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CLASSIFICATION of Elements and PERIODICITY IN PROPERTIES

Chapter review :-

- History of development of periodic table
- Modern Periodic law
- Periodic classification as a logical consequence of the Electronic configuration of atoms.
- Periodic trends in physical and chemical properties of elements.

Why do we need to classify Elements :-

- As the chemistry developed, a large number of elements were discovered.
- It is very difficult to study individually the chemistry of all these elements and their innumerable compounds individually.
- To make it easier scientist developed a systematic way to organise their knowledge by classifying the Elements.
- classification is not only helpful in knowing chemical facts about elements, but even predict new ones for undertaking further study.
- Elements are the basic units of all type of matters.
- In 1800 → 31 Elements were known to us.
- By 1865 → 63 Elements were known to us.
- At present → 114 Elements are known. ⇒ (118)
- Recently discovered Elements are man-made.
- 94 Elements are found in nature. [Neptunium & plutonium like actinium and protactinium is also found in pitch blende - an ore of uranium]
- Elements after uranium (transuranic or post-uranic Elements) are man-made. (32)

GENESIS OF PERIODIC CLASSIFICATION :-

1 Dobereiner's Law of triads :-

- Dobereiner was the first to consider the idea of trends among properties of Elements.
- He identified some groups of three Elements (triads) having similarity in their physical and chemical properties
- He also noticed that the middle element of each of the triads had an atomic weight approx equal to arithmetic mean of other two Elements. Also the properties of the middle element were in between those of the other two members.

Examples

Li	Na	K	Ca	Sr	Ba	Cl	Br	I
7	23	39	40	88	137	35.5	80	127
$\frac{7+39}{2}$ = 23.00			$\frac{40+137}{2}$ = 88.50			$\frac{35.5+127}{2}$ = 81.25		

3. Newlands law of octaves :-

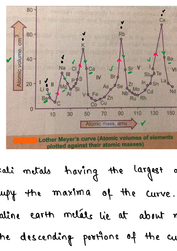
- He arranged the elements in increasing order of their atomic weights and noted that every eighth Element had properties similar to the first Element.
- This law seemed to be true only for elements upto calcium.

The next attempt to classify Elements was made by a French geologist A.E.B. de chancourtois in 1862. He arranged Elements in order of increasing atomic weights and made a cylindrical table of elements to display the periodic recurrence of properties.

* The periodic law, as we know it today owes its development to the Russian chemist, Dmitri Mendeleev (1834-1907) and the German chemist, Lother Meyer (1830-1895). Working independently, both chemists in 1869 proposed that on arranging Elements in the increasing order of their atomic weights, similarities appear in physical and chemical properties at regular intervals.

4. Lother Meyer's Curve :-

He used physical properties such as m.p., B.P, atomic vol etc to relate similarities among particular set of Elements. Similar Elements were found to occupy similar position



Lother Meyer's curve (Atomic volumes of elements plotted against their atomic masses)

(i) Alkali metals having the largest atomic volumes occupy the maxima of the curve. (A→H, D→AEM, M→A)

(ii) Alkaline earth metals lie at about midpoint on the descending portions of the curve.

5. Mendeleev's classification :-

* Mendeleev, the scientist who is generally credited with the development of the modern periodic table.
* It was Mendeleev who was responsible for publicising the periodic law for the first time. It states as follows:

  The properties of elements are a periodic function of their atomic weight.

* He arranged 63 Elements
* He arranged elements in → horizontal rows (Periods) (12) & vertical columns (groups) (8) in order of their increasing atomic weights.
* His system was more elaborate than that of Lother Meyer
* At some places the order of atomic mass was changed in order to justify the chemical and physical nature.
* Some places were left vacant for new elements which were not discovered at that time.
* In particular, Mendeleev relied on the similarities in the empirical formulas & properties of the compounds formed by elements.

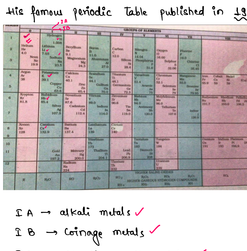
→ Example → Iodine with lower atomic wt than that of tellurium (GpVI) was placed in Grp VII along with F, Cl, Br bcz of similarities in properties.

→ for example Both Germanium & gallium were unknown at that time.

Eka-Aluminium Eka-Silicon

Property	Eka-aluminium (predicted)	Gallium (found)	Eka-silicon (predicted)	Germanium (found)
Atomic weight	68	70	72	72.6
Density / g/cm³	5.9	5.94	5.5	5.36
Melting point /K	Low	303.65	High	1231
Formula of oxide	E_2O_3	Ga_2O_3	EO_2	GeO_2
Formula of chloride	ECl_3	$GaCl_3$	ECl_4	$GeCl_4$

* His famous periodic Table published in 1905



I A → alkali metals ✓
I B → Coinage metals ✓
II A → Alkaline earth metals ✓
III A → Pnicogens (choking gas formers) ✓
VI A → Chalcogens (chalk formers) ✓
VII A → Halogens (salt formers) ✓
Zero grp. → Noble gases (inert gases or rare gases)