MOSELEY'S MODERN PERIODIC TABLE

Long Form of The Periodic Table or Moseley's Periodic Table

Modern Periodic Table (Modified Mendeleev Periodic Table)

(a) Moseley put forward this proposal.

(b) The foundation of the modern periodic table lies in the atomic number.

(c) Moseley conducted an experiment wherein he bombarded metal surfaces with high-speed electrons, resulting in the generation of X-rays. He determined a relationship between the frequency of X-rays (ν) and the atomic number (Z).

Characteristics Of Modern Periodic Table

(a) There are 9 vertical columns referred to as groups.

(b) The groups range from the 1st to the 8th, with an additional 0 group comprising inert gases.

(c) Ramsay introduced inert gases into the periodic table.

(d) There are 7 horizontal series known as periods.

In 1909, he examined the frequency of X-rays generated by bombarding a metal target with a concentrated electron beam. His findings revealed that the square root of the X-ray frequency ($\sqrt{\nu}$) is directly proportional to the number of effective nuclear charges (z) in the metal, specifically to the atomic number, and not to the atomic mass of the metal's atom. This is due to the fact that the nuclear charge of a metal atom is equivalent to its atomic number.

i.e. $(\sqrt{\nu}) = a\,(z - b)$

Here, 'a' represents the proportionality constant, and 'b' is a constant applicable to all lines within a specific X-ray series. Consequently, he inferred that the atomic number was a more reliable fundamental property of an element compared to its atomic weight. As a result, he proposed that the classification of elements should be based on atomic number (z) rather than atomic weight.

Modern Periodic Law (Moseley's Periodic Law)

The physical and chemical characteristics of elements are governed by their atomic numbers in a periodic manner. When elements are arranged in ascending order of their atomic numbers, elements with comparable properties reappear at regular intervals.

- **Periodicity**

Periodicity is the recurrence of element properties at consistent intervals when the elements are organized in ascending order of their atomic numbers.

- **Cause of Periodicity**

The periodic recurrence of element properties is attributed to the repetition of a similar valence shell electronic configuration at regular intervals.

For instance, alkali metals share the same electronic configuration ns1, leading to similar properties.

Long Form / Present Form of Modern Periodic Table

(This is also known as the 'Bohr-Bury-Rang-Werner Periodic Table.)

(a) It is constructed on the Bohr-Bury electronic configuration concept and atomic number.

(b) This model is presented by Rang & Werner.

(c) Comprising 7 periods and 18 vertical columns (groups).

(d) According to I.U.P.A.C., the 18 vertical columns are designated as the 1st to the 18th group.

(e) Elements within the same group possess an identical number of electrons in the outermost shell, resulting in similar properties.

(f) Elements within the same group share the same number of electrons in the outermost shell, hence exhibiting similar properties. The extended periodic table is a collaborative effort of Rang, Werner, Bohr, and Bury. It is often referred to as Bohr's table due to its adherence to Bohr's scheme of arranging elements into four types based on their electronic configuration. The modern periodic table is comprised of horizontal rows (periods) and vertical columns (groups).

➢ Periods

There are seven periods designated as 1, 2, 3, 4, 5, 6, and 7.

(i) Each period encompasses a sequence of elements sharing the same valence shell.

(ii) Each period corresponds to a specific principal quantum number associated with the valence shell within it.

(iii) Each period commences with an alkali metal featuring an outermost electronic configuration of ns^1.

(iv) Each period concludes with a noble gas exhibiting an outermost electronic configuration of ns2np6, with the exception of helium, which has an outermost electronic configuration of $1s^2$.

(v) Each period initiates with the filling of a new energy level.

(vi) The number of elements in each period is twice the number of atomic orbitals available in the energy level being filled.

To illustrate,

1^{st} period shortest period having only two elements. Filling of electron takes place in the first energy shell, for which,

$$n = 1, \lambda. = 0 \text{ (s-subshell) and } m = 0.$$

Only one orbital (1s) is available and thus it contains only two elements.

3^{rd} period short period having only eight elements. Filling of electrons takes place in the third energy level.

