



BAL BHARATI PUBLIC SCHOOL, PITAMPURA, DELHI – 110034

SUBJECT : - CHEMISTRY

CLASS - IX

CHAPTER-3: ATOMS AND MOLECULES

Week:11th JANAURY to 15th JANAURY 2021

Guidelines

- Refer to the content given below and view the links.
- These notes will help you to understand the concept and complete the assignment that follows.
- The assignment is to be done in the Chemistry notebook.
- Please read Science NCERT book before you begin answering.

Instructional Aids / Resources:

NCERT link for Ch-3 is given below:

<https://ncert.nic.in/ncerts/l/iesc103.pdf>

YouTube link:

For better understanding, refer to the given YouTube Link: -

https://www.youtube.com/watch?v=qw_txG0hUXg

Learning Outcomes:

Each student will be able to:

1. Understand the concept of Molecules
2. Understand the difference between molecules of elements and compounds.
3. Understand and calculate the Atomicity.
4. Understand the concept of valency and how to calculate valency
5. Differentiate between the types of Ions: Cations and Anions
6. Write various chemical formulae.

Sub Topics:

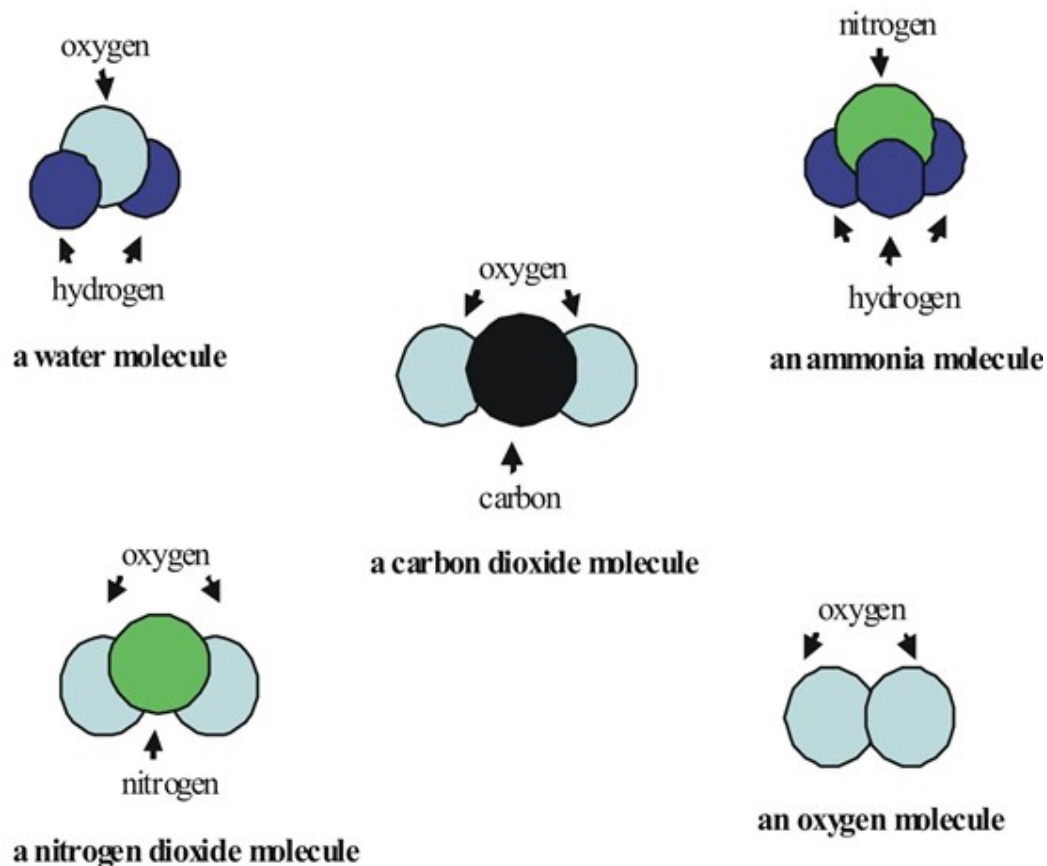
1. Molecules and Atomicity
2. Types of molecules as molecules of elements and compounds.
3. Valency and calculating of valency
4. Types of Ions
5. Writing of chemical formulae

LESSON DEVELOPMENT

1. Molecules

Molecules are formed by the combination of two or more atoms.

For example; two atoms of hydrogen (H_2) and one atom of oxygen (O_2) react with each other and form one molecule of water.



