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Revision Notes

CHEMISTRY

Periodic Classification of Elements

Dobereiner's Triads

Johann Wolfgang Dobereiner, a German chemist, classified the known elements in groups of three elements on the basis of similarities in their properties in the order of increasing atomic masses. These groups were called triads.

Characteristics of Dobereliner's Triads

i. Properties of elements in each triad are similar.
ii. The atomic mass of the middle element is roughly the average of the atomic masses of the other two elements.

Example of Dobereiner's Triads

Element	Atomic mass	Element	Atomic mass
Lithium (Li)	6.9	Calcium (Ca)	40.1
Sodium (Na)	23.0	Strontium (Sr)	87.6
Potassium (K)	39.0	Barium (Ba)	137.3

Limitations of Dobereiner's Traids

Dobereiner could identify only three triads. He was not able to prepare triads of all the known elements.

Newlands, Law of Octaves

John Newlands, an English scientist, arranged the known elements in the order of increasing atomic masses and called it the **Law of Octaves**. It is also known as **Newlands' Law of Octaves**.

Characteristics of Newlands' Law of Octaves

i. It contained the elements from Hydrogen to Thorium.
ii. Properties of every eighth element are similar to those of the first element.

Table showing Newlands' Octaves

sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	da (la)	ni (ti)
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co and Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce and La	Zr	-	-

Limitations of Newlands' Law of Octaves

i. The law was applicable to elements up to Calcium (Ca) only.
ii. It contained only 56 elements. Further, it was assumed by Newlands that only 56 elements existed in nature and no more elements would be discovered in the future.
iii. To fit elements into the table, Newlands adjusted two elements in the same slot and also put some unlike elements under the same note. For example, Iron, which resembles Cobalt and Nickel in properties, has been placed differently away from these elements.

Mendeleev's Periodic Table

Dmitri Ivanovich Mendeleev, a Russian chemist, was the most important contributor to the early development of a periodic table of elements wherein the elements were arranged on the basis of their atomic masses and chemical properties.

Characteristic of Mendeleev's Periodic Table

i. Mendeleev arranged all the 63 known elements in an increasing order of their atomic masses.
ii. The table contained eight vertical columns called 'groups' and seven horizontal rows called 'periods'.
iii. Elements with similar physical and chemical properties came under same groups.

Mendeleev’s Periodic Law

The properties of elements are the periodic function of their atomic masses.

Achievements of Mendeleev’s Periodic Table

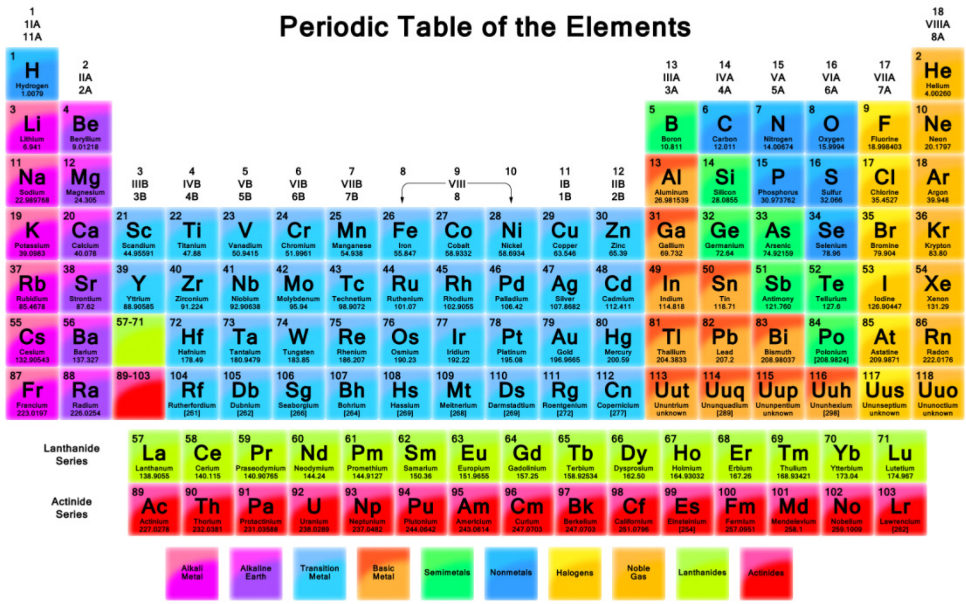
i. Through this table, it was very easy to study the physical and chemical properties of various elements.
ii. Mendeleev adjusted few elements with a slightly greater atomic mass before the elements with slightly lower atomic mass, so that elements with similar properties could be grouped together. For example, Aluminium appeared before Silicon, and Cobalt appeared before Nickel.
iii. Mendeleev left some gaps in his periodic table. He predicted the existence of some elements that had not been discovered at that time. His predictions were quite true as elements such as Scandium, Gallium and Germanium were discovered later.
iv. Gases such as Helium, Neon and Argon, which were discovered later, were placed in a new group without disturbing the existing order.

