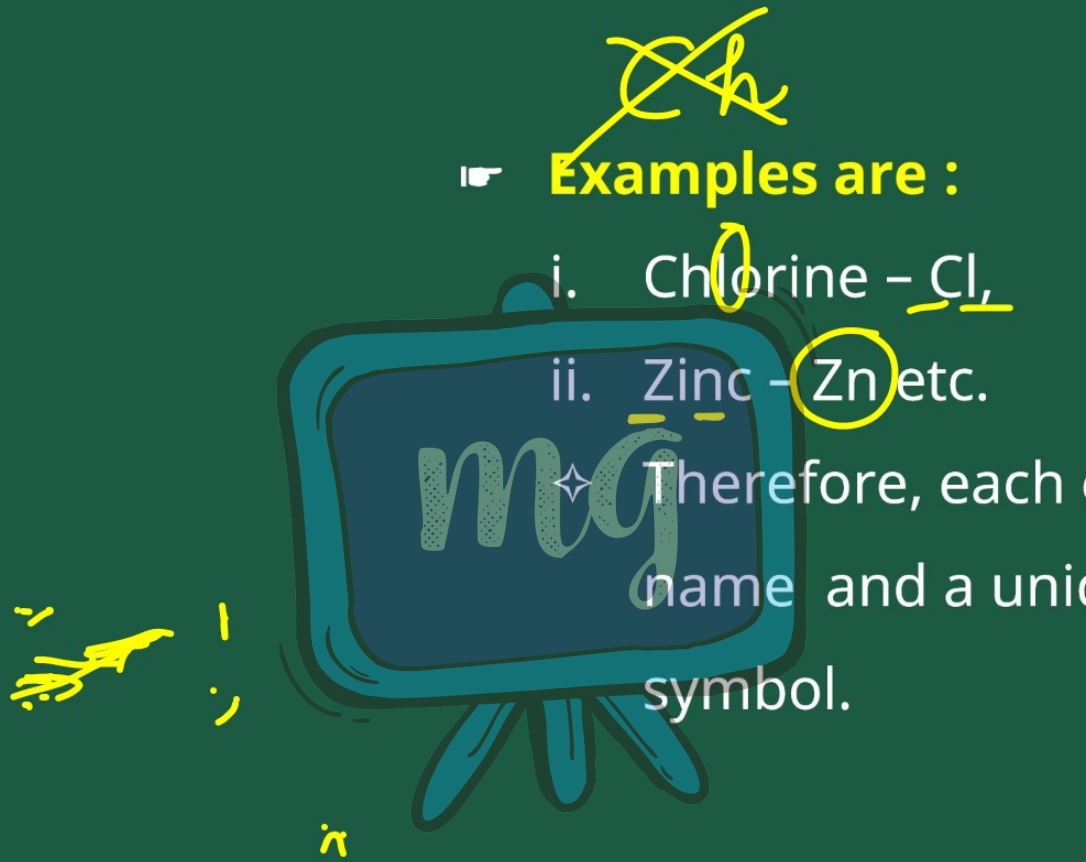


For example :

- Iron is Fe from its Latin name ferrum, sodium is Na from natrium, potassium is K from kalium.
- Symbols of some elements are formed from the first letter of the name and a letter, appearing later in the name.

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☛ **Examples are :**

i. Chlorine – Cl,

ii. Zinc – Zn etc.

✧ Therefore, each element has a name and a unique chemical symbol.

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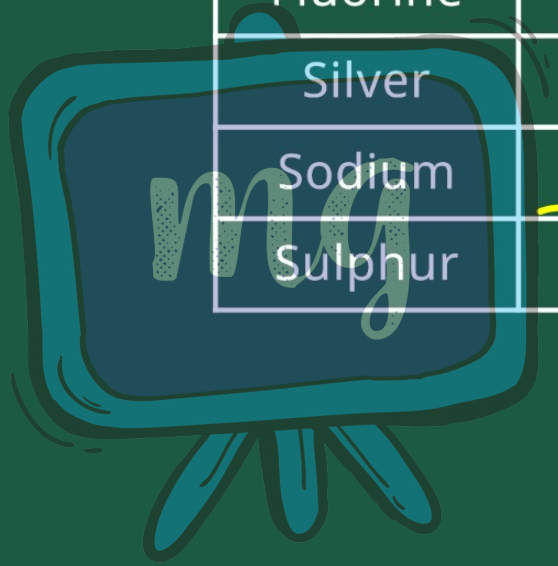
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Element	Symbol	Element	Symbol
Aluminium	Al	Gold	Au
Argon	Ar	Hydrogen	H
Barium	Ba	Iodine	I
Boron	B	Iron	Fe
Bromine	Br	Lead	Pb
Calcium	Ca	Magnesium	Mg
Carbon	C	Neon	Ne
Chlorine	Cl	Nitrogen	N
Cobalt	Co	Oxygen	O
Copper	Cu	Potassium	K

