

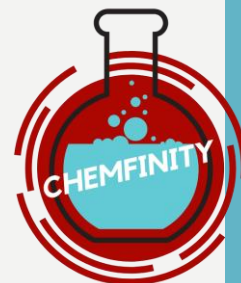
# PERIODIC CLASSIFICATION OF ELEMENTS

CLASS 10<sup>TH</sup> CHEMISTRY



# GLOSSARY

- Dobereiner's Triads
- Newlands' Law of Octaves
- Mendeleev's Periodic Law
- Moseley's Periodic Law
- Bohr's Periodic Table
- Trends in Periodic Table
- Metals, Metalloids and Non-Metals



# DOBEREINER'S TRIADS

- Dobereiner observed that certain elements had similar properties and could be put into groups.
- “When elements are arranged in order of increasing atomic masses in groups of 3, called triads, groups of elements having similar chemical properties are obtained.
- “The atomic mass of middle/central element in these triads is roughly equal the average of the other two elements.
- 3 such triads were formed.

Lithium (7)	Calcium (40)	Chlorine (35.3)
Sodium (23)	Barium (88)	Bromine (80)
Potassium (39)	Strontium (137)	Iodine (127)



### Alkali Metal Group (Dobereiner's Triad)

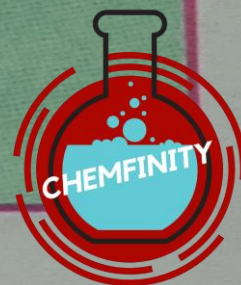
<i>Elements of the triad</i>	<i>Symbols</i>	<i>Atomic masses</i>
1. Lithium	Li	7
2. Sodium	Na	23
3. Potassium	K	39

### Alkaline Earth Metal Group (Dobereiner's Triad)

<i>Elements of the triad</i>	<i>Symbols</i>	<i>Atomic masses</i>
1. Calcium	Ca	40
2. Strontium	Sr	88
3. Barium	Ba	137

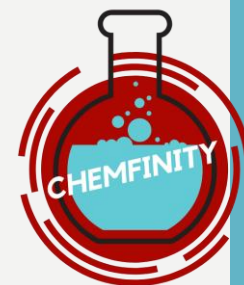
### Halogen Group (Dobereiner's Triad)

<i>Elements of the triad</i>	<i>Symbols</i>	<i>Atomic masses</i>
1. Chlorine	Cl	35.5
2. Bromine	Br	80
3. Iodine	I	127



# LIMITATION OF DT

- Failed to arrange all the then known elements in the form of triads of elements.
- Only three triads were identified.
- Not much successful.





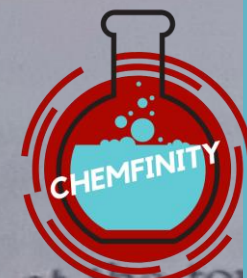
# NEWLANDS' OCTAVES

- When Newland arranged then known elements in the order of increasing atomic masses, he found that properties of every 8th element were similar to the corresponding first. From there he concluded his law of octaves.
- “When elements are arranged in the order of increasing atomic masses the properties of every eight element are a repetition of that of the first.

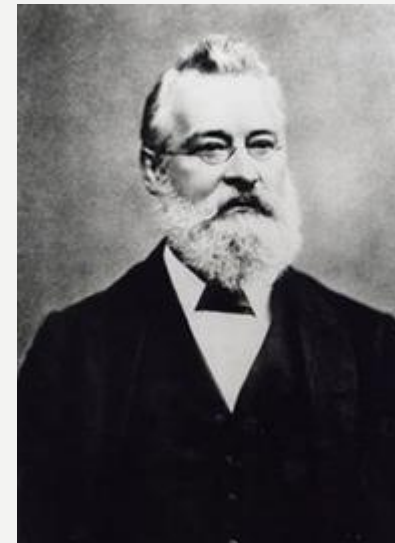
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co, Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce, La	Zr		



