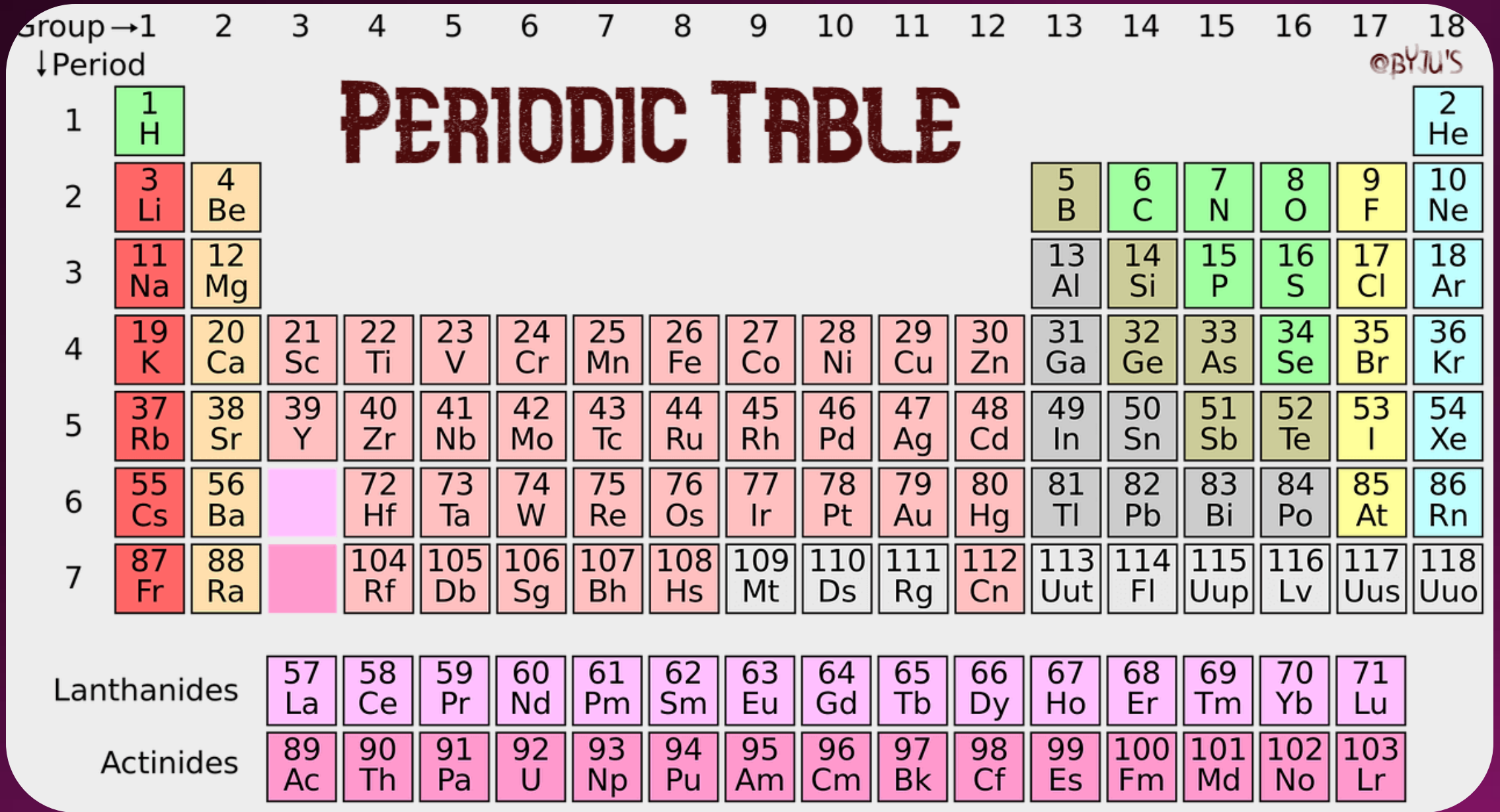

SAFALTA CLASS™
An Initiative by अमर उजाला

Periodic Classification of Elements


Group →1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
↓Period
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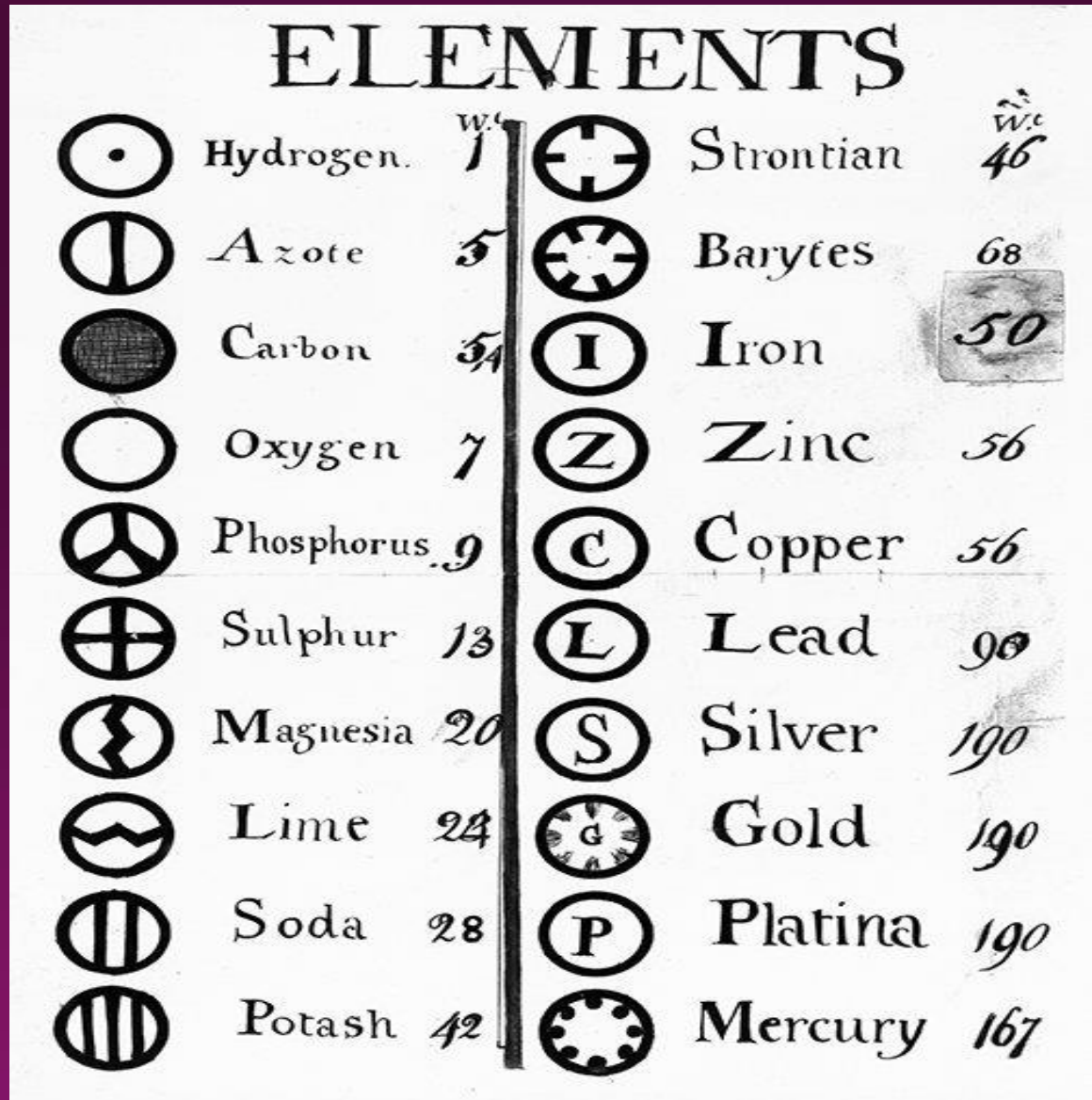
PERIODIC TABLE
1 1 H 2 He
2 3 Li 4 Be 5 B 6 C 7 N 8 O 9 F 10 Ne
3 11 Na 12 Mg 13 Al 14 Si 15 P 16 S 17 Cl 18 Ar
4 19 K 20 Ca 21 Sc 22 Ti 23 V 24 Cr 25 Mn 26 Fe 27 Co 28 Ni 29 Cu 30 Zn 31 Ga 32 Ge 33 As 34 Se 35 Br 36 Kr
5 37 Rb 38 Sr 39 Y 40 Zr 41 Nb 42 Mo 43 Tc 44 Ru 45 Rh 46 Pd 47 Ag 48 Cd 49 In 50 Sn 51 Sb 52 Te 53 I 54 Xe
6 55 Cs 56 Ba 72 Hf 73 Ta 74 W 75 Re 76 Os 77 Ir 78 Pt 79 Au 80 Hg 81 Tl 82 Pb 83 Bi 84 Po 85 At 86 Rn
7 87 Fr 88 Ra 104 Rf 105 Db 106 Sg 107 Bh 108 Hs 109 Mt 110 Ds 111 Rg 112 Cn 113 Uut 114 Fl 115 Uup 116 Lv 117 Uus 118 Uuo
Lanthanides 57 La 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
Actinides 89 Ac 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

