



SSC GK

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Chemistry

Periodic Table

Lecture :- 4

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PERIODIC TABLE

Periodic Table of the Elements

Atomic Number Boiling Point
 Symbol Name Atomic Mass

Normal boiling points are in °C.
 0°C = Triple Point
 Pressure is fixed at 101.3 kPa.
 Elements in bold are more than one allotrope.

1 1A 1A	2 2A 2A											13 3A 3A	14 4A 4A	15 5A 5A	16 6A 6A	17 7A 7A	18 8A 8A		
H Hydrogen 1.008	He Helium 4.003											B Boron 10.81	C Carbon 12.011	N Nitrogen 14.007	O Oxygen 15.999	F Fluorine 18.998	Ne Neon 20.180		
3 1A 1A	4 2A 2A	5 3A 3A	6 4A 4A	7 5A 5A	8 6A 6A	9 7A 7A	10 8A 8A	11 1B 1B	12 2B 2B	13 3B 3B	14 4B 4B	15 5B 5B	16 6B 6B	17 7B 7B	18 8B 8B	19 1A 1A	20 2A 2A		
Li Lithium 6.941	Be Beryllium 9.012	B Boron 10.81	C Carbon 12.011	N Nitrogen 14.007	O Oxygen 15.999	F Fluorine 18.998	Ne Neon 20.180	Na Sodium 22.990	Mg Magnesium 24.305	Al Aluminum 26.982	Si Silicon 28.086	P Phosphorus 30.974	S Sulfur 32.06	Cl Chlorine 35.45	Ar Argon 39.948	K Potassium 39.098	Ca Calcium 40.078		
21 3A 3A	22 4A 4A	23 5A 5A	24 6A 6A	25 7A 7A	26 8A 8A	27 9A 9A	28 10A 10A	29 11A 11A	30 12A 12A	31 13A 13A	32 14A 14A	33 15A 15A	34 16A 16A	35 17A 17A	36 18A 18A	37 1A 1A	38 2A 2A		
Na Sodium 22.990	Mg Magnesium 24.305	Al Aluminum 26.982	Si Silicon 28.086	P Phosphorus 30.974	S Sulfur 32.06	Cl Chlorine 35.45	Ar Argon 39.948	K Potassium 39.098	Ca Calcium 40.078	Sc Scandium 44.956	Ti Titanium 47.88	V Vanadium 50.942	Cr Chromium 51.996	Mn Manganese 54.938	Fe Iron 55.845	Co Cobalt 58.933	Ni Nickel 58.69	Cu Copper 63.546	Zn Zinc 65.38
39 1A 1A	40 2A 2A	41 3B 3B	42 4B 4B	43 5B 5B	44 6B 6B	45 7B 7B	46 8B 8B	47 9B 9B	48 10B 10B	49 11B 11B	50 12B 12B	51 13B 13B	52 14B 14B	53 15B 15B	54 16B 16B	55 1A 1A	56 2A 2A		
Rb Rubidium 85.468	Sr Strontium 87.62	Y Yttrium 88.906	Zr Zirconium 91.224	Nb Niobium 92.906	Mo Molybdenum 95.94	Tc Technetium 98	Ru Ruthenium 101.07	Rh Rhodium 102.91	Pd Palladium 106.37	Ag Silver 107.87	Cd Cadmium 112.41	In Indium 114.82	Sn Tin 118.71	Sb Antimony 121.76	Te Tellurium 127.6	I Iodine 126.91	Xe Xenon 131.29		
57 1A 1A	58 2A 2A	59 3B 3B	60 4B 4B	61 5B 5B	62 6B 6B	63 7B 7B	64 8B 8B	65 9B 9B	66 10B 10B	67 11B 11B	68 12B 12B	69 13B 13B	70 14B 14B	71 15B 15B	72 16B 16B	73 1A 1A	74 2A 2A		
Cs Cesium 132.91	Ba Barium 137.33	Hf Hafnium 178.49	Ta Tantalum 180.95	W Tungsten 183.85	Re Rhenium 186.21	Os Osmium 190.23	Ir Iridium 192.22	Pt Platinum 195.08	Au Gold 196.97	Hg Mercury 200.59	Tl Thallium 204.38	Pb Lead 207.2	Bi Bismuth 208.98	Po Polonium 209	At Astatine 210	Rn Radon 222			
87 1A 1A	88 2A 2A	89-103 Lanthanide Series	104 4B 4B	105 5B 5B	106 6B 6B	107 7B 7B	108 8B 8B	109 9B 9B	110 10B 10B	111 11B 11B	112 12B 12B	113 13B 13B	114 14B 14B	115 15B 15B	116 16B 16B	117 17B 17B	118 18B 18B		
Fr Francium 223	Ra Radium 226	Lanthanide Series																	
Actinide Series																			
89-103 Lanthanide Series: La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu 89-103 Actinide Series: Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, Lr Legend: Alkali Metal, Alkaline Earth, Transition Metal, Basic Metal, Semimetal, Nonmetal, Halogen, Noble Gas, Lanthanide, Actinide																			

