

6. Periodic Classification of Elements

- The first classification of elements was as metals and non-metals.
- After the discovery of atomic mass (old term, atomic weight) it was thought to be the fundamental property of elements and attempts were made to correlate it to their other properties.
- John Dobereiner grouped elements into triads. The atomic mass and properties of the middle element were mean of the other two. He could group only a few elements into triads. For example (i) Li, Na and K (ii) Ca, Sr and Ba (iii) Cl, Br and I.
- Newlands tried to see the periodicity of properties and stated his law of octaves as “*When elements are arranged in the increasing order of their atomic weights every eighth element has properties similar to the first*”. He could arrange elements up to calcium only out of more than sixty elements then known.
- Mendeleev observed the correlation between atomic weight and other properties and stated his periodic law as, “*The chemical and physical properties of elements are a periodic function of their atomic weights*”.
- Mendeleev gave the first periodic table which is named after him which included all the known elements. It consists of seven horizontal rows called **periods** and numbered them from 1 to 7. It has eight vertical columns called **groups** and numbered them from I to VIII.
- Main achievements of Mendeleev’s periodic table were (i) inclusion of all the known elements and (ii) prediction of new elements.
- Main defects of Mendeleev’s periodic table were (i) position of isotopes, (ii) anomalous pairs of elements like Ar and K and (iii) grouping of dissimilar elements and separation of similar elements.
- Moseley discovered that atomic number and not atomic mass is the fundamental property of elements. In the light of this the periodic law was modified to “*The chemical and physical properties of elements are periodic functions of their atomic numbers*”. This is the Modern Periodic Law.
- Modern Periodic Table is based upon atomic number. Its long form has been accepted by IUPAC. It has seven periods (1 to 7) and 18 groups (1 to 18). It is free of main defects of Mendeleev’s periodic table. Elements belonging to same group have same number of valence electrons and thus show same valency and similar chemical properties.
- Arrangement of elements in the periodic table shows periodicity. Atomic radii and metallic character increase in a group from top to bottom and in a period decrease from left to right.

Build Your Understanding

Classification of Elements

Major attempts were made for classification of elements

1. Dobereiner’s Triads
2. Newlands’ Law of Octaves
3. Mendeleev’s Periodic Law & Periodic Tables

4. Modern Periodic Table

Mendeleevs Periodic law

We will start with the Mendleev’s periodic classification. *The chemical and physical properties of elements are a periodic function of their atomic masses.*

Merits of Mendeleev's Periodic Classification

Classification of elements (all 63 elements known at that time classify.)

Correction of atomic masses, atomic masses of Be, Au (Gold) corrected

Prediction of new elements: Germanium, Gallium

Defects

- Position of Hydrogen could not be explain.
- Position of isotopes could not explain.
- Anomalous pairs of elements
- Grouping of chemically dissimilar elements
- Separation of chemically similar elements

Modern periodic Law

Chemical and physical properties of elements are periodic functions of their atomic number.

If the elements are arranged in the order of their increasing atomic numbers the elements with similar properties are separated after certain regular intervals.

Merits of the Modern Periodic Table

- Position of isotopes can be explain.
- Anomalous pairs are corrected.
- Electronic configuration can be explain
- Separation of metals and non-metals
- position of transition element

Variation in Periodical Properties**1. Atomic Size**

- Increases in groups from top to bottom due to increase in the number of shells
- Decreases in the periods from left to right due to increase in attraction between nucleus and valence electron

2. Metallic character

- Increase in the group from top to bottom due to the tendency to loose the electron increases
- Decreases in the periods from left to right because tendency to loose the electron is decrease.

**Stretch Yourself**

1. How many groups and periods are available in modern period table?
2. How is the position of isotopes justified in modern periodic table?
3. Carbon is non-metal but lead is a metal why?

**Test Yourself**

1. Mendeleev's could not explain the position of isotopes in the periodic table why?
2. Potassium is more metallic in nature as compared to Lithium.
3. Carbon is less metallic in nature as compared to Lithium
4. Atomic size decrease in the periodic table from left to right but increases in the groups from top to bottom explain
5. What do you mean metalloids? Give few examples of metalloids