

U.G.SEMESTER-IV

MJC-5 (T)

Inorganic Chemistry: s-, p-, d- and f- block elements

Unit-I : Periodic Table and Periodicity of Elements

Topic- s-, p-, d- and f- block elements and Long form of Periodic Table

(PART - 1)

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PERIODIC TABLE AND PERIODICITY IN PROPERTIES

Classification of Elements was necessary since many elements were being discovered in the 19th century and the study of these elements individually was proving difficult.

There were many attempts at classifying elements including '*Dobereiner's Triads*' and '*Newland's Octaves*'.

MODERN PERIODIC TABLE (LONG FORM OF PERIODIC TABLE)

In the year 1913, English physicist **Henry Moseley** studied the wavelength of the characteristic x-rays. By using different metals as anti cathode and showed that the square root of the frequency of the line is related to the atomic number. On the basis of the above observations Moseley gave the **modern periodic law** which states that :

“Physical and chemical properties of the elements are the periodic function of their atomic numbers”.

Meaning: When elements are arranged by increasing atomic number, similar properties recur at regular intervals (periodically). This corrects Mendeleev's discrepancies and links periodicity directly to electronic structure.

The atomic mass of an element is due to the mass of protons and neutrons present in the nucleus of its atom. Since the nucleus is located inside an atom, It is not very much linked with the properties of the element, particularly the chemical properties. These are related to the number of electrons and also the distributions of the electrons in the different energy shells. The elements with different electronic arrangements of atoms possess different chemical properties. As the number of electrons in an atom is given by the atomic number and not by the mass number, therefore atomic number should form the basis of the classification of the elements in the periodic table and not atomic mass as predicted by Mendeleev.

Repetitions of the similar properties of the elements placed in a group and separated by certain definite gap of atomic number are known as Periodicity

- Mendeleev's table used atomic mass and showed anomalies (e.g., Co/Ni).

- **Modern Periodic Law (Moseley, 1913):** “The physical and chemical properties of the elements are a periodic function of their **atomic numbers**.”
- The modern table is arranged in increasing atomic number.
- It has **7 periods** (rows) and **18 groups** (columns).
- Elements are classified into **s-, p-, d-, and f-** blocks based on electron configurations.

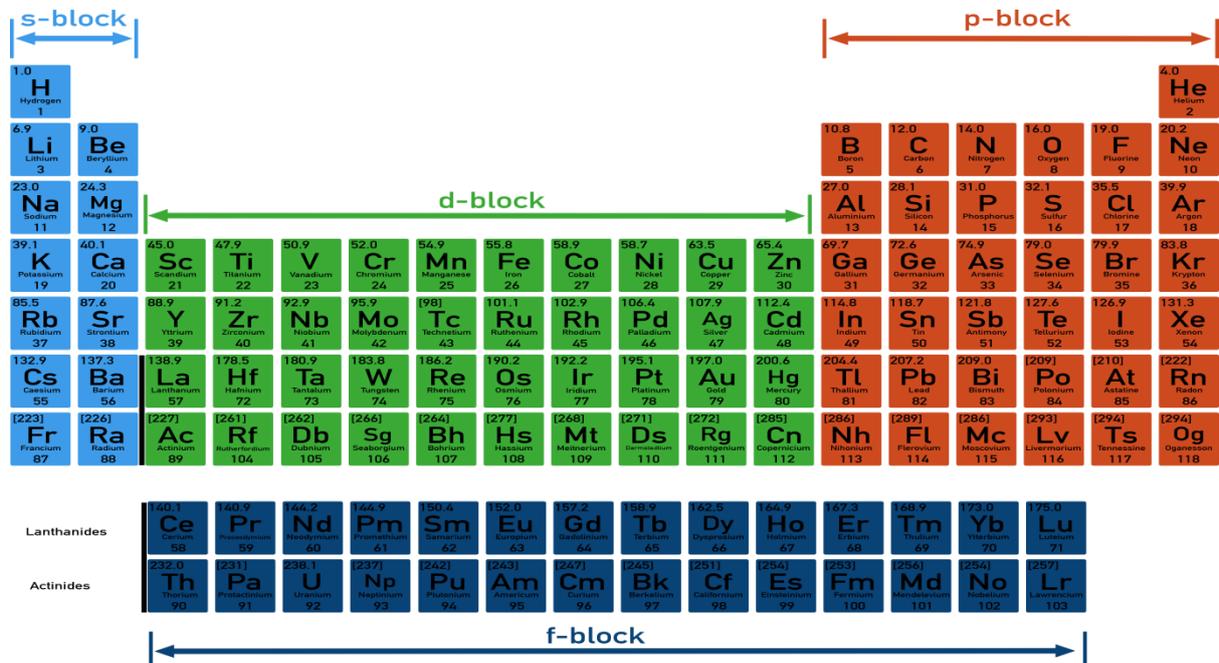
Each new period begins with filling of a new principal energy level (n).

The Shift from Atomic Mass to Atomic Number

While Mendeleev’s periodic law (based on atomic mass) organized many elements successfully, some anomalies remained. For example, cobalt and nickel did not align perfectly by mass with their chemical similarities; isotopes also caused placement issues because they differ in mass but not in chemical properties.

In 1913, **Henry Moseley** showed from X-ray spectra that the fundamental property governing periodicity is **atomic number (Z)** – the number of protons in the nucleus – not atomic mass. Ordering by increasing Z removed the anomalies and produced a consistent, predictive framework.

Classification of elements in modern periodic table:



Structure of the Modern Periodic Table

TO BE CONTINUED.....