	GROUP I	GROUP II	GROUP III	GROUP IV	GROUP V	GROUP VI	GROUP VII	GROUP VIII
Oxides →	$R_2O$	$RO$	$R_2O_3$	$RO_2$	$R_2O_5$	$RO_3$	$R_2O_7$	$RO_4$
Hydrides →	$RH$	$RH_2$	$RH_3$	$RH_4$	$RH_3$	$RH_2$	$RH$	—
PERIODS ↓ 1	H 1.0							
2	Li 7.0	Be 9.1	B 11.0	C 12.0	N 14.0	O 16.0	F 19.0	
3	Na 23.0	Mg 24.3	Al 27.0	Si 28.4	P 31.0	S 32.0	Cl 35.5	
1st series : 4	K 39.1	Ca 40.1	... 44	Ti 48.1	V 51.4	Cr 52.1	Mn 55.0	Fe 55.8 Co 58.9 Ni 58.7
2nd series : 5	Cu 63.5	Zn 65.4	... 68	... 72	As 75	Se 79	Br 79.9	
1st series : 6	Rb 85.4	Sr 87.6	Y 89.0	Zr 90.6	Nb 94.0	Mo 96.0	Tc 99	Ru 101.0 Rh 102.9 Pd 106.4
2nd series : 7	Ag 107.9	Cd 112.4	In 114.0	Sn 119.0	Sb 120.0	Te 127.6	I 126.9	
1st series : 8	Cs 132.9	Ba 137.3						
2nd series : 9	Au 197.2	Hg 200.0						



# LIMITATIONS OF NLO



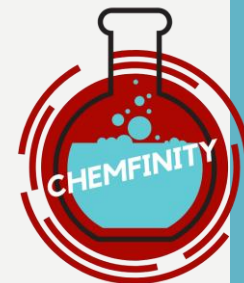
- Could classify elements until Calcium only.
- More and more elements were discovered but could not be fitted into octave structure.
- Assumed that only 56 elements existed in nature and no more would be discovered.
- In order to fit elements into octave structure, some elements, even having stark difference in properties were put into the same slot.
- Fe which resembled Co, Ni was placed in a column far far away...





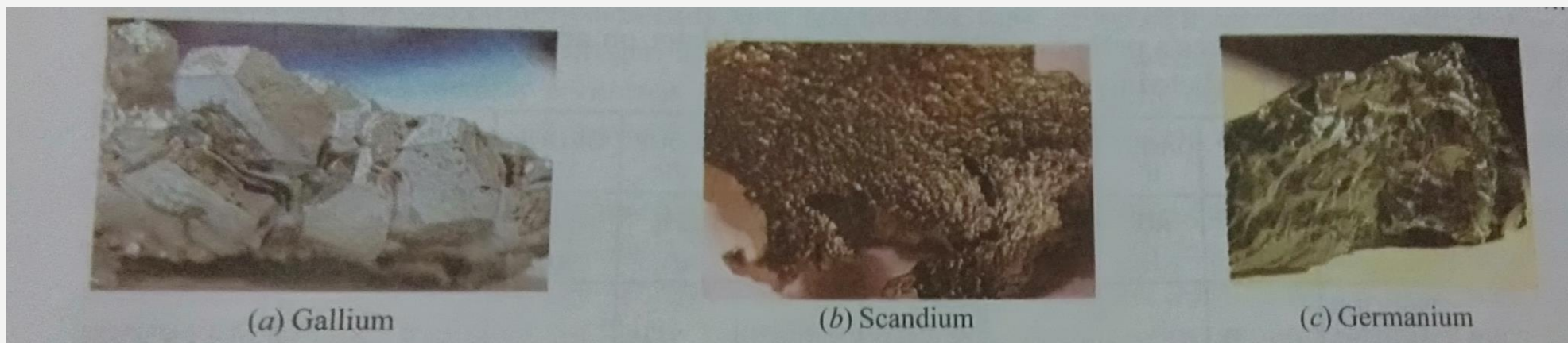
# MENDELEEV'S CLASSIFICATION

- Dmitri Ivanovich Mendeleev
- When he started his work only 63 elements were known.
- When he arranged elements in order of increasing atomic masses, he discovered that the properties of elements repeated after certain intervals.
- “The properties of elements are a function of atomic masses.
- Called vertical columns “groups” and horizontal rows “periods”.
- 6 periods and 8 groups.



