Chemistry Study Materials for Class 10
(NCERT Based Revision Notes of Chapter - 05)

Ganesh Kumar Date:- 29/01/2022

Periodic Classification of Elements

Modern Periodic Table

Alkali Metals

Elements of group I A of the periodic table constitute a family of very reactive metals called alkali metals. They are lithium, sodium, potassium, rubidium, caesium and francium. All of them have one electron in the valence shell. They are called alkali metals because their hydroxides are strong alkalis. These metals are soft, light and easily fusible. In fact, sodium and potassium are lighter than water. At room temperature they readily get oxidised in air and so are preserved under kerosene in the laboratory.

Lithium	3	2, 1	+1	Li_2O	LiOH
Sodium	11	1, 8, 1	+1	Na_2O	NaOH
Potassium	19	2, 8, 8, 1	+1	K_2O	KOH
Rubidium	37	2, 8, 18, 8, 1	+1	Rb_2O	RbOH
Caesium	55	2, 8, 18, 18, 8, 1	+1	Cs_2O	CsOH
Francium	87	2, 8, 18, 32, 18, 8, 1	+1	-	-

Halogens

The elements placed in group 7 (VIIA) of the periodic table are called halogens or salt producers. All these elements form salts called halides, e.g. NaCl, NaI, KCl, KI etc. Halogen is an ancient Greek word meaning 'salt producer'. Halogens have seven electrons in their valence shell and so are monovalent.

Bromine is the only Liquid non-metal. Iodine when heated undergoes sublimation.

Fluorine	9	2, 7	-1	Greenish but more yellow
Chlorine	17	2, 8, 7	-1	Greenish yellow Liquid
Bromine	35	2, 8, 18, 7	-1	Dark red liquid
Iodine	53	2, 8, 18, 18, 7	-1	Solid Dark purple
Astatine	85	2, 8, 18, 32, 18, 7	-1	- -

Transition Elements

All the elements belonging to 3 to 12 groups are called transition elements. They resemble each other in several physical and chemical properties. They are all metals. They are called transition elements because they are placed between the most reactive metals on the left and non-metals on the right. Their compounds are coloured. They exhibit variable valency.

Inner-transition Elements

The 6^{th} period consists of elements that have atomic numbers 58 to 71. They are called Lanthanides. The 7^{th} period consists of elements that have atomic numbers 90 to 105. They are called Actinides. Both of them are called inner transition elements. Lanthanides and actinides are not accommodated in the main body of the periodic table but are placed in separate rows in form of two series at the bottom of the modern periodic table. The 7^{th} period is an incomplete period as it has only 23 elements.

Trends in the Modern Periodic Table

Valency:- The combing capacity of an atom or ion is called valency.

- The valency of an element is determined by the number of valence electrons present in its outermost shell.
- In a group, all the elements have the same number of valence electrons.
- On moving from left to right in each short period, the valency increases from 1 to 4 and then decreases to zero.

Atomic Size:- The distance between center of the nucleus and electron cloud present in outermost orbit of an atom or ion is called atomic size (atomic radius or ionic radius)

Atomic size refers to the radius of the atom.

It is the distance between the centre of the nucleus and the outermost shell of an isolated atom.

In a period, the atomic radius decreases from left to right. This is because electrons are added to the same shell and so they experience a greater pull from the nucleus.

Moving in a group from top to bottom, the atomic radius increases as new shells are added, resulting in the outermost electrons being farther away from the nucleus.

Metallic & Non-metallic Properties

Metals show a tendency to lose electrons and are said to be electropositive.

Non-metals show a tendency to accept or share electrons and are said to be electronegative.

Moving from left to right in a period, the metallic character decreases and the non-metallic character increases. The atomic size decreases and so electrons are not released easily.

In a group, the metallic character increases from top to bottom and the non-metallic character decreases. This is because, as the atomic size increases the valence electrons can be easily removed.

Elements on the left of the periodic table are all metals and on the right of the periodic table are all non-metals.

A zigzag line in the periodic table separates the metals from non-metals. The borderline elements show intermediate properties and are called metalloids.

Merits of the Long Form of the Periodic Table

1. This classification is based on the most fundamental property of the Elements - the atomic number, so it is more accurate.
2. With the atomic number as the basis of this classification, the position of isotopes in one place is justified.
3. The electronic configuration determines the properties of the lements.
4. The position of elements governed by this feature is useful in studying the properties of elements.

5. The position of the elements, which were misfit on the basis of atomic mass is now justified on the basis of atomic number.
6. The lanthanides and actinides have been placed separately due to their properties being different from other groups.
7. The whole table is easy to remember and reproduce in terms of electronic configuration and properties of the elements.

Demerits of the Long Form of the Periodic Table

Although the long form of the period table has been able to help in systematic studying the elements to a great extent, it has some minor defects:

1. Hydrogen resembles both the alkali metals and halogens. But it has been placed with the alkalis not with the halogens.
2. The lanthanides and actinides have not been placed in the main body of the table.

Periodic Properties

1.Valency: Valency is the combining capacity of an element. For metals it is the number of electrons lost during chemical combination while for nonmetals it is the number of electrons gained during chemical combination.

When metals combine with hydrogen, they show a valency corresponding to group number, & nonmetals show a valency equal to (8 – group number).

Thus, valency of an element with respect to hydrogen increases from 1 to 4 and then falls from 4 to 1 across a period.

All elements when combining with oxygen can show a valency corresponding to group number. For example, phosphorus forms phosphorus penta oxide (P_2O_5), where the valency of P is 5 & corresponds to its group number (V A). While combining with hydrogen, phosphorus forms phosphine (PH_3) where it shows a valency of 3 (8- group number)

Thus, valency of an element with respect to oxygen increases from 1 to 7 along a period.

2.Atomic Volume

It is defined as the volume occupied by one mole atoms of the element at its melting point, in solid state.

Variation along the Group – increases on moving down the group.

Variation along the period – decreases along the period, reaches a minimum in the middle and then starts increasing. Alkali metals have maximum atomic volume in a period.

3.Atomic Size (Atomic Radius/ Ionic Radius)

Atomic Radius – The distance between the centre of the nucleus and the electron clouds present in outermost orbit / shell of an isolated atom or ion is called atomic size.

Covalent radius of an element – half the internuclear distance between the two atoms of the element held by a single covalent bond

Metallic radius of an element – half the internuclear distance between the two nearest metal atoms in a metallic crystal.

Atomic radii increases down the group and increases across the period.

4.Ionization Enthalpy

The minimum energy needed to remove loosely bounded electron(s) from outermost orbit from the neutral atom in the gaseous state.

It increases across a period in general and decreases down the group.

Factors affecting ionization Enthalpy

1. Size of the atom
2. Magnitude of Nuclear Charge
3. Screening Effect of the inner electrons
4. Electronic Configuration

****