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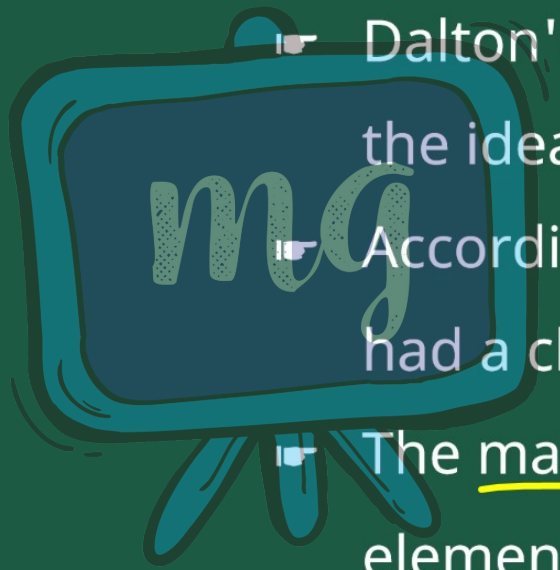
Element	Symbol	Element	Symbol
Fluorine	F	Silicon	Si
Silver	Ag	Uranium	U
Sodium	Na	Zinc	Zn
Sulphur	S		



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ATOMIC MASS



- Dalton's atomic theory proposed the idea of atomic mass.
- According to him, each element had a characteristic atomic mass.
- The mass of an atom of an element is called its atomic mass.

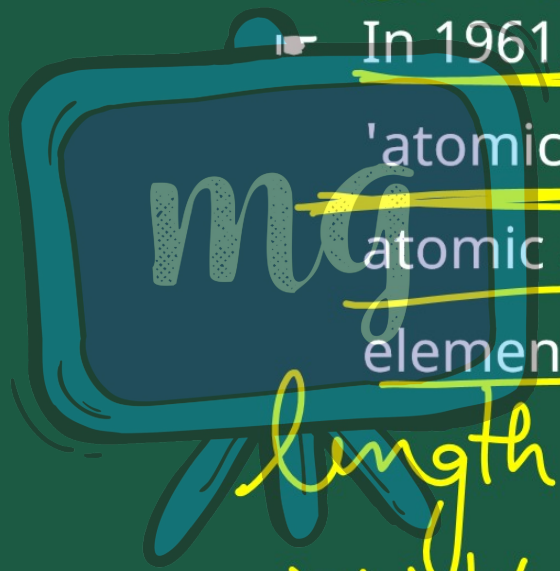
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a. m. u (u) unified mass

RELATIVE ATOMIC MASS

- In 1961, IUPAC have accepted 'atomic mass unit' (u) to express atomic and molecular mass of elements and compounds.



