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Chapter-3

Modern Periodic Table

Development of Periodic Table:
i) Dmitri Mendeleev
ii) J. Lothar Meyer } 1869

Periodic Table: A tabular arrangement of elements in rows and columns, highlighting the regular repeatition of properties of the elements, is called periodic table.

In modern versions of the periodic tables, each entry lists the atomic number, atomic symbol and atomic mass of an element.

Mendeleev's Statement of the Law Periodicity:

The properties of elements are a periodic function of their atomic weight: That is if the ~~weight~~ elements are arranged in an increasing order of their atomic weight, the properties of the elements which are similar are repeated after a certain interval or period.

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Modern statement of the laws of periodicity: It was stated by **Moseley**. The properties of elements are a periodic function of their atomic weight. That is if the elements are arranged in increasing order of their atomic weight, the properties of the elements which are similar are repeated after definite regular intervals or Periods.

Features of periodic table:

1) There are rows and columns.
2) The column are called groups. The groups are divided into two types: A and B. The number of valance electrons equal the Group number. All members of the group has same valance configuration but different principal quantum number.

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3) The rows are called periods. There are 7 periods in the periodic table. The period number of an element ~~means~~ ~~indicates~~ indicates the highest unexcited energy level for an electron in that element. Period number = principal quantum number of valance shell.

4) Group 1 elements are called Alkali Metals. They are highly reactive & have +1 charge.

5) Group 2 elements are called Alkali Earth Metals. They have +2 charge.

6) Transition metals are in the middle, they consists of groups I B to VIIIB.

7) The inner transition metals are at the bottom — Lanthanide and Actinides.

8) Group 17 is called Halogens. They are salt producers and have -1 charge.

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9) Group VIII A / 18 / zero is called noble gases / inert gases. They are non-reactive.

10) Hydrogen occupies an unique position at the top of the periodic table. It doesn't fit into any group naturally. It has a single positive charge like alkali metals, but in room temperature it is a gas that doesn't act like metals.

11) The elements of VIIIB consists of three groups of elements at the middle of periodic table. They contain triads, which are metals with very similar properties and is usually found together.

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Classification of elements by Block:

1) s- block : having valance configuration s^1 or s^2

2) P- block : having valance configuration s^2p^1 to s^2p^6

3) d- block : having valance configuration d^1 in which d- subshells are filled.

4) f- block : having valance configuration in which f- subshells are being filled.

Classifications depending on electronic config.:

1) Inert Gas : Elements of Group -17 / or "0" group.

2) Representative Elements : elements of s and p blocks.

3) Transition Elements : elements of d - block.

4) Inner transition Elements : elements of f - block.

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Classifications depending on Metal, Nonmetal and metalloids.

Metals:

- Lustrous (shiny)
- can be hammed into sheets (malleable)
- can be drawn into wire (ductile)
- good conductors of heat & electricity
- ability to easily move the electron in the outer shell of metal atoms.

Exception: Mercury (Hg), has low heating and boiling points.

Group I A : Alkali Metals:

Li Na K Rb Cs Fr

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Alkali metals are in the first column and has +1 charge. They are less dense and have large atomic sizes in their periods. They are very reactive.

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Group IIA : Alkali Earth Metals:

Be Mg Ca Sr Ba Ra

বিরিয়াম ম্যাগনেশিয়াম ক্যালসিয়াম স্ট্রন্সিয়াম বেরিয়াম রেডিয়াম

The alkali earth metals are placed in group 2. They have +2 charge. They are smaller than alkali metals.

Group IB - VIIIB : Transition Metals:

Iron and Gold are examples of Transition metals. They are

- hard
- high melting points and boiling points
- good conductors of heat and electricity
- very malleable
- positive oxidation states of +2 and +3
- has 2 in complete energy levels (s and d)
- effective catalyst
- forms coloured compounds
- forms complex compounds.

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- found as triads.

Group VIIIB: Metal triads:

The iron triads consists of iron, cobalt and nickle. Just under iron, cobalt and nickel is palladium triads of ruthenium, rhodium and palladium while under them is the platinum triads of osmium, iridium and platinum.

Lanthanide:

- called rare earths ~~metals~~
- silvery metals
- tarnish easily
- soft metals
- high melting and boiling points
- used to improve properties of other metals
- used in lamps, magnets and lasers.

Actinides:

- radioactive
- positive charged ions.
- reactive
- reacts with nonmetals mostly
- used in medicines and nuclear devices.

Lanthanide and Actinides have ~~three~~ three incomplete outer levels (s, d, f) and their properties are similar to transition metals.

Nonmetals and metalloids:

Nonmetals:

- Mostly gases
- solid nonmetals are hard but brittle
- Bromine only liquid non-metal

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Halogens:

F Cl Br I At

located in group - 17 / VII A. they have -1 charge and they are highly reactive. Their physical properties vary.

Nobel Gases / Inert Gases:

He Ne Ar Kr Xe Rn

- complete pairing of all electrons present
- absence of any molecular orbital
- stable energy state
- very high ionization potential
- negligible electron Affinity.
- used in lights, refrigerants and lasers.

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Usefulness of periodic table:

— Organized classification of elements
— Prediction of Uncovered elements
— Correction of atomic weight
— Periodic table in industrial research

Limitations of periodic table:

— Position of hydrogen
— Position of lanthanides and actinides
— Properties are not periodic functions
— Diagonal relationship.