



**CLASS IX**  
**CHEMISTRY**  
**CHAPTER 3**  
**ATOMS AND MOLECULES**

**NOTES**

**Atom** - It is defined as **the smallest particle of an element** which can take part in a chemical reaction.

**Law of Chemical Combination**

1. **Law of Conservation of Mass**
2. **Law of Constant Proportion**

**Law of Conservation of Mass (Antoine L. Lavoisier, 1774)**

This law states that mass can neither be created nor destroyed in a chemical reaction.

**Law of Constant Proportion (Proust, 1799)**

This law states that a pure compound always contains the same elements combined in the same proportions by mass e.g. hydrogen and oxygen combined together in the same proportion of 1:8 by mass.

**Dalton's Atomic Theory (1808)**

- Matter is made up of indivisible particles known as atoms.
- Atoms are neither created nor destroyed.
- Atoms of one element are all identical. They have the same mass and the same properties.
- Atoms of different elements combine in fixed ratios to form compounds.
- When elements combine to form compounds, the atoms of these elements unite in simple whole number ratios to form compound atoms.
- The relative number and kinds of atoms are constant in a given compound.

**Molecule**

- It is the smallest particle of an element- or a compound which can exist independently and shows all the properties of that substance.
- Molecule of an element is composed of same type of atoms.
- Molecules may be monoatomic, di-atomic or polyatomic.
- Molecules of compounds join together in definite proportions and constitutes different type of atoms.



**Atomicity** - It is defined as **the number of atoms present in one molecule of the element or compound.**

**Table 1 - Atomicity of some common elements**

Types of elements	Element	Atomicity
Non-metal	Helium	1 (monoatomic)
	Neon	1 (monoatomic)
	Argon	1 (monoatomic)
	Hydrogen	2 (diatomic)
	Oxygen	2 (diatomic)
	Nitrogen	2 (diatomic)
	Chlorine	2 (diatomic)
	Ozone	3 (triatomic)
	Phosphorus	4 (tetra-atomic)
	Metals	Iron
Copper		1 (monoatomic)
Silver		1 (monoatomic)

**Atomic radii:** It's is a size of an element i.e. distance from the nucleus to the outermost shell of an atom. It is measured in nanometres (nm).

$$1\text{nm} = \frac{1}{10^9} \text{ meter}$$

**Table 2 – Atomic radii of some common elements**

Element	Atomic radius
Hydrogen	0.037nm
Carbon	0.077nm
Oxygen	0.073nm
Sulphur	0.104nm
Nitrogen	0.074nm

### Atomic Mass

It is the average relative mass of an atom of an element as compared to the mass of an atom of carbon (C-12 isotope) taken as 12 (u).

$$\text{Atomic mass} = \frac{\text{Mass of 1 atom of an element}}{1/12 \text{ of the mass of an atom of C-12}}$$



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### Atomic Mass Unit (amu)

The atomic mass unit has been defined as  $1/12$  (one twelfth) the mass of carbon-12 atom taken as 1 u.

Nowadays, the atomic mass unit which was abbreviated as **amu**, is written as “**u**” (unified mass), according to the IUPAC (International Union of Pure and Applied Chemistry).

**Thus,  $1u = 1/12$  the mass of carbon-12**

**Table 3 – atomic masses of some common elements**

<b>Element</b>	<b>Atomic mass(u)</b>
<b>Hydrogen</b>	<b>1</b>
<b>Carbon</b>	<b>12</b>
<b>Oxygen</b>	<b>16</b>
<b>Nitrogen</b>	<b>14</b>
<b>Chlorine</b>	<b>35.5</b>

**Gram Atomic Mass:** The atomic mass of an element expressed in grams is known as gram atomic mass.

**For example:**

The atomic mass of oxygen (O) = 16u

Therefore, gram atomic mass of oxygen (O) = 16g

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