Periodic Classification of Elements

- "The periodic table is a tabular method of displaying the elements in such a way, that the elements having similar properties occur in the same vertical column or group".

John Dalton's Periodic Tables



Dobereiner's Triads:

- This classification is based on the atomic mass.
- According to this, when elements are arranged in order of increasing atomic masses, groups of three elements, having similar properties are obtained.
- The atomic mass of middle element of the triad being nearly equal to the average of the atomic masses of the other two elements.
- For Example Li (6.9), Na (23), K (39).
- Limitation: It fails to arrange all the known elements in the form of triads, even having similar properties.

Dobereiner's Triads

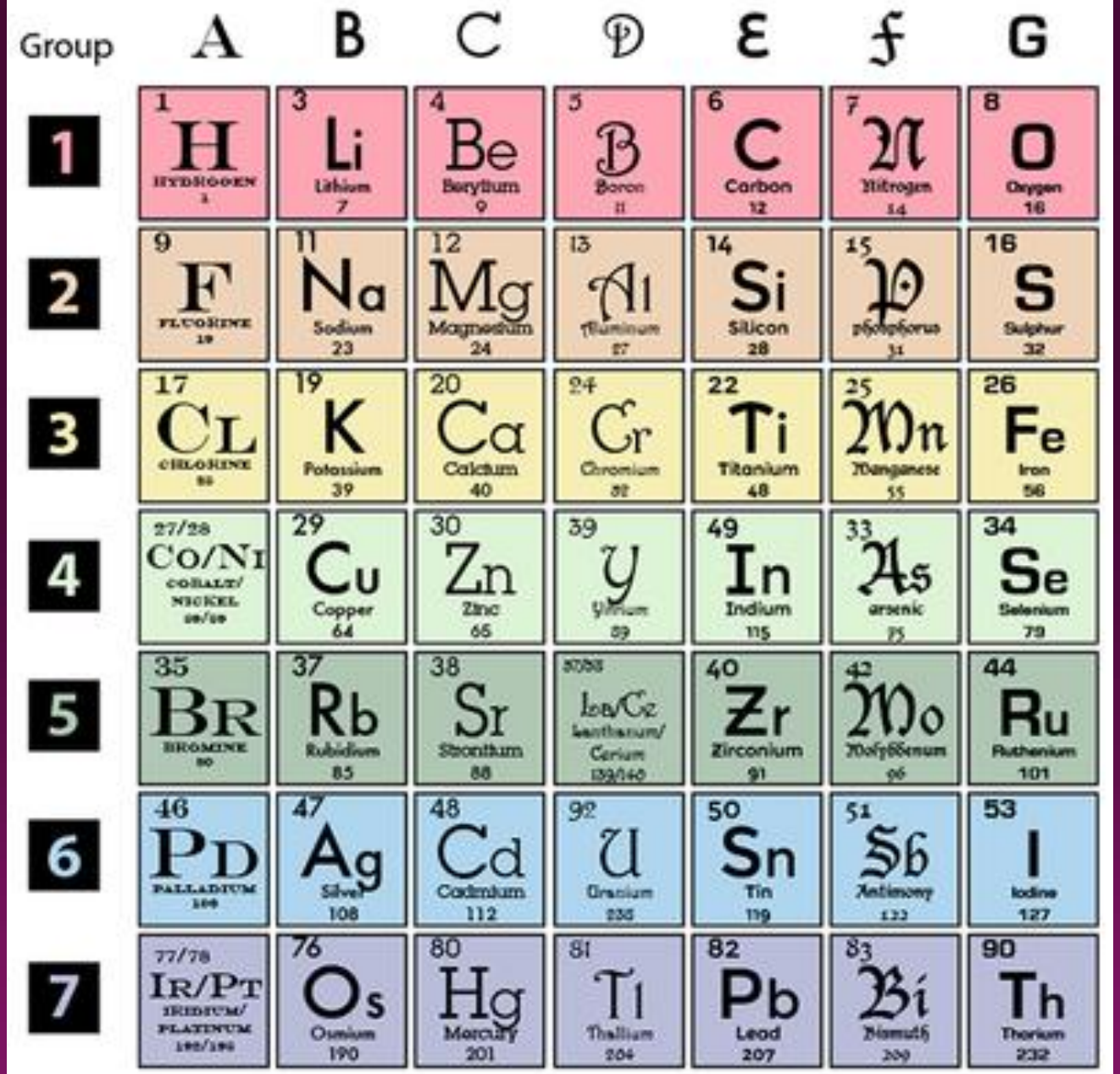
Element	Atomic Mass	Average	Density	Average
Cl	35.5		1.56	
Br	79.9	81.2	3.12	3.25
I	126.9		4.95	
Ca	40.1		1.55	
Sr	87.6	88.7	2.6	2.53
Ba	137.3		3.5	