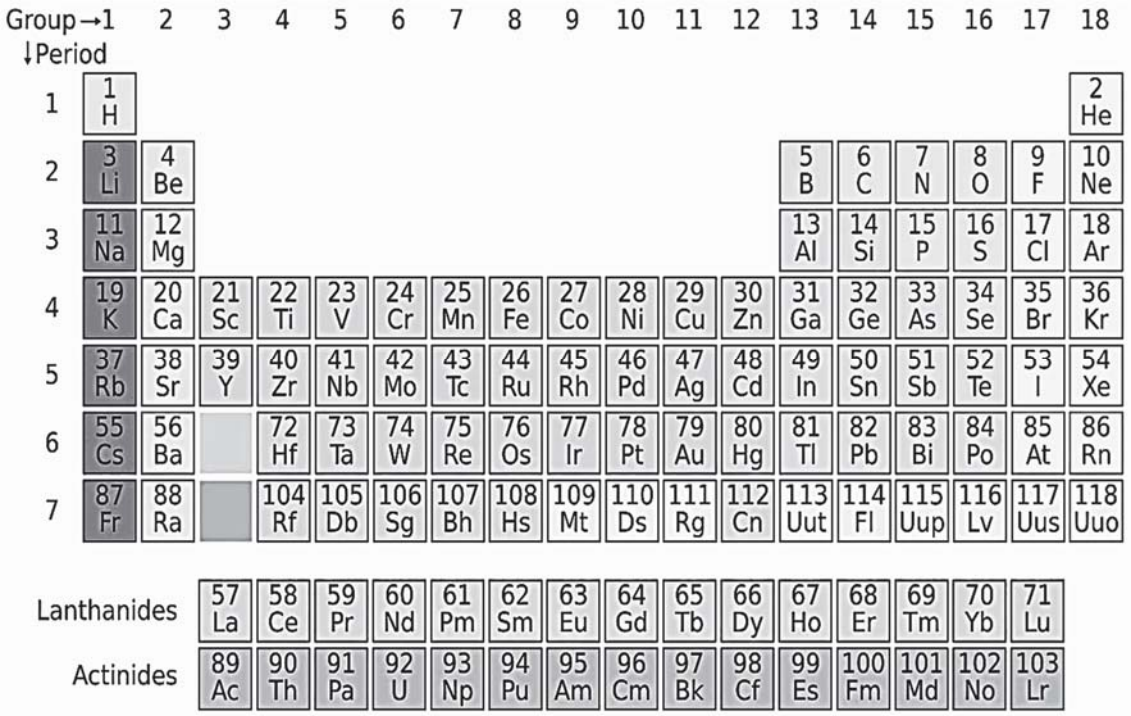
For which,

$n = 3, \lambda. = 0, 1,2$ and no. of orbitals m =	0,	3,	5
no. of orbitals	1	3	5
	(3s)	(3p)	(3d)
Total no. of orbitals	9		

However, the energy of 3d orbitals is higher than that of 4s orbitals. Consequently, the four orbitals (one 3s and three 3p orbitals) corresponding to $n = 3$ are filled before the filling of the 4s orbital (the subsequent energy level). As a result, the 3^{rd} period comprises eight elements, not eighteen elements.

➢ Groups

There are eighteen groups designated as 1, 2, 3, 4, 5, ... 13, 14, 15, 16, 17, 18. Each group comprises a series of elements sharing a similar valence shell electronic configuration.



Description of periods

Period n	Sub shell	No. of elements	Element	Name of Period
1. 1	1s	2	$_1H$, $_2He$	Shortest
2. 2	2s, 2p	8	$_3Li$ – $_{10}Ne$	Short
3. 3	3s, 3p	8	$_{11}Na$ – $_{18}Ar$	Short
4. 4	4s, 3d, 4p	18	$_{19}K$ – $_{36}Kr$	Long
5. 5	5s, 4d, 5p	18	$_{37}Rb$ – $_{58}Xe$	Long
6. 6	6s, 4f, 5d, 6p	32	$_{55}Cs$ – $_{86}Rn$	Longest
7. 7	7s, 5f, 6d,	26	$_{87}Fr$ – $_{112}Uub$	Incomplete