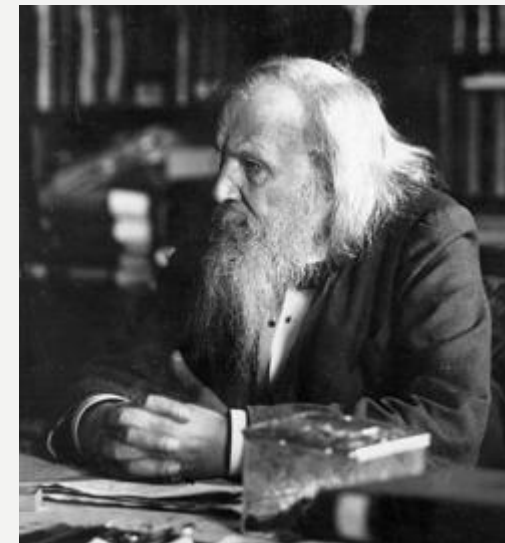
# ADVANTAGES

- Some gaps were left deliberately by him in his periodic table. This was done to accommodate the elements that were not discovered at that time. So he predicted the existence of new elements that were yet to be discovered.
- Separated a group for noble gases; not discovered till that time.
- Scandium → Eka-Boron; Gallium → Eka-Aluminium; Germanium → Eka-Silicon



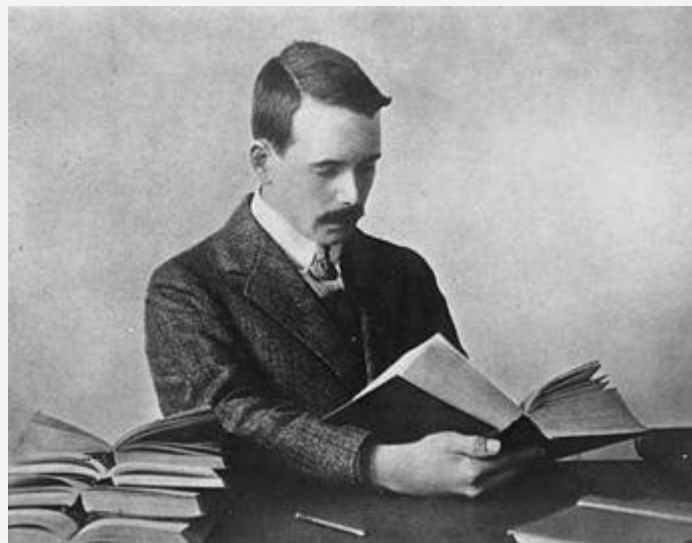
# LIMITATIONS OF MPL

- Could not assign a unique position to Hydrogen.
- The position of ISOTOPEs could not be explained.
- Some elements were wrongly arranged to accommodate for the periodic nature of properties of elements. E.g. **Co and Ni** / **V and Cr**.



# HENRY MOSELEY

- In 1913, he showed that:
- “ Properties of elements are a periodic function of their atomic numbers. → The Modern Periodic Law.
- But the modern form of periodic table was designed by Niels Bohr.



# PERIODIC TABLE

- Arrangement of elements in a manner such that elements having similar properties are repeated in a repeated fashion.
- Horizontal rows → Periods
- Vertical columns → Groups
- Modern Periodic Table: 118 elements: 18 groups, 7 periods.





# Periodic Table of the Elements

Periodic Table of the Elements																18	
1 1IA 1A															VIIIA 8A		
1 H Hydrogen 1.008	2 IIA 2A											13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.99	12 Mg Magnesium 24.305	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 ↓ VIII 8	9 ↓ VIII 8	10 ↓ VIII 8	11 IB 1B	12 IIB 2B	13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 83.789
37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.95	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.414	49 In Indium 114.818	50 Sn Tin 118.711	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.294
55 Cs Cesium 132.905	56 Ba Barium 137.328	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.085	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [208.982]	85 At Astatine 209.987	86 Rn Radon 222.018
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [278]	110 Ds Darmstadtium [281]	111 Rg Roentgenium [280]	112 Cn Copernicium [285]	113 Nh Nihonium [286]	114 Fl Flerovium [289]	115 Mc Moscovium [286]	116 Lv Livermorium [293]	117 Ts Tennessine [294]	118 Og Oganesson [294]