Note: In each case, the numerical values for the atomic mass and density of the middle element are close to the averages of the other two elements

Newland's Law of Octaves:

- According to this 'when elements are placed in order of increasing atomic masses, the physical and chemical properties of every 8th element are a repetition of the properties of the first element.'

John Newlands and his Interval of Eight



Limitations

- Law of octaves was applicable only upto calcium (only for lighter elements).
- Newland adjusted two elements in the same slot (e.g. Co and Ni), having different properties. For example; Co and Ni with Fluorine, Chlorine, Bromine and Iodine.
- According to Newland, only 56 elements existed in nature and no more elements would be discovered in future.

- **Mendeleev's Periodic Table:** Mendeleev's periodic table is based on the physical and chemical properties of elements and their atomic masses.

- **Mendeleev's Periodic Law:** According to this "The physical and chemical properties of the elements are the periodic function of their atomic masses."

- **Periodicity of Properties:** The repetition of properties of elements after certain regular intervals is known as Periodicity of Properties.

Periodic Table of Elements

1 **H** Hydrogen 1,01 $1s^1$																	2 **He** Helium 4,01 $1s^2$
3 **Li** Lithium 6,97 $[He]\ 2s^1$	4 **Be** Beryllium 9,01 $[He]\ 2s^2$											5 **B** Boron 10,81 $[He]\ 2s^2\ 2p^1$	6 **C** Carbon 12,01 $[He]\ 2s^2\ 2p^2$	7 **N** Nitrogen 14,01 $[He]\ 2s^2\ 2p^3$	8 **O** Oxygen 15,99 $[He]\ 2s^2\ 2p^4$	9 **F** Fluorine 18,99 $[He]\ 2s^2\ 2p^5$	10 **Ne** Neon 20,18 $[He]\ 2s^2\ 2p^6$
11 **Na** Sodium 22,99 $[Ne]\ 3s^1$	12 **Mg** Magnesium 24,3 $[Ne]\ 3s^2$											13 **Al** Aluminum 26,98 $[Ne]\ 3s^2\ 3p^1$	14 **Si** Silicon 28,08 $[Ne]\ 3s^2\ 3p^2$	15 **P** Phosphorus 30,97 $[Ne]\ 3s^2\ 3p^3$	16 **S** Sulfur 32,07 $[Ne]\ 3s^2\ 3p^4$	17 **Cl** Chlorine 35,45 $[Ne]\ 3s^2\ 3p^5$	18 **Ar** Argon 39,95 $[Ne]\ 3s^2\ 3p^6$
19 **K** Potassium 39,1 $[Ar]\ 4s^1$	20 **Ca** Calcium 40,08 $[Ar]\ 4s^2$	21 **Sc** Scandium 44,96 $[Ar]\ 4s^2\ 3d^1$	22 **Ti** Titanium 47,87 $[Ar]\ 4s^2\ 3d^2$	23 **V** Vanadium 50,94 $[Ar]\ 4s^2\ 3d^3$	24 **Cr** Chromium 51,99 $[Ar]\ 4s^1\ 3d^5$	25 **Mn** Manganese 54,94 $[Ar]\ 4s^2\ 3d^5$	26 **Fe** Iron 55,845 $[Ar]\ 4s^2\ 3d^6$	27 **Co** Cobalt 58,93 $[Ar]\ 4s^2\ 