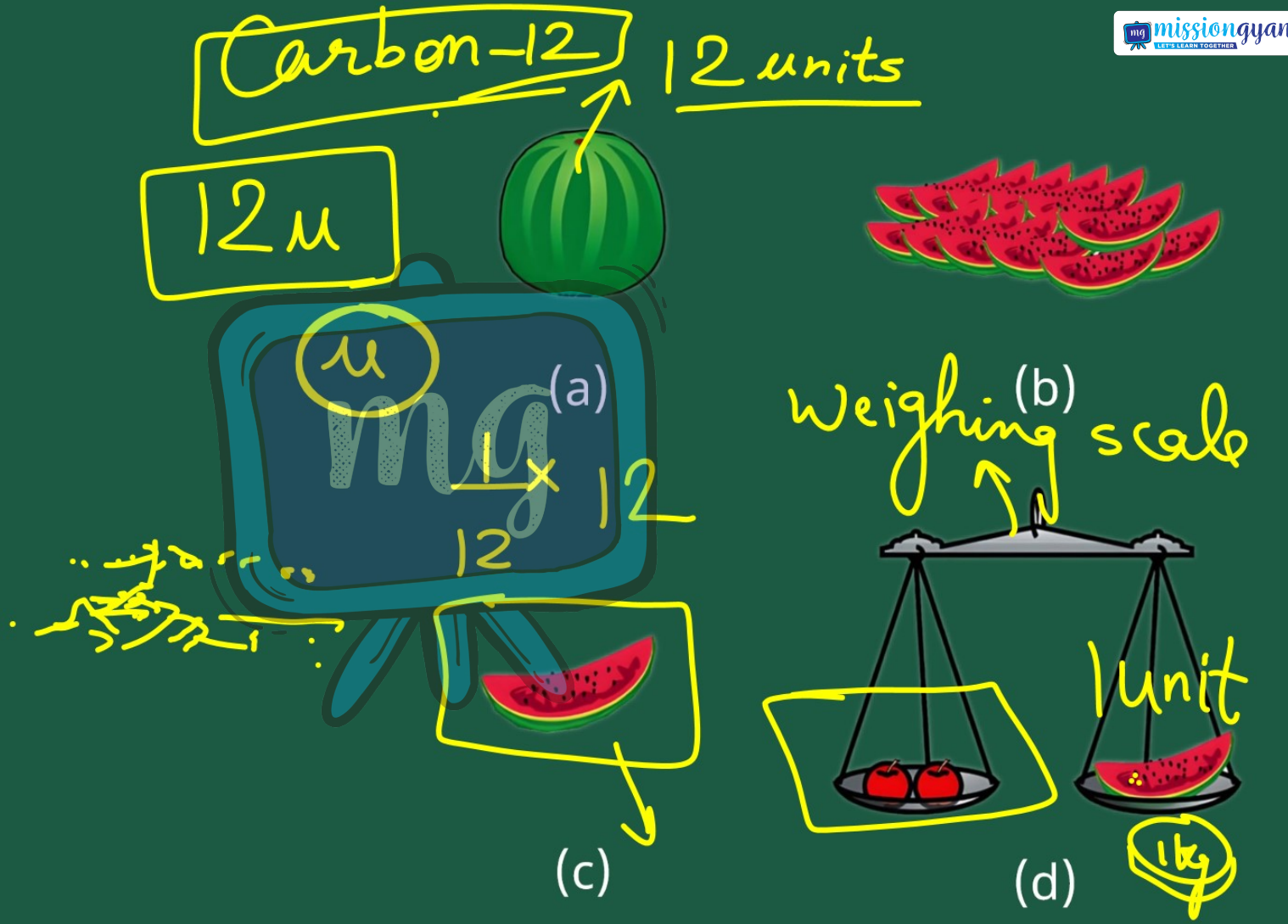
length → m

Weight → Kg

10^{-27} kg

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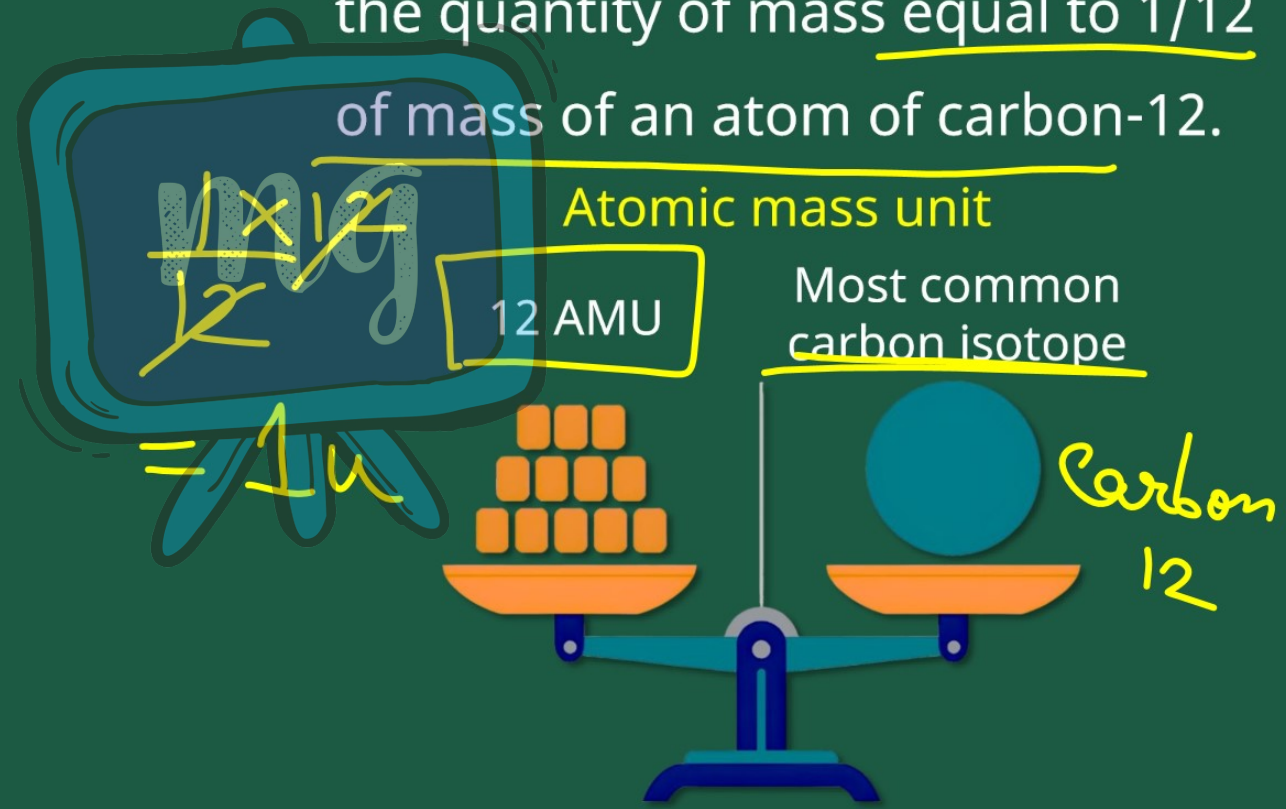
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☛ The atomic mass unit is defined as the quantity of mass equal to 1/12 of mass of an atom of carbon-12.