Lanthanide Series

57 <b>La</b> Lanthanum 138.905	58 <b>Ce</b> Cerium 140.116	59 <b>Pr</b> Praseodymium 140.908	60 <b>Nd</b> Neodymium 144.243	61 <b>Pm</b> Promethium 144.913	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.925	66 <b>Dy</b> Dysprosium 162.500	67 <b>Ho</b> Holmium 164.930	68 <b>Er</b> Erbium 167.259	69 <b>Tm</b> Thulium 168.934	70 <b>Yb</b> Ytterbium 173.055	71 <b>Lu</b> Lutetium 174.967
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Actinide Series

89 <b>Ac</b> Actinium 227.028	90 <b>Th</b> Thorium 232.038	91 <b>Pa</b> Protactinium 231.036	92 <b>U</b> Uranium 238.029	93 <b>Np</b> Neptunium 237.048	94 <b>Pu</b> Plutonium 244.064	95 <b>Am</b> Americium 243.061	96 <b>Cm</b> Curium 247.070	97 <b>Bk</b> Berkelium 247.070	98 <b>Cf</b> Californium 251.080	99 <b>Es</b> Einsteinium [254]	100 <b>Fm</b> Fermium 257.095	101 <b>Md</b> Mendelevium 258.1	102 <b>No</b> Nobelium 259.101	103 <b>Lr</b> Lawrencium [262]
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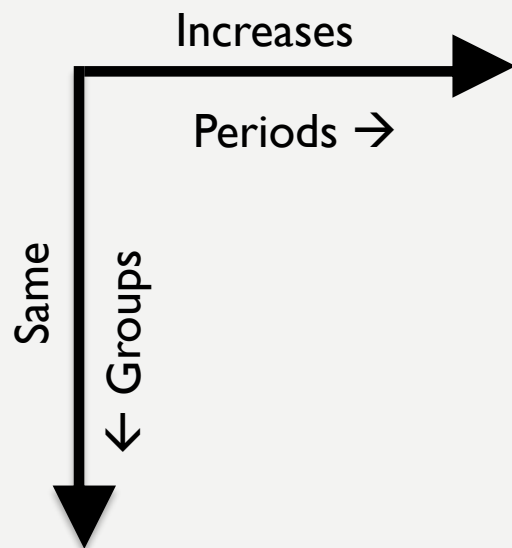
Alkali Metal	Alkaline Earth	Transition Metal	Basic Metal	Semimetal	Nonmetal	Halogen	Noble Gas	Lanthanide	Actinide
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Source: IUPAC, Periodic Table of the Elements