3d^7$	28 **Ni** Nickel 58,69 $[Ar]\ 4s^2\ 3d^8$	29 **Cu** Copper 63,55 $[Ar]\ 4s^1\ 3d^{10}$	30 **Zn** Zinc 65,38 $[Ar]\ 4s^2\ 3d^{10}$	31 **Ga** Gallium 69,72 $[Ar]\ 4s^2\ 3d^{10}\ 4p^1$	32 **Ge** Germanium 72,63 $[Ar]\ 4s^2\ 3d^{10}\ 4p^2$	33 **As** Arsenic 74,92 $[Ar]\ 4s^2\ 3d^{10}\ 4p^3$	34 **Se** Selenium 78,98 $[Ar]\ 4s^2\ 3d^{10}\ 4p^4$	35 **Br** Bromine 79,9 $[Ar]\ 4s^2\ 3d^{10}\ 4p^5$	36 **Kr** Krypton 83,8 $[Ar]\ 4s^2\ 3d^{10}\ 4p^6$
37 **Rb** Rubidium 85,47 $[Kr]\ 5s^2$	38 **Sr** Strontium 87,62 $[Kr]\ 5s^2$	39 **Y** Yttrium 88,91 $[Kr]\ 5s^2\ 4d^1$	40 **Zr** Zirconium 91,22 $[Kr]\ 5s^2\ 4d^2$	41 **Nb** Niobium 92,91 $[Kr]\ 5s^1\ 4d^4$	42 **Mo** Molybdenum 95,95 $[Kr]\ 5s^1\ 4d^5$	43 **Tc** Technetium 98 $[Kr]\ 5s^2\ 4d^5$	44 **Ru** Ruthenium 101,07 $[Kr]\ 5s^1\ 4d^7$	45 **Rh** Rhodium 102,91 $[Kr]\ 5s^1\ 4d^8$	46 **Pd** Palladium 106,42 $[Kr]\ (5s^0)\ 4d^{10}$	47 **Ag** Silver 107,87 $[Kr]\ 5s^1\ 4d^{10}$	48 **Cd** Cadmium 112,41 $[Kr]\ 5s^2\ 4d^{10}$	49 **In** Indium 114,81 $[Kr]\ 5s^2\ 4d^{10}\ 5p^1$	50 **Sn** Tin 118,71 $[Kr]\ 5s^2\ 4d^{10}\ 5p^2$	51 **Sb** Antimony 121,76 $[Kr]\ 5s^2\ 4d^{10}\ 5p^3$	52 **Te** Tellurium 127,6 $[Kr]\ 5s^2\ 4d^{10}\ 5p^4$	53 **I** Iodine 126,9 $[Kr]\ 5s^2\ 4d^{10}\ 5p^5$	54 **Xe** Xenon 131,29 $[Kr]\ 5s^2\ 4d^{10}\ 5p^6$
55 **Cs** Cesium 132,91 $[Xe]\ 6s^1$	56 **Ba** Barium 137,33 $[Xe]\ 6s^2$	57—71 La Lu Lanthanides	72 **Hf** Hafnium 178,49 $[Xe]\ 6s^2\ 4f^{14}\ 5d^2$	73 **Ta** Tantalum 180,95 $[Xe]\ 6s^2\ 4f^{14}\ 5d^3$	74 **W** Tungsten 183,84 $[Xe]\ 6s^2\ 4f^{14}\ 5d^4$	75 **Re** Rhenium 186,2 $[Xe]\ 6s^2\ 4f^{14}\ 5d^5$	76 **Os** Osmium 190,23 $[Xe]\ 6s^2\ 4f^{14}\ 5d^6$	77 **Ir** Iridium 192,22 $[Xe]\ 6s^2\ 4f^{14}\ 5d^7$	78 **Pt** Platinum 195,08 $[Xe]\ 6s^2\ 4f^{14}\ 5d^8$	79 **Au** Gold 196,97 $[Xe]\ 6s^2\ 4f^{14}\ 5d^9$	80 **Hg** Mercury 200,59 $[Xe]\ 6s^2\ 4f^{14}\ 5d^{10}$	81 **Tl** Thallium 204,38 $[Xe]\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^1$	82 **Pb** Lead 207,2 $[Xe]\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^2$	83 **Bi** Bismuth 208,98 $[Xe]\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^3$	84 **Po** Polonium 209 $[Xe]\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^4$	85 **At** Astatine 210 $[Xe]\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^5$	86 **Rn** Radon 222 $[Xe]\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^6$

