Chemistry Study Materials for Class 9

(Based on Chapter 3: Atoms and Molecules)

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How do Atoms Exist?

- Atoms of a few elements such as noble gases like helium, neon, argon and krypton etc. exist in the Free State that is as single atoms.
- But most elements, being chemically reactive, do not exist in the Free State. They either exist as molecules or ions.
- For example, an iodine crystal is a collection of many iodine molecules. These molecules are so tiny that they are not visible to the naked eye. But, what is visible is the entire iodine crystal.
- Similarly, in sodium chloride, the sodium ions and chloride ions being very tiny are not visible. But, we see the compound sodium chloride as a white powder which is made up of several sodium and chloride ions.

Molecule

- A molecule is a group of two or more atoms chemically bonded together. A molecule is the smallest particle of an element or a compound which has properties of the element or the compound and can exist in a free state.
- Molecules can be formed either by the combination of atoms of the same element or of different elements.
- Thus, there are two types of molecules — **molecules of elements** and **molecules of compounds.**

Molecules of Elements

- A molecule of an element contains two or more similar atoms combined together.
- They are classified as diatomic, triatomic, tetra-atomic and poly-atomic molecules, depending on the number of atoms present in them.

Atomicity

Atomicity is the total number of atoms present in one molecule.

Table showing atomicity of some elements

Name	Molecule's Formula	Atomicity	
Helium	**He**	**1**	**Monoatomic**
Hydrogen	**H_2**	**2**	**Diatomic**
Nitrogen	**N_2**	**2**	**Diatomic**
Ozone	**O_3**	**3**	**Tri-atomic**
Oxygen	**O_2**	**2**	**Diatomic**
Phosphorus	**P_4**	**4**	**Tetra-atomic**
Sulphur	**S_8**	**8**	**Poly-atomic**

Molecules of Compounds

- A molecule of a compound contains two or more different types of atoms, chemically combined together.
- The atoms of different elements join together in definite proportions to form the molecules of compounds.

Compound	Molecular Formula	Combining Element	Simplest Ratio
Water	**H_2O**	**Hydrogen, Oxygen**	**1 : 8**
Ammonia	**NH_3**	**Nitrogen, Hydrogen**	**14:3**
Carbon dioxide	**CO_2**	**Carbon, Oxygen**	**3 : 8**

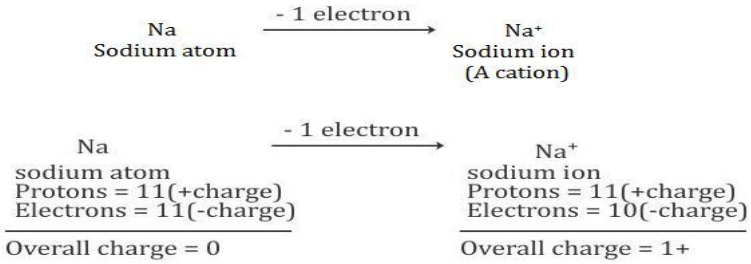
Ions and Radicals

An atom or a group of atoms can exist independently with charge(s). These are formed by the loss or gain of electron(s). They are called radicals or more commonly ions.

Types of Ions or Radicals

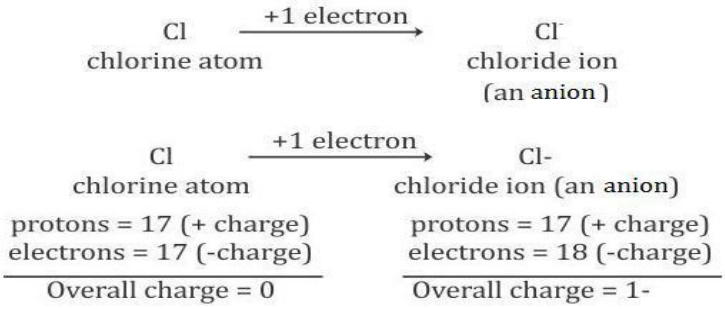
Ions are either positively charged or negatively charged.

Positively charged ions are called cations. Example: Sodium ion (Na^+)



Formation of a Sodium ion

Negatively charged ions are called anions. Example: Chloride ion (Cl^-)



Formation of a Chloride ion

- Sometimes, groups of atoms also give or accept electrons forming positive or negative groups of ions. Such groups of atoms having a positive or negative charge are called **radicals**

What does the charge indicate?

The charge indicates the **valency of an ion.**

Magnesium ion is written as Mg^{2+}, where the 2+ charge indicates that its valency is 2.

Sulphate ion is written as SO_4^{2-}, where the 2- charge indicates that its valency is 2. The valencies of ions and radicals are useful in writing the chemical formulae of the compounds.

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