Early Attempts

Dobberneir's Law of Triads

- Gave Triads Theory in 1817
- Increasing atomic mass \rightarrow Middle atomic mass will be average of 1st and 3rd element

Set I		Set II		Set-III	
Element	Atomic mass	Element	Atomic mass	Element	Atomic mass
Calcium	40	Lithium	7	Chlorine	35.5
Strontium	87.5	Sodium	23	Bromine	80
Barium	137	Potassium	39	Iodine	127
Average of the atomic masses of calcium and barium $= \frac{40+137}{2} = 88.5$		Average of the atomic masses of lithium and potassium $= \frac{7+39}{2} = 23$		Average of the atomic masses of chlorine and iodine $= \frac{35.5+127}{2} = 81.2$	
Atomic mass of strontium = 87.5		Atomic mass of sodium = 23		Atomic mass of bromine = 80	

Newland Law of Octaves

- In 1865
 - The law states that: when elements are arranged in increasing order of their atomic mass, the properties of every eighth element resemble the property of the starting element.
- Newlands arranged the elements in horizontal rows, with each row having seven elements

\rightarrow Based on Musical notes

sa (do)	1	re (re)	2	ga (mi)	3	ma (fa)	4	pa (so)	5	da (la)	6	ni (ti)	7
H		Li		Be		B		C		N		O	
F		Na		Mg		Al		Si		P		S	
Cl		K		Ca		Cr		Ti		Mn		Fe	
Co and Ni		Cu		Zn		Y		In		As		Se	
Br		Rb		Sr		Ce and La		Zr		—		—	

Newlands published his concept on 1864, however recognised in 1865. The law was only true for elements upto Calcium. It failed for the following reasons:

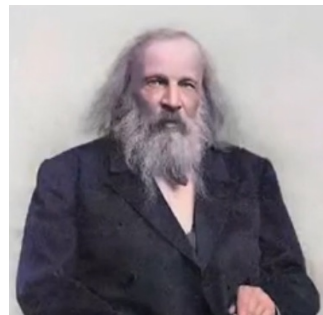
1. The law was only applicable up to Calcium
2. With the discovery of rare gases, it was the ninth element and not the eighth having similar chemical properties

Mendeleev's Periodic Table

- The periodic table was created in 1869 by Dimitri Mendeleev, a Russian chemist and inventor
- He arranged the 63 known elements at the time in order of their increasing relative atomic masses
- He divided the table into eight groups and seven periods
- The law states that the properties of elements are a periodic function of their relative atomic masses

The Full List of Mendeleev's Predictions with their Sanskrit Names

Mendeleev's Given Name	Modern Name
Eka-aluminium → 68	Gallium 69.7
Eka-boron → 44	Scandium
Eka-silicon → 72	Germanium
Eka-manganese	Technetium
Tri-manganese	Rhenium
Dvi-tellurium	Polonium
Dvi-caesium	Francium
Eka-tantalum	Protactinium



Eka Boron → 44 (Scandium)

Eka Silicon → 72 (Germanium)

Eka Aluminium → 68

Mendeleev's Periodic Table (1969)

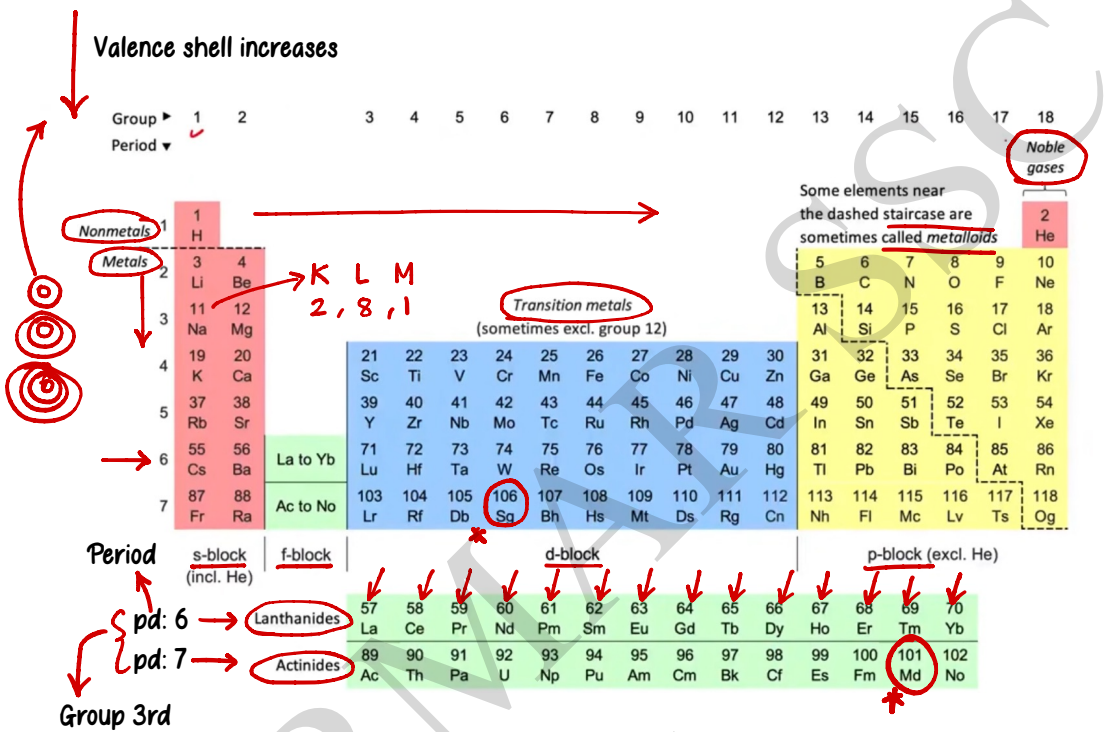
H 1.01							
Li 6.94	Be 9.01	B 10.8	C 12.0	N 14.0	O 16.0	F 19.0	
Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5	
K 39.1	Ca 40.1	Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.9	Ni 58.7
Cu 63.5	Zn 65.4		As 74.9	Se 79.0	Br 79.9		
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9	I 127	Ru 101
Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128		Rh 103
Ce 133	Ba 137	La 139	Pb 207	Ta 181	W 184	Os 194	Lr 192
Au 197	Hg 201	Tl 204	Th 232	Bi 209	U 238		Pt 195