Merits of Mendeleev's Periodic Table

- Mendeleev's left vacant places in his table which provided an idea for the discovery of new elements. Example: Eka-boron, Eka-aluminium and Eka-silicon.
- Mendeleev's periodic table was predicted properties of several undiscovered elements on the basis of their position in Mendeleev's periodic table.
- It is useful in correcting the doubtful atomic masses of some elements.
- Noble gases could accommodate in the Mendeleev's periodic table without disturbing the periodic table after discovery.

Limitations of Mendeleev's Periodic Table

(a) No fixed position for hydrogen: No correct position of the hydrogen atom was in Mendeleev's periodic table.

Example: Position of hydrogen with alkali metals and halogens (17th group).

(b) No place for isotopes: Position of isotopes were not decided.

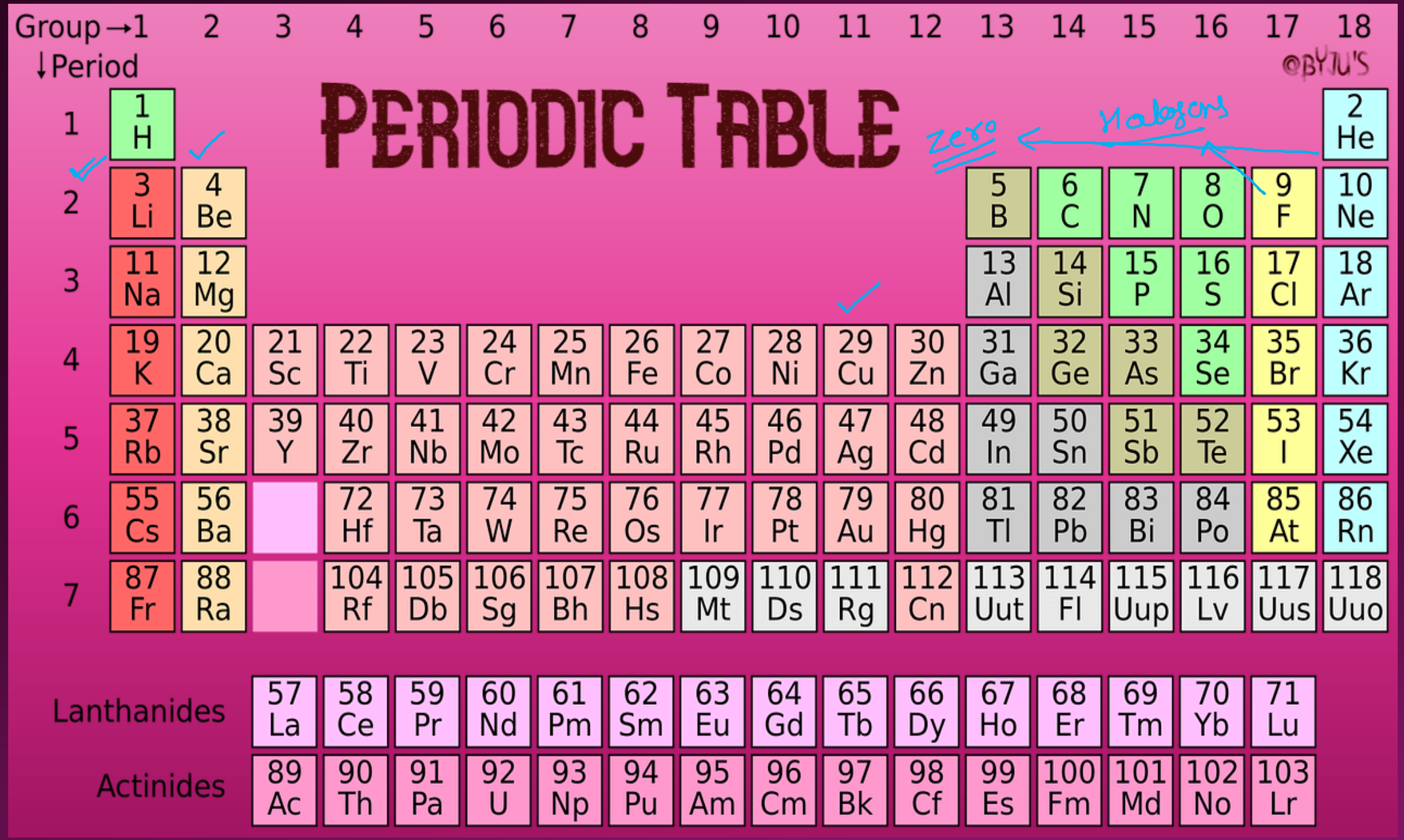
Example: Cl-35 and Cl-37.

(c) No regular trend in atomic mass: Position of some elements with lower atomic masses before with higher atomic mass.

Example: Ni-58.7 before Co-58.9.

The Modern Periodic Table:

- In 1913, Henry Moseley showed that the atomic number of an element is a more fundamental property than its atomic mass.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PERIODIC TABLE
Zero
Halogens
1 H
2 He
3 Li
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5 B
6 C
7 N
8 O
9 F
10 Ne
11 Na
12 Mg
13 Al
14 Si
15 P
16 S
17 Cl
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 Kr
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 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
104 Rf
105 Db
106 Sg
107 Bh
108 Hs
109 Mt
110 Ds
111 Rg
112 Cn
113 Uut
114 Fl
115 Uup
116 Lv
117 Uus
118 Uuo
Lanthanides
57 La
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
Actinides
89 Ac
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

- **Modern Period Law:** The physical and chemical properties of elements are the periodic function of their atomic number.

Modern periodic table is based on atomic number of elements.

Atomic number (Z) is equal to the number of protons present in the nucleus of an atom of an element.

Modern periodic table contains 18 vertical column known as group and seven horizontal rows known as periods.

On moving from left to right in a period, the number of valence electrons increases from 1 to 8 in the elements present.

On moving from left to right in a period, number of shell remains same.

All the elements of a group of the periodic table have the same number of valence electrons.

⇒ हैलोजन → Group → 17 ⇒ तत्व सबसे अधिक क्रियाशील

फ्लोरीन

* Total elements → 118
  - 91 (metal)
  - 27 (nonmetal)