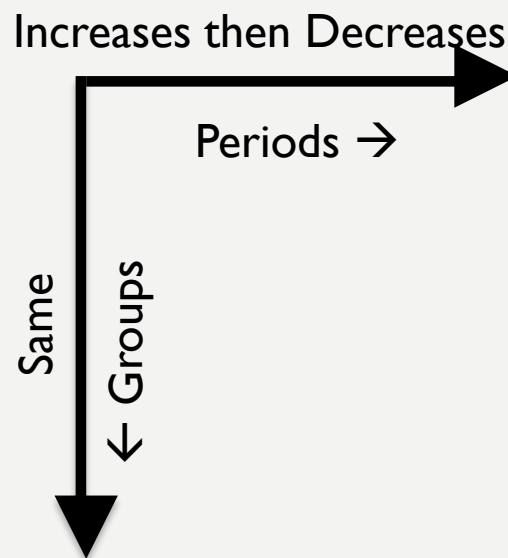


# TRENDS IN MODERN PERIODIC TABLE

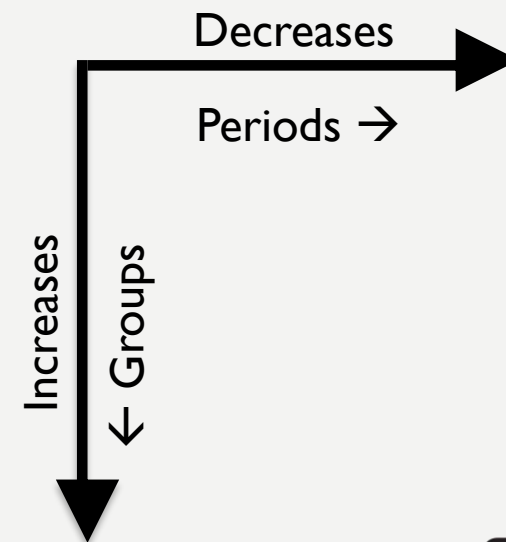
## Valence Electrons



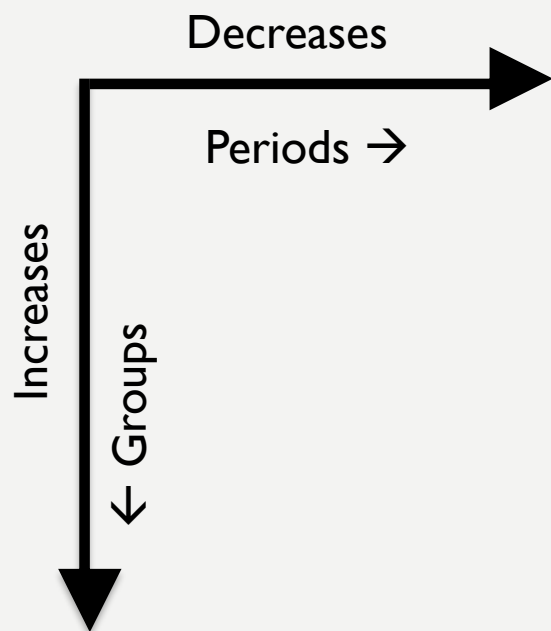
## Valency



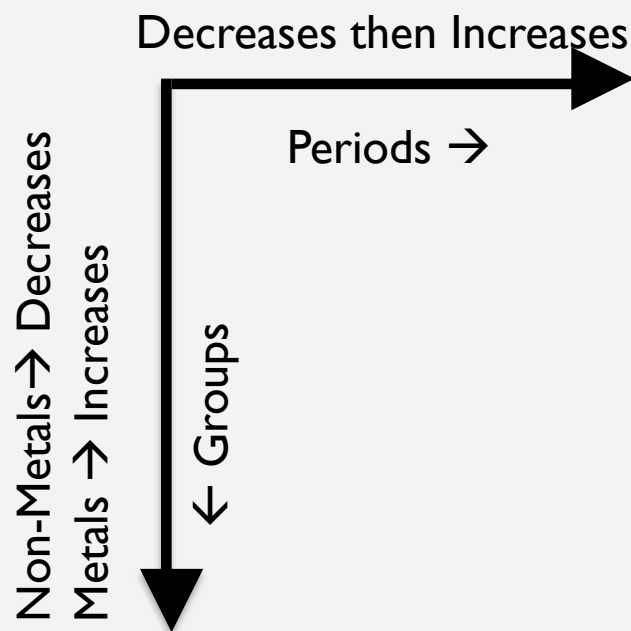
## Atomic Size



## Metallic Character

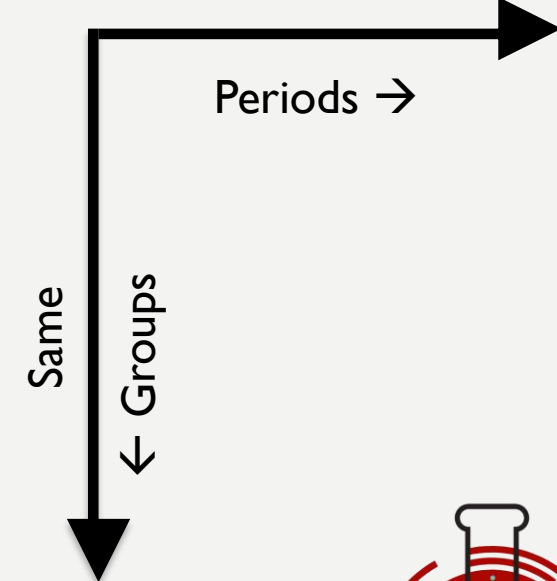


## Chemical Reactivity



## Nature of Oxides

Basic Nature → Decreases  
Acidic Nature → Increases



# METALS, NON-METALS, METALLOIDS

