Periodic Classification of Elements Modern Periodic Table

MAKING ORDER OUT OF CHOAS – THE MODERN PERIODIC TABLE:

A large number of scientists made attempts to remove drawbacks of Mendeleev's periodic table. In 1913, the English Physicist Henry Moseley studied the X-ray spectra of many elements. He observed that a plot (where v is the frequency of the X-rays emitted) against atomic number (Z) gave a straight line and not the plot of against atomic weight. He proposed that atomic number is a more fundamental property of an element than its atomic weight. Therefore, the physical and chemical properties of the elements are determined by their atomic numbers instead of their atomic weights. This observation led to the development of modern periodic law and the **modern periodic law** can be stated as follows:

Properties of elements are a periodic function of their atomic number.

Let us recall that the atomic number gives us the number of protons in the nucleus of an atom and this number increases by one in going from one element to the next. Elements, when arranged in order of increasing atomic number Z, lead us to the classification known as the **modern periodic table**. Prediction of properties of elements could be made with more precision when elements were arranged on the basis of increasing atomic number.

What is Periodicity

The recurrence of properties of the elements, after a certain regular interval, when they are arranged in the increasing order of their atomic numbers, is called **periodicity**.

Cause of Periodicity

We know that properties of elements depend upon the number of valence electrons, i.e. the number of electrons in the outermost shell. When the elements are arranged in the increasing order of their atomic numbers, then the elements having the same numbers of valence electrons are repeated at regular intervals of 2, 8, 8, 18, 18, 32...... Since the chemical properties depend upon the number of valence electrons,

therefore, chemical properties are repeated at regular intervals, i.e. there is periodicity in the chemical properties of the elements.

grou 1* Ia* 1 H 3 Li	P ** 11a 4 Be		ilkali m ilkaline ransiti other m other n	netals earth ion met netals onmeta	metals als ls	halogens noble gases rare earth elements (21, 39, 57–71) lanthanide elements (57–71 only) actinide elements						13 IIIa 5 B	14 IVa 6 C	15 Va 7 N	16 VIa 8 0	17 VIIa 9 F	18 0 2 He 10 Ne
11 Na	12 Mg	3 1115	4 IVb	5 Vb	6 VIb	7 VIIb	8	9 - VIIIb	10	11 4 Ib	12 IIb	13 Al	14 Si	15 P	16 S	17 C1	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Кг
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 I n	50 Sn	51 Sb	52 Te	53 	54 Xe
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 ₩	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 T1	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 *** (Uub)	113 **** (Uut)	114 *** (Uuq)	115 *** (Uup)	116 *** (Uuh)		
lanthanide series 6 actinide series 7			58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	1
			90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	1

*** Mumbering system widely used, especially in the 0.5., from the mid-20th century. *** Discoveries of elements 112–116 are claimed but not confirmed. Element names and symbols in parentheses are temporarily

assigned by IUPAC.

Long form of periodic table:

Groups: The 18 vertical columns are called groups. The elements belonging to a particular group

is known as a family and is usually named after the first number. Apart from this some of

the groups are given typical name as exemplified beneath.

- (i) Elements of group 1 are called ALKALI METALS.
- (ii) Elements of group 2 are called **ALKALINE EARTH METALS.**
- (iii) Elements of group 15 are called **PNICTOGENS.** Means choking to system due to toxicity.

Class-X

- (iv) Elements of group 16 are called CHALCOGENS.
- (v) Elements of group 17 are called **HALOGENS.**
- (vi) Elements of group 18 are called **NOBLE GASES OR AEROGENS.**

All the other groups are named after the first member of each group.

A few important characteristics of the elements present in groups are listed.

- (i) The elements present in a group are separated by definite gaps of atomic numbers (8, 8, 18, 18, 32). These are called magic numbers.
- (ii) There are eighteen (18) independent groups in the Long from of Periodic Table.These are numbered from 1 to 18.
- (iii) The elements present in a group have the same number of electrons in the valence shell of their atoms.
- (iv) The elements present in a group have the same valency.
- (v) The elements present in group have identical chemical properties.
- (vi) The physical properties of the elements in group such as melting point, boiling point, density vary gradually.
- (vii) Atomic radii of the elements present in a group increase downwards.

Periods: The horizontal rows are called periods. There are Seven Periods in the long form of the periodic Table.

Period	n	Subshell	No.of Element	Element	Name of Period
1	1	1s	2	1H – 2He	Shortest
2	2	2s, 2p	8	3Li-10Ne	Short
3	3	3s, 3p	8	11Na – 18Ar	Short
4	4	4s, 3d, 4p	18	19K – 36Kr	Long
5	5	5s, 4d, 5p	18	37Rb-58Xe	Long
6	6	6s, 4f, 5d, 6p,	32	55Cs-86Rn	Longest
7	7	7s, 5f, 6d	26	87Fr-112UUb	Incomplete

The important characteristics of the elements in a period are as follows:

- (i) In all the elements present in a period the electrons are filled in the valence shell.
- (ii) As the number of electrons in the valence shell change, the chemical properties of the elements present in a period also change.
- (iii) Atomic radii of the elements in a period decrease from left to the right.
- (iv) Along a period, the metallic character of the elements decreases and the non-metallic character increases.
- (v) Along a period, the reducing character of the elements decreases and their oxidizing character increases.

Both the lanthanide and actinide series of elements were placed under the rest of the periodic table. These elements technically should be placed between the alkaline earth metals and the transition metals, however, since this would make the periodic table too wide, they were placed below the rest of the elements.

ADVANTAGES OF LONG FORM OVER MENDELEEV'S PERIDIC TABLE:

There are several advantages of long form of periodic table over Mendeleev's periodic table. Some of these are as follows:

- (i) It is based upon atomic number which is a fundamental property instead of atomic mass.
- (ii) The elements have been grouped as s,p,d and f-block elements. which helps us to understand the electronic configuration in a better way.
- (iii) In the long form of periodic table, the elements are arranged in the increasing order of their atomic numbers, therefore, no separate place is required for isotopes.
- (iv) The position of some of the elements which were a misfit on the basis of atomic mass is now explained on the basis of increase in atomic number. For example, argon proceeds potassium because argon has atomic number 18 which is less than that of potassium which is 19.
- (v) Metals, non-metals, metalloids, transition elements, lanthanoids and actinoids are now better classified.