2. Types of Molecules

2.(a) Molecules of Elements

- The molecules of an element are formed by combinations of similar types of atoms. For example, Helium (He) is made up of only one atom while oxygen is made up of two atoms.
- **Atomicity** – the number of atoms in a molecule of an element is called its atomicity. For example, helium is monoatomic and oxygen is diatomic.
- **Monoatomic** – when an element comprises of a single atom. Example – all metals
- **Diatomic** – when an element comprises of two atoms. Example – all gases
- **Triatomic** – when an element comprises of three atoms
- **Tetra-atomic** – when an element comprises of four atoms

- **Poly-atomic** – when an element comprises of more than two atoms

Here a few examples of atomicity of elements –

Atomicity of some Elements		
Name	Atomicity	Formula
Argon	Monoatomic	Ar
Helium	Monoatomic	He
Oxygen	Diatomic	O ₂
Hydrogen	Diatomic	H ₂
Nitrogen	Diatomic	N ₂
Chlorine	Diatomic	Cl ₂
Phosphorous	Tetra – atomic	P ₄
Sulphur	Poly – atomic	S ₈

2.(b)Molecules of Compounds

Molecules of compounds constitute atoms of different elements that combine together in a fixed proportion. For example, water comprises of two atoms of hydrogen and one atom of oxygen.

Molecules of some compounds :-

Compound	Combining elements	Number of atoms of each elements
Water – H ₂ O	Hydrogen, Oxygen	2 - Hydrogen, 1 - Oxygen
Ammonia – NH ₃	Nitrogen, Hydrogen	1 - Nitrogen, 3 - Hydrogen
Carbon dioxide CO ₂	Carbon, Oxygen	1 - Carbon, 2 - Oxygen
Hydrochloric acid HCl	Hydrogen, Chlorine	1 - Hydrogen, 1 - Chlorine
Nitric acid HNO ₃	Hydrogen, Nitrogen, Oxygen	1 - Hydrogen, 1 - Nitrogen, 3 - Oxygen
Sulphuric acid H ₂ SO ₄	Hydrogen, Sulphur, Oxygen	2 - Hydrogen, 1 - Sulphur, 4 - Oxygen

Depending on types of atoms, molecules are further divided into two types:

1. Homo-atomic Molecule: Molecules formed by only one type of atoms are known as Homo-atomic molecule. For example; H₂, N₂, P₄ etc.

2. Hetero-atomic Molecule: Molecules formed by different types of atoms are known as Hetero-atomic molecules. For example; CO₂, NO₂, CH₄, HCl etc.

3.Valency

- It is defined as the combining capacity of an element.
- The outermost shell of any element is also called valence shell and the number of electrons present in that shell determines the valency.

Note -

- In general ,metals are said to be electropositive elements because they have the tendency to donate electrons. For example; Sodium has valency of +1, Calcium has valency of +2, etc.
- Non-metals are said to be electronegative elements because they have the tendency to accept electrons. For example; Chlorine has a valency of -1, Oxygen has a valency of -2, etc.
- There are also certain elements which possess more than one valency. For example;
 - Iron shows two types of valencies one is Fe⁺² which is popularly known as ferrous and another is Fe⁺³ which is known as ferric.
 - Copper also shows valency of +1 known as Cuprous and +2 known as Cupric.

Classification of Ions on the basis of their Valency:

Monovalent Ions: Ions having the valency of 1 are said to be monovalent. For example; OH⁻, NO₃⁻, HCO₃⁻, HSO₄⁻, etc.

Divalent Ions: Ions having the valency of 2 are said to be divalent. For example; SO₄²⁻, SO₃²⁻, CO₃²⁻, etc.

Trivalent Ions: Ions having the valency of 3 are said to be trivalent. For example; PO₄³⁻, N³⁻, etc.

VALENCY TABLE

Vale-ncy	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 (I)*	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⁺				
3.	Aluminium	Al ³⁺	Nitride	N ³⁻	Phosphate	PO ₄ ³⁻
	Iron (III)*	Fe ³⁺				

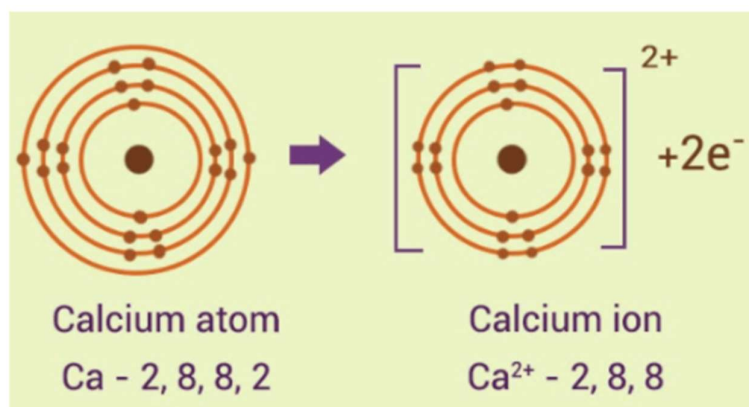
4. Ions and Types of Ions

Ions are the atoms or group of atoms which have a net charge on them. For example; Na⁺, Cl⁻, etc.

