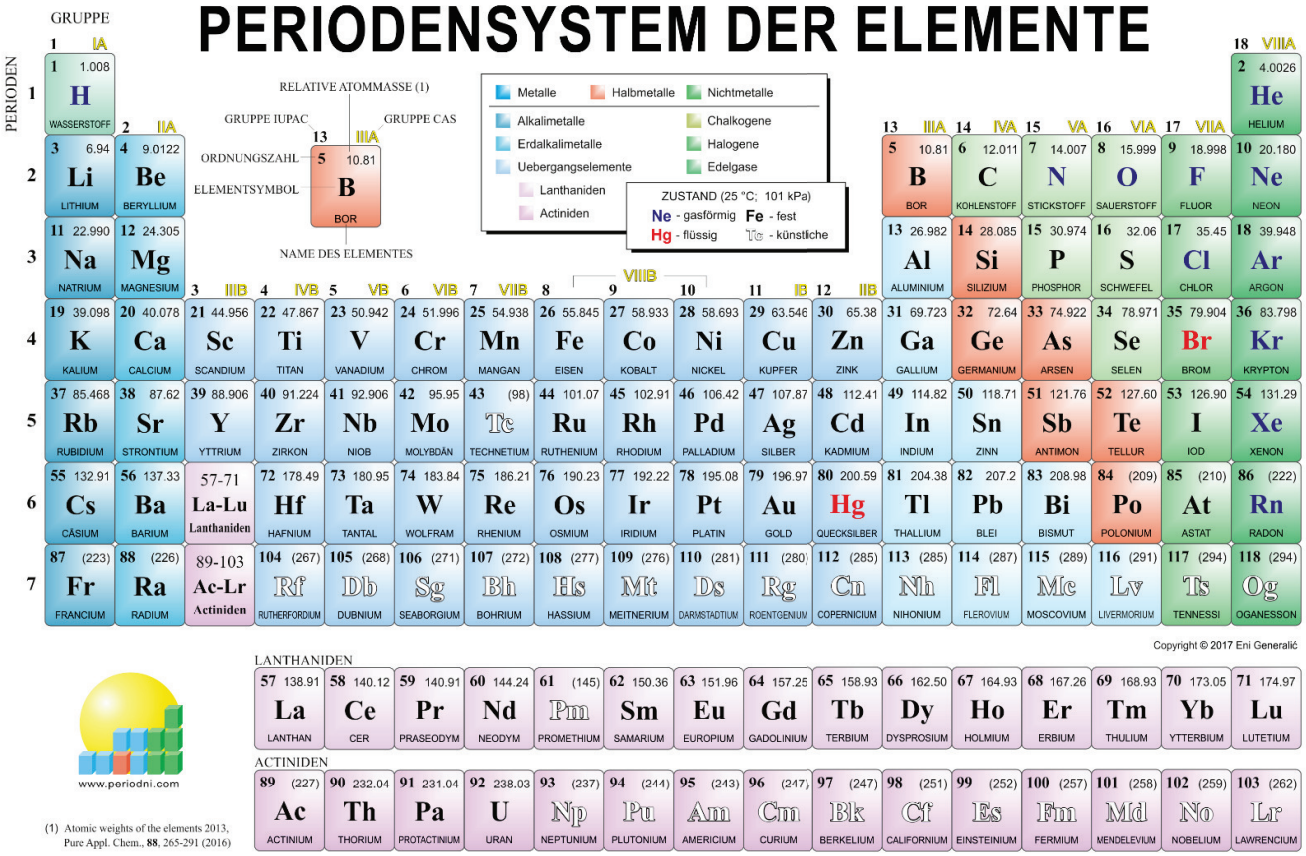
CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES



CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

Introduction:

Classification of elements was proposed in order to study all the elements in a systematic manner. In this Unit, we shall study the development of the Periodic Law and the Periodic Table. Mendeleev's Periodic Table was based on atomic masses. Modern Periodic Table arranges the elements in the order of their atomic numbers in seven horizontal rows (periods) and eighteen vertical columns (groups or families).

Why Do We Need Classification?

Elements are the basic units of all types of matter. At present, 118 elements are known. With such a large number of elements, it is very difficult to study individually the chemistry of all these elements and their number of compounds. So to make the study of chemistry simpler, scientists searched for a systematic way to organise their knowledge by classifying the elements. Main aim behind this classification was to keep the elements of same properties together, so that by studying one element out of that group, we can have general idea about the properties of all the elements in that group.

Periodic Table

Periodic table may be defined as the tabular arrangement of elements in such a way that the elements having same properties are kept together.

Dobereiner's Triads Law

1st attempt towards the classification of elements was made by Johann W. Dobereiner in 1817. He arranged elements in the groups of three and in such a way that the atomic weight of middle element was equal or nearly equal to the average of atomic weights of other two elements.

	ELEMENTS	SYMBOL	ATOMIC MASS
1	Lithium	Li	6.9
	Sodium	Na	23
	Potassium	K	39
2	Calcium	Ca	40.1
	Strontium	Sr	87.6
	Barium	Ba	137.3
3	Chlorine	Cl	35.5
	Bromine	Br	79.9
	Iodine	I	126.9

Drawback: Only limited triads were arranged in this pattern.

Newland's Law of Octaves

In 1865, John Newland observed that in a series of elements arranged in the increasing order of atomic weights, 1st and 8th elements have same properties. Now, a days, 1st and 9th elements have same properties in that series because noble gases were discovered late.