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1 u

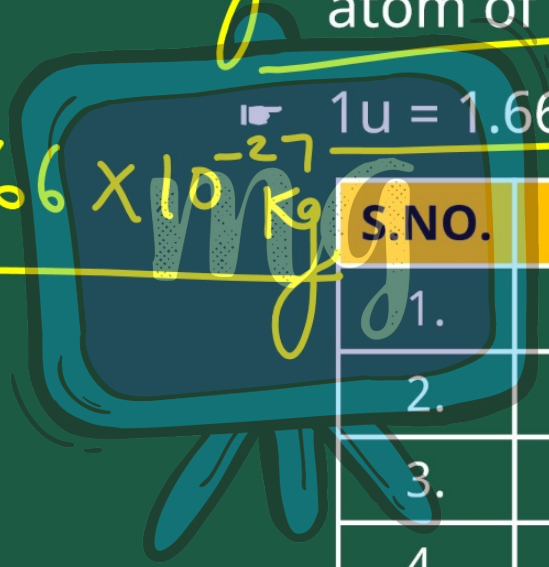
$= 1 \times 1.66 \times 10^{-27}$ kg

12 u =

$12 \times 1.66 \times 10^{-27}$ kg

☛ 1 amu or u = 1/12 x Mass of an atom of C^{12}

☛ $1u = 1.66 \times 10^{-27}$kg

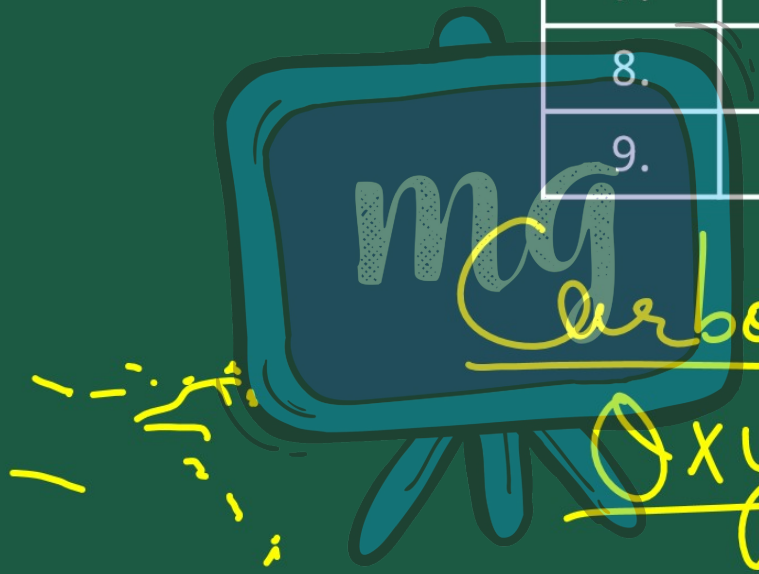


S.NO.	Element	Atomic Mass
1.	Hydrogen	1u
2.	Carbon	12u
3.	Nitrogen	14u
4.	Oxygen	16u
5.	Sodium	23u
6.	Magnesium	24u

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S.NO.	Element	Atomic Mass
7.	Sulphur	32u
8.	Chlorine	35.5u
9.	Calcium	40u

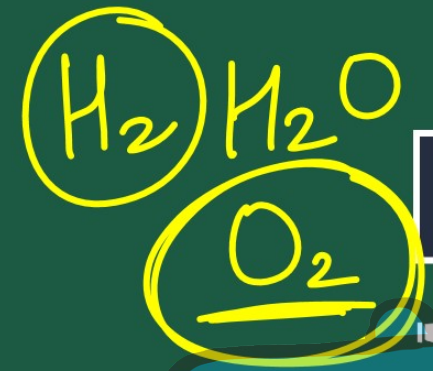


Carbon-12 atom

Oxygen

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H atom O- ato

MOLECULES

- A molecule is a group of two or more atoms that are chemically bonded together.
- A molecule is the smallest particle of matter of an element or compound which is capable of an independent existence and show all properties of that substance.

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H_2O H_2O H_2

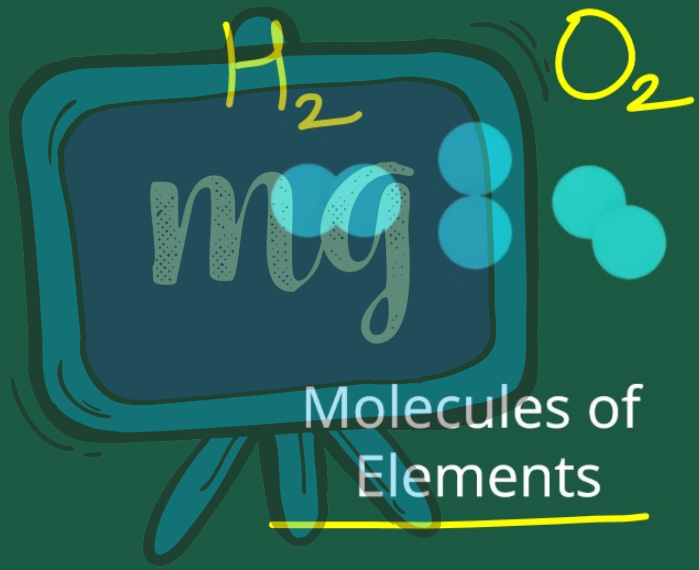
Example :

- 'H_2O' is the smallest particle of water which shows all the properties of water.
- A molecule may have atom of same or different elements.

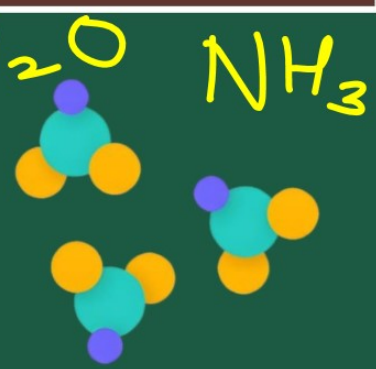
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DIFFERENT TYPES OF MOLECULES



