

CONCEPT MAP

CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

Elements are classified in such a way that similar elements are grouped together and dissimilar elements are separated from one another.

Earlier Attempts

Döbereiner's Law of Triads

- Elements in a triad had similar properties.
- The atomic weight of the middle element was very close to the arithmetic mean of the other two elements.

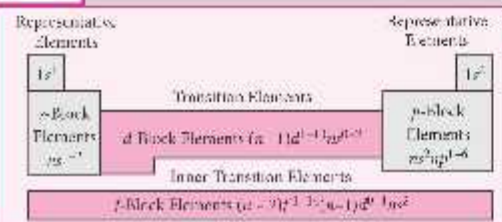
Newland's Law of Octaves

- When elements were arranged in increasing order of their atomic weights, properties of every eighth element were similar to those of the first one like the eighth note of a musical scale.

Mendeleev's Periodic Law

- The properties of the elements are periodic function of their atomic weights.
- Mendeleev's original periodic table contains 8 vertical columns called groups and 6 horizontal rows called periods.

Blocks



Arrangement of Elements

- Metals: > 78% of all known elements appear on the left hand side of the periodic table.
- Non metals: < 20, lie on the top right hand side of the periodic table.
- Metalloids or semi-metals: B, Si, Ge, As, Sb, Te, Po and At, run diagonally across the periodic table.

Modern Periodic Table

Modern Periodic Law

- The physical and chemical properties of the elements are a periodic function of their atomic numbers.

Long Form of Periodic Table

- Based on modern periodic law.
- Follows Bohr's scheme for the arrangement of various electrons around the nucleus.
- Contains 18 groups and 7 periods.

Groups

- Group number for:
 - s-block: no. of valence electrons in ns-orbital.
 - p-block: 10 + no. of valence electrons in np-orbital.
 - d-block: no. of valence electrons in (n-1)d and ns-orbitals.
- Group 1 - Alkali metals
- Group 2 - Alkaline earth metals
- Group 11 - Coinage metals
- Group 15 - Pnictogens
- Group 16 - Chalcogens
- Group 17 - Halogens
- Group 18 - Noble gases or Aerogens.

Periods

- Periodic number: highest principal quantum number (n) of the elements of the periodic table.
- Number of elements in each period is twice of the atomic orbitals available in the energy level that are being filled.
- Period 1 (n = 1) - 2 elements
- Period 2 (n = 2) - 8 elements
- Period 3 (n = 3) - 8 elements
- Period 4 (n = 4) - 18 elements
- Period 5 (n = 5) - 18 elements
- Period 6 (n = 6) - 32 elements
- Period 7 (n = 7) - 32 elements
- Lanthanoids: 14 elements of period 6
- Actinoids: 14 elements of period 7 (Placed in the bottom of the periodic table separately)

Periodic Trends

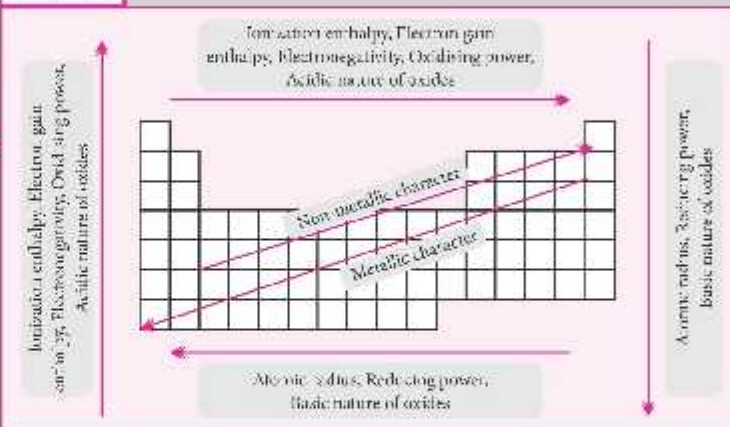
Periodic Properties

- Properties which show a regular gradation from left to right in a period and top to bottom in a group.

Exceptions

- $\Delta_{\text{vap}}H$ of Be, Mg, Ca, N and inert gases is positive.
- Ar and Kr have the same value of $\Delta_{\text{vap}}H$.
- $\Delta_{\text{vap}}H$ of F is less -ve than Cl.
- $\Delta_{\text{vap}}H$ of CO is less -ve than S.
- LE_1 of $\text{O} < LE_1$ of N.

Properties



Have a Look!

- Mendeleev had predicted the properties of gallium (*eka-aluminium*) and germanium (*eka-silicon*) long before they were known.
- IUPAC names of elements with atomic numbers > 100 are derived directly from the atomic numbers using numerical roots for 0 and number from 1 - 9 and adding suffix *ium*.
- Valency first increases from 1 to 4 and then decreases to zero along a period and remains same within a group.
- Some elements in second period show similarities with third period elements placed diagonally to each other.
- Boron (B) has the smallest atomic volume and highest tensile strength.
- Technetium (Tc) is the first synthetic element.
- Lanthanide which does not occur in nature is promethium (Pm).
- Francium (Fr) is liquid, radioactive element.
- Zn, Cd and Hg are volatile d-block elements.
- Mercury (Hg) is also called 'liquid silver'.