Defects in Mendeleev's Periodic Table

1. The position of hydrogen not fixed
2. The increasing order of atomic weight is not maintained
3. Some elements in the same group differ in their properties
4. Lanthanides and actinides were not included in the table

Modern Periodic Table

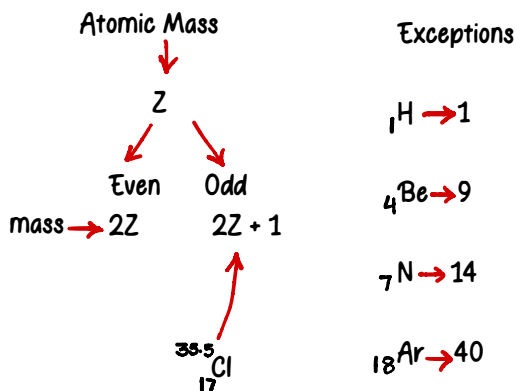
- It is given by Henry Moseley in 1913
 - He said: Chemical properties of elements are a periodic function of their **atomic number**
- The modern periodic table contains: 18 Groups and 7 Periods



Group 3rd

Hydrogen
↓
H — Group 1A

- 1st group: Alkali Metals
 - 2nd group: Alkaline Earth Metals
 - Group 15: Pnictogens
 - Group 16: Chalcogens
 - Group 17: Halogens
- Elements in these groups are known as
- Lanthanides and Actinides are collectively called as **Inner Transition Metals**



Diagonal Relationships

- This relationship is prominent among the lighter members of the second and third periods
- A diagonal relationship in the periodic table is when two elements that are diagonally adjacent in the second and third periods have similar properties

Some examples of diagonal relationships include:

- Boron and silicon are both semiconductors
- Li and Mg
- Be and Al
- Carbon and phosphorous

- Mendeleevium: 101
- Sea Borgiaium: 106

1 pd - 2
 2pd - 8
 3 pd - 8
 4 th - 18
 5th - 18
 6th - 32

Trends in Periodic Table

- Atomic Size: increases down the group
- Electronegativity: decreases down the group
- Metallic Character: increases down the group

- Horizontal rows: Periods

- Vertical columns: Groups

- Position of non-metals in periodic table: on the right side

- Nuclear charge experienced by valence electrons decreases down the group: the outermost electrons are farther away from the nucleus

- Group 3-12 are called Transition elements: d-block

- Mass no. of the titanium: 47.78

- Mass no. of potassium: 39 → $Z = 19 \times 2 + 1$

- Atomic no. of lead: 82

- Atomic no. of Francium: 87

- Atomic no. of Gallium: 31

- Gallium and Caesium melting point is low



- Atomic no. of Carbon: 6

- element of Group 13

- Low melting point: 303 K

- Atomic no of Hydrogen: 1

- Widely used in doping semiconductors and producing solid-state devices such as transistors

- Atomic no of Chromium: 24

- Liquifies just above room temperature

- Atomic no of Sulphur: 16

- Sodium is located on: left side of periodic table



very reactive metal hence kept in Kerosene oil



- Atomic mass of Oxygen: 16
- Valency of Boron: 3
- Leftmost group of periodic table: Alkali metals
- Cobalt belongs to group 9
- Group that consists of elements that are non-reactive, monoatomic, and low boiling points
- Electrons that are there in the outermost shell of a group 16 element: 6

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