Molecules of Elements

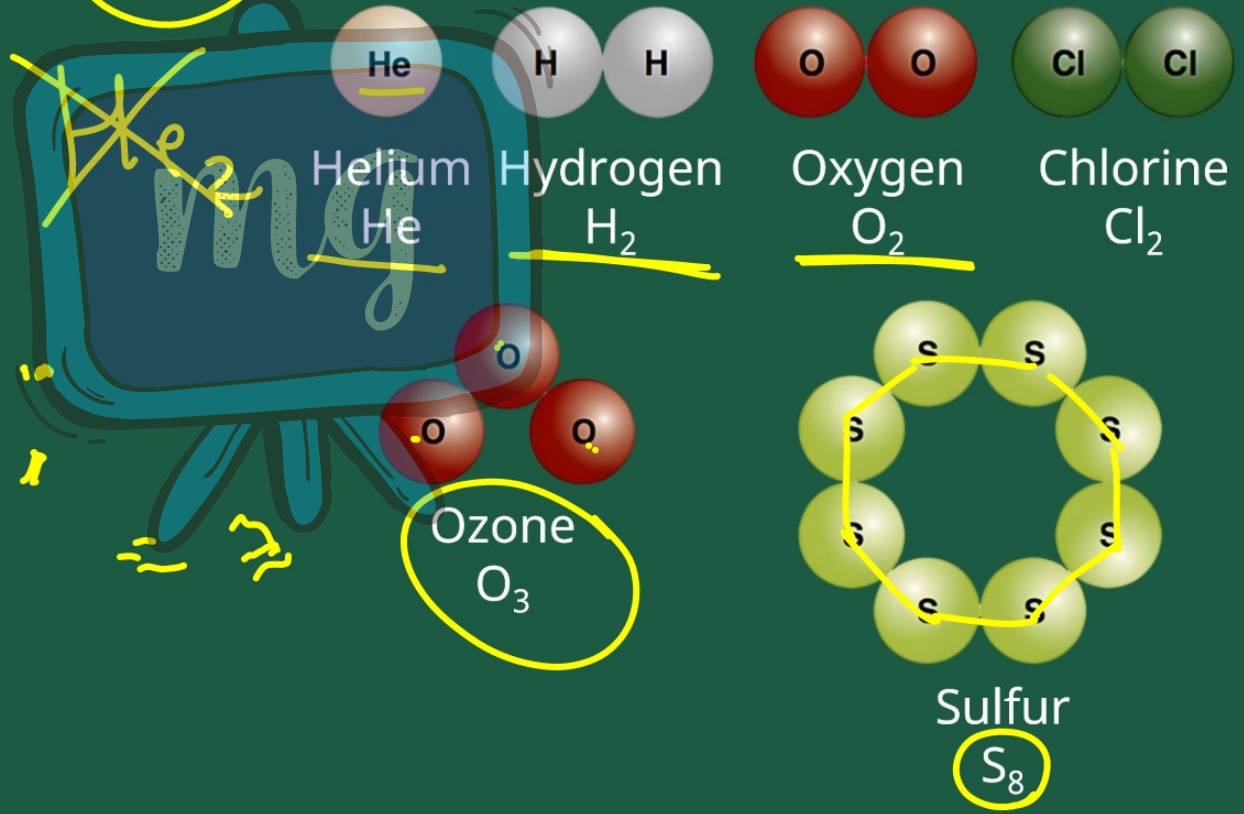


Molecules of Compound

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MOLECULES OF ELEMENTS



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ATOMICITY