1	2	3	4	5	6	7	8
Li	Be	B	C	N	O	F	Ne Na
9	10	11	12	13	14	15	16
Mg	Al	Si	P	S	Cl	Ar K	Ca

Mendeleev's Periodic Table

"The physical and chemical properties of elements are a periodic function of atomic weights".

Mendeleev arranged elements in horizontal rows and vertical columns of a table in order of their increasing atomic weights in such a way that the elements with similar properties occupied the same vertical column or group. Vertical Colums are called groups which are numbered I to VIII group, each group is further subdivided into sub groups A and B. Horizontal rows are called **periods**.

The Periodic Table
Based on Mendeleev's Periodic Law

0	I	II	III	IV	V	VI	VII	VIII		
	H 1.01									
HE 4.00	Li 6.94	Be 9.01	B 10.8	★ C 12.0	N 14.0	O 16.0	F 19.0			
Ne 20.2	Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	★ S 32.1	Cl 35.5			
Ar 40.0	K 39.1	Ca 40.1	Sc 45.0	Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	★ Fe 55.9	Co 58.9	Ni 58.7
	★ Cu 63.5	Zn 65.4	Ga 69.7	Ge 72.6	As 74.9	Se 79.0	Br 79.9			
Kr 83.8	Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9	Tc (99)	Ru 101	Rh 103	Pd 106
	★ Ag 108	Cd 112	In 115	★ Sn 119	Sb 122	Te 128	I 127			
Xe 131	Ce 133	Ba 137	★ La 139	Hf 179	Ta 181	W 184	Re 180	Os 194	Ir 192	Pt 195
	★ Au 197	★ Hg 201	Ti 204	★ Pb 207	Bi 209	Po (210)	At (210)			
Rn (222)	Fr (223)	Ra (226)	★ Ac (227)	★ Th 232	★ Pa (231)	★ U 238				

★ Lanthanide Series
★ Actinide Series
★ Known to Ancients

Dobereiner's Triads
Known to Mendeleev

Defects in Mendeleev's Table-

i. **Position of hydrogen**: Position of hydrogen was not justified.

ii. **Position of isotope**: Isotopes should be placed separately according to periodic law. But actually one place was given to all isotopes of an element.

iii. **Cause of periodicity**: Mendeleev could not explain why elements exhibit a periodicity in their properties when arranged in the order of increasing atomic weight.

iv. **Anomalous pairs of elements**: Some anomalous pairs were present in table. As Tellurium (128 u) comes in VI group before Iodine (127 u).

Moseley's Modern Periodic Table

"The physical and chemical properties are the periodic function of their atomic numbers".

The long form of periodic table, also called Modem Periodic Table, is based on Modern periodic law. In this table, the elements have been arranged in order of increasing atomic numbers.

A modern version, the so-called "**long form**" of the **Periodic Table** of the elements, is the most convenient and widely used. The horizontal rows are called periods and the vertical columns, groups. Elements having similar outer electronic configurations in their atoms are arranged in vertical columns, referred to as groups or families. According to the recommendation of International Union of Pure and Applied Chemistry (IUPAC), the groups are numbered from 1 to 18 replacing the older notation of groups IA … VIIA, VIII, IB … VIIB and 0.

There are altogether seven periods. The period number corresponds to the highest principal quantum number (n) of the elements in the period. The first period contains 2 elements. The subsequent periods consists of 8, 8, 18, 18 and 32 elements, respectively. The seventh period is incomplete and like the sixth period would have a theoretical maximum of 32 elements. In this form of the Periodic Table, 14 elements of both sixth and seventh periods (lanthanoids and actinoids, respectively) are placed in separate panels at the bottom.

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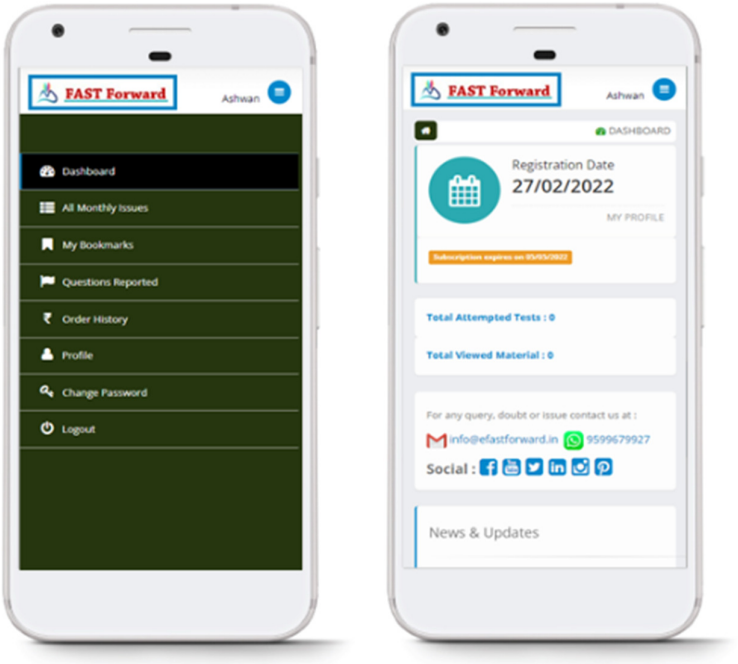

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