Limitations of Mendeleev’s Periodic Table

i. Mendeleev could not assign a correct position to Hydrogen in the periodic table.
ii. The position of isotopes of all elements was not certain according to Mendeleev’s periodic table.
iii. Atomic masses did not increase in a regular manner in going from one element to the next. So, it was not possible to predict how many elements could be discovered between two elements.

Modern Periodic Table

Henry Moseley gave a new property of elements—atomic number. This was adopted as the basis of the Modern Periodic Table.



Modern Periodic Law

Properties of elements are a periodic function of their atomic number.

Characteristics of Modern Periodic Table

i. The modern periodic table consists of 18 groups and 7 periods.
ii. All the elements in a group have the same number of valence electrons and show similar chemical properties.
iii. Elements present in a period contain the same number of shells. The number of elements in a period is fixed by the maximum number of electrons which can be accommodated in the various shells of an atom.
iv. Each period marks a new electronic shell getting filled.

Trends in the Modern Periodic Table

Valency

The valency of an element is determined by the number of valence electrons present in the outermost shell of its atom.

a. The valency of elements in a particular group is the same.
b. The valency of elements in a particular period increases from 1 to 4 and then decreases to zero.

Atomic Size

It refers to the radius of an atom.

a. In a period, the atomic size decreases from left to right. This is due to an increase in the nuclear charge which tends to pull the electrons closer to the nucleus and reduces the size of the atom.
b. In a group, the atomic size increases from top to bottom. This is because on moving down, new shells are added. This increases the distance between outermost electrons and nucleus which increases the size of the atom.

Metallic and Non-metallic Properties

a. The tendency to lose electrons from the outermost shell of an atom is called the metallic character of an element.
b. The metallic character decreases across a period and increases down the group.
c. The tendency to gain electrons in the outermost shell of an atom is called the non-metallic character of an element.
d. The non-metallic character increases across a period and decreases down the group.
e. Elements intermediate between metals and non-metals that show characteristics of both metals and non-metals are called semi-metals or metalloids.
f. Metals have a tendency to lose electrons while forming a bond. Hence, they are electropositive in nature.
g. Non-metals have a tendency to gain electrons while forming a bond. Hence, they are electronegative in nature.

Chemical reactivity

a. Across a period, the chemical reactivity of elements first decreases and then increases.
b. Down a group, the chemical reactivity of metals increases due to an increase in their tendency to lose electrons.
c. Chemical reactivity of non-metals decreases down a group because of a decrease in tendency of their atoms to gain electrons.

Nature of oxides

a. Oxides formed by metals are generally basic, and oxides formed by non-metals are generally acidic.
b. The nature of oxides of all the elements of a group is the same.
c. Across a period, the basic nature of oxides decreases and the acidic nature of oxides increases.