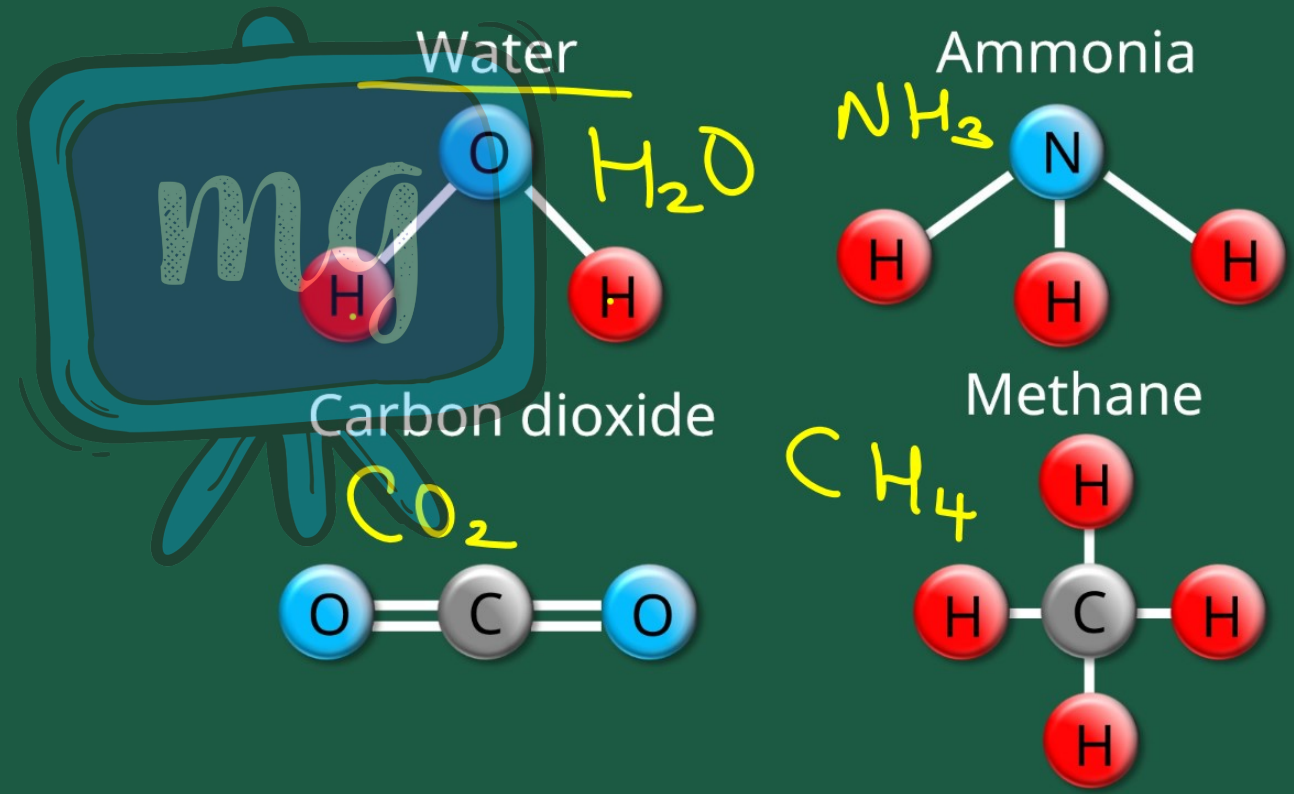
☛ The number of atoms present in one molecule of an element is called its atomicity.

S.NO.	Name	Symbol	Atomicity
1.	Argon	Ar	Monoatomic
2.	Helium	He	Monoatomic
3.	Oxygen	O2	Diatomic
4.	Nitrogen	N2	Diatomic