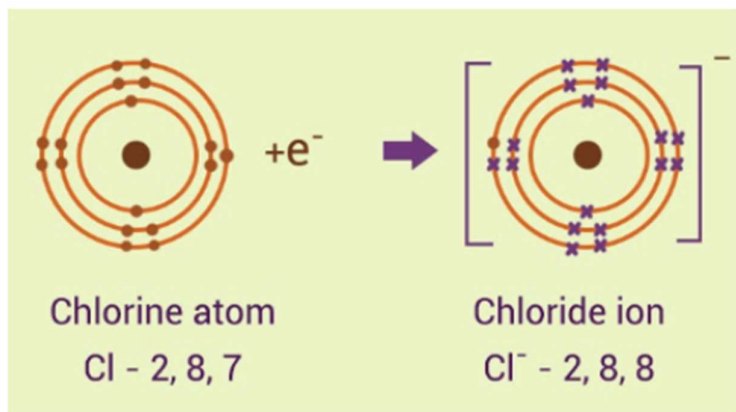
Classification of Ions

1. On the basis of charge:

Cation: Ions containing positive charge are called cations. For example; Na⁺, K⁺, Mg²⁺, etc



Anion: Ions containing negative charge are called anion. For example; Br⁻, F⁻, O²⁻, etc.



2. On the basis of number of ions:

Monoatomic Ions: Ions containing only one atom are said to be monoatomic. For example; Na⁺, K⁺, Br⁻, F⁻, etc.

Polyatomic Ions: Ions containing more than one atom are said to be polyatomic. For example; CO₃²⁻, NO₃⁻, HCO₃⁻, etc.

5. Rules of writing a Chemical Formula

- Valencies of the ions must balance.
- In a case where both metal and non-metal substances are present in a compound, the name of the metal is always written first in the chemical formula. For example, Sodium Chloride is written as NaCl
- In case of polyatomic ions, the ion is written in brackets before writing the number of ions associated to it. In case of a single ion, there is no need to mention the ion in brackets

Writing the Formulae of Simple Compounds

Binary compounds – compounds that consist of two different elements

How to write a Formula of a Compound

- Write the symbols of the corresponding elements of the compound as explained above
- Write the valencies of the elements of the compound
- Crossover the valencies of the elements

Here are a few examples of writing the chemical formula

(i) Formula of Sodium Oxide

Symbol → Na $\begin{array}{c} \diagup \text{O} \\ \diagdown \end{array}$

Charge → +1 $\begin{array}{c} \leftarrow \\ \rightarrow -2 \end{array}$

Formula → Na₂O

(iii) Formula of Sodium Oxide

Symbol → Na $\begin{array}{c} \diagup \text{S} \\ \diagdown \end{array}$

Charge → +1 $\begin{array}{c} \leftarrow \\ \rightarrow -2 \end{array}$

Formula → Na₂S

(ii) Formula of aluminium chloride

Symbol → Al $\begin{array}{c} \diagup \text{Cl} \\ \diagdown \end{array}$

Charge → +3 $\begin{array}{c} \leftarrow \\ \rightarrow -1 \end{array}$

Formula → AlCl₃

(iv) Formula of magnesium hydroxide

Symbol → Mg $\begin{array}{c} \diagup \text{OH} \\ \diagdown \end{array}$

Charge → +2 $\begin{array}{c} \leftarrow \\ \rightarrow 1 \end{array}$

Formula → Mg(OH)₂

ASSIGNMENT

Q1. How many atoms are present in a (i) H₂S molecule and (ii) PO₄³⁻ ion?

Q2. Write down the formulae of (i) sodium oxide (ii) aluminium chloride (iii) sodium sulphide (iv) magnesium hydroxide (v) Magnesium chloride (vi) Calcium oxide (vii) Copper nitrate (viii) Aluminium chloride (ix) Calcium carbonate.

Q3. Write down the names of compounds represented by the following formulae: (i) Al₂(SO₄)₃ (ii) CaCl₂ (iii) K₂SO₄ (iv) KNO₃ (v) CaCO₃.

Q4. Which of the following represents a polyatomic ion? (a) Sulphide (b) Chloride (c) Sulphate (d) Nitride

Q5. Match the columns by choosing the correct option.

	Column I (Ion)		Column II (Nature)
(A)	Chloride ion	1.	Divalent, negative
(B)	Calcium ion	2.	Trivalent, positive
(C)	Aluminium ion	3.	Divalent, positive
(D)	Oxide ion	4.	Monovalent, negative

(a) A - 4, B - 2, C - 1, D - 3 (b) A - 4, B - 3, C - 2, D - 1 (c) A - 3, B - 2, C - 1, D - 4 (d) A - 1, B - 4, C - 3, D - 2