Classification of Elements and Periodicity in Properties

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1. **Periodic Classification**
2. **Modern Periodic Law and the present form of the Periodic Table**
3. **Nomenclature of Elements**
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Johann Dobereiner classified elements in group of three elements called triads.

According to Mendeleev's periodic law the physical and chemical properties of elements are periodic functions of their atomic weights.

Merits of Mendeleev's periodic table:

- Mendeleev's periodic table helped to remember and study the properties of large number of elements.
- Mendeleev's periodic table helped in correcting the atomic masses of some of the elements like gold, beryllium and platinum based on their positions in the periodic table.
- Mendeleev could predict the properties of some undiscovered elements like scandium, gallium and germanium.

Demerits of Merits of Mendeleev's periodic table:

- Position of hydrogen was not correctly defined in periodic table.
- In certain pairs of elements increasing order of atomic masses was not obeyed. For example argon (Ar, atomic mass 39.9) is placed before potassium (K, atomic mass 39.1)
- Isotopes were not given separate places in the periodic table.
- Some similar elements are separated and dissimilar elements are grouped together.

Moseley studied the frequencies of the X-rays emitted from the elements. With these experiments he concluded that atomic number is more fundamental property of an element than its atomic mass.

After Moseley's experiments, Mendeleev's periodic law was modified to modern periodic law.

Modern periodic table is also referred to as long form of periodic table

Modern Periodic Table arranges the elements in the order of their atomic numbers in seven horizontal rows **(periods**) and eighteen vertical columns (**groups or families**).

- Atomic numbers in a period are consecutive, whereas in a group they increase in a pattern.
- Elements of the same group have similar **valence shell** electronic configuration and, therefore, exhibit similar chemical properties.
- However, the elements of the same period have incrementally increasing number of electrons from left to right, and, therefore, have different valencies.
- Four types of elements can be recognized in the periodic table on the basis of their electronic configurations. These are **s-block, p-block, d-block** and **f -block** elements.
- **Hydrogen** with one electron in the 1s orbital occupies a unique position in the periodic table.
- **Metals** comprise more than seventy eight per cent of the known elements.
- Non-**metals,** which are located at the top of the periodic table, are less than twenty in number.
- Elements of group 18 having ns^2 np^6 configuration are called noble gases.
- Elements of group 17 are called halogens.
- Elements which lie at the border line between metals and non-metals (e.g., Si, Ge, As) are called **metalloids** or **semi-metals**.
- Metallic character increases with increasing atomic number in a group whereas decreases from left to right in a period.
- The physical and chemical properties of elements vary periodically with their atomic numbers.
- Elements in lanthanoid and actinoid series are called inner transition series.

Nomenclature of an element is done by IUPAC. According to IUPAC, a new element is given a temporary name until it's discovery is proved and its name is officially recognized. This nomenclature is based on Latin words for their numbers.

The interim names of the newly discovered elements are derived by combining together the roots in order of digits which make up the atomic number and ium is added at the end.

Periodic trends are observed **in atomic sizes, ionization enthalpies, electron gain enthalpies, electronegativity and valence.**

- The atomic radii decrease while going from left to right in a period and increase with atomic number in a group.
- Ionization enthalpies generally increase across a period and decrease down a group. Electronegativity also shows a similar trend.
- **Electron gain enthalpies**, in general, become more negative across a period and less negative down a group.
- Group 17 elements have high negative electron gain enthalpy because they can attain a stable electronic configuration as of noble gases by accepting an electron.
- There is some periodicity in valence, for example, among representative elements, the valence is either equal to the number of electrons in the outermost orbitals or eight minus this number.
- **Chemical reactivity** is highest at the two extremes of a period and is lowest in the centre. The reactivity on the left extreme of a period is because of the ease of electron loss (or low ionization enthalpy).
- Highly reactive elements do not occur in nature in free state; they usually occur in the combined form. Oxides formed of the elements on the left are basic and of the elements on the right are acidic in nature. Oxides of elements in the centre are amphoteric or neutral.