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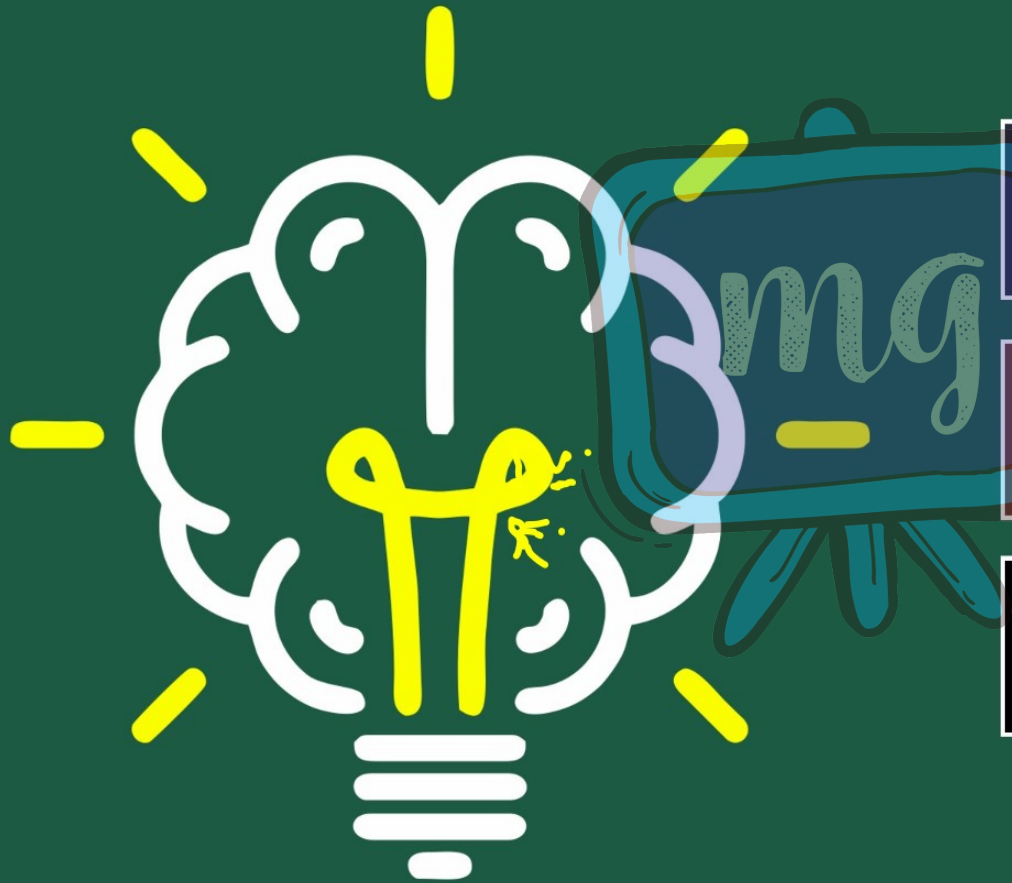
MOLECULES OF COMPOUNDS



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LEARNING OUTCOMES

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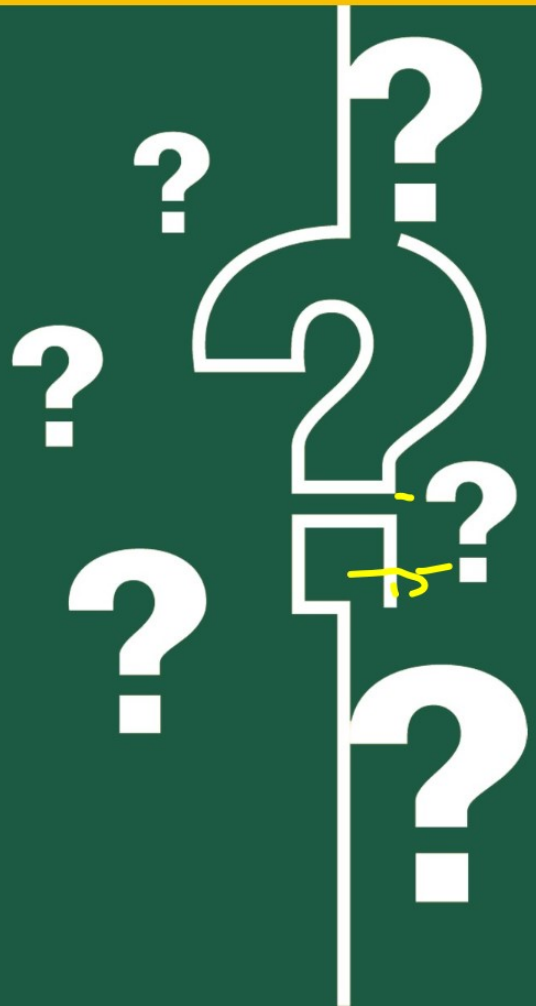


1. Atom
2. Atomic mass
3. Molecules and their types

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ASSESSMENT

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1 | Which of the following is the correct pair of atom and its atomic symbol?

A. Sulphur – S

B. Potassium – K

C. Phosphorus – P

D. Nitrogen – N

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ASSESSMENT

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2 What is the mass of one atom of carbon-12 ?

- A 12u
- B 1u
- C 1/12u
- D 6u

$\frac{1}{12} \times 12 = 1u$

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ASSESSMENT

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3 Which of the following is an example of molecule of an element?

A. H_2O

B. O_2 → 1 molecule of oxygen

C. CH_4

D. NH_3