⇒ Earth में सबसे ज्यादा ⇒ O_2

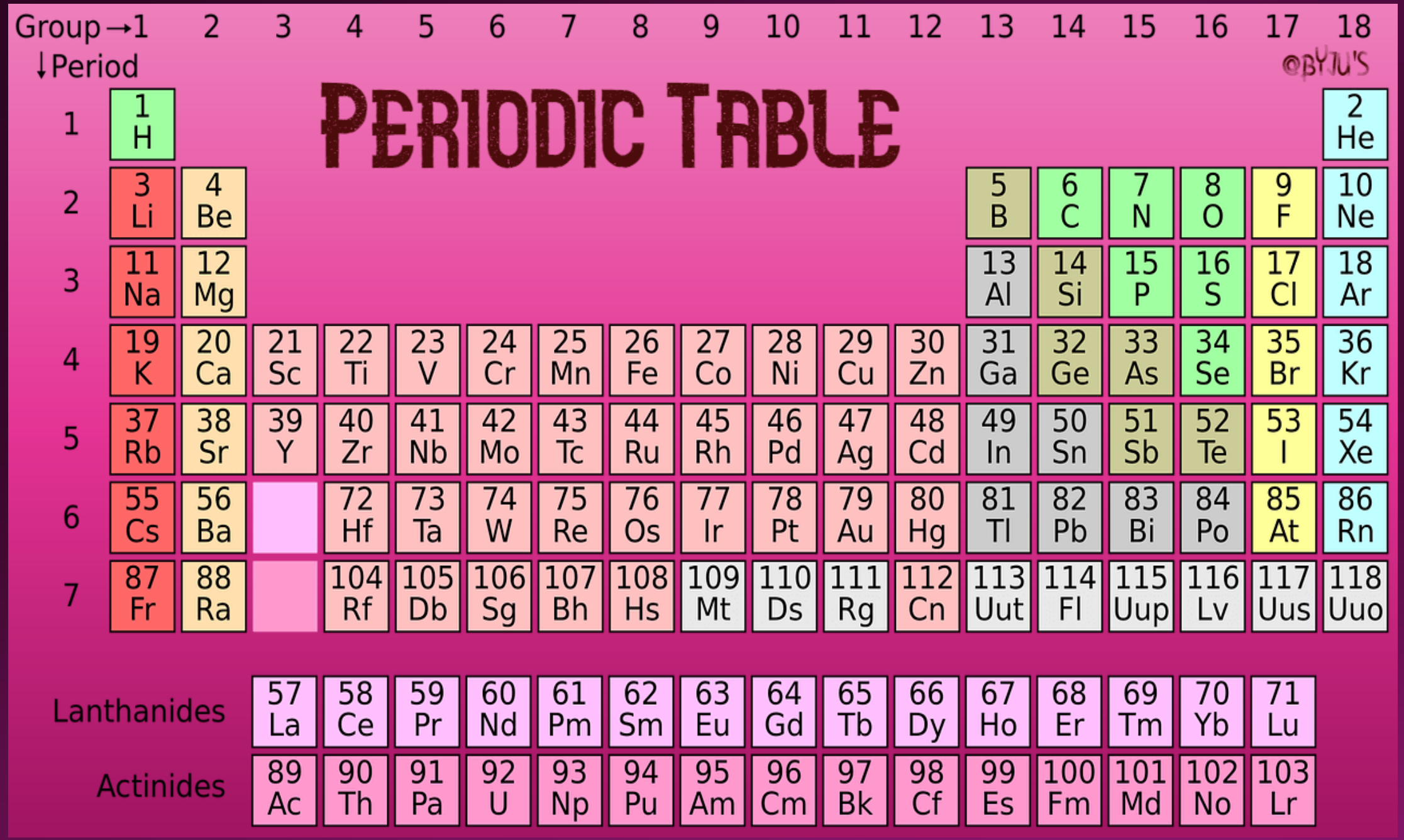
⇒ " " " " (धातु) ⇒ Al

⇒ In Periodic Table Lightest elem. ⇒ Hydrogen

⇒ " " " " metal ⇒ Li

⇒ " " " Heaviest elem ⇒ Ununoctium

" " " " metal ⇒ Os (osmium)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14 Si
15 P
16 S
17 Cl
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 Kr
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 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
104 Rf
105 Db
106 Sg
107 Bh
108 Hs
109 Mt
110 Ds
111 Rg
112 Cn
113 Uut
114 Fl
115 Uup
116 Lv
117 Uus
118 Uuo
Lanthanides
57 La
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
Actinides
89 Ac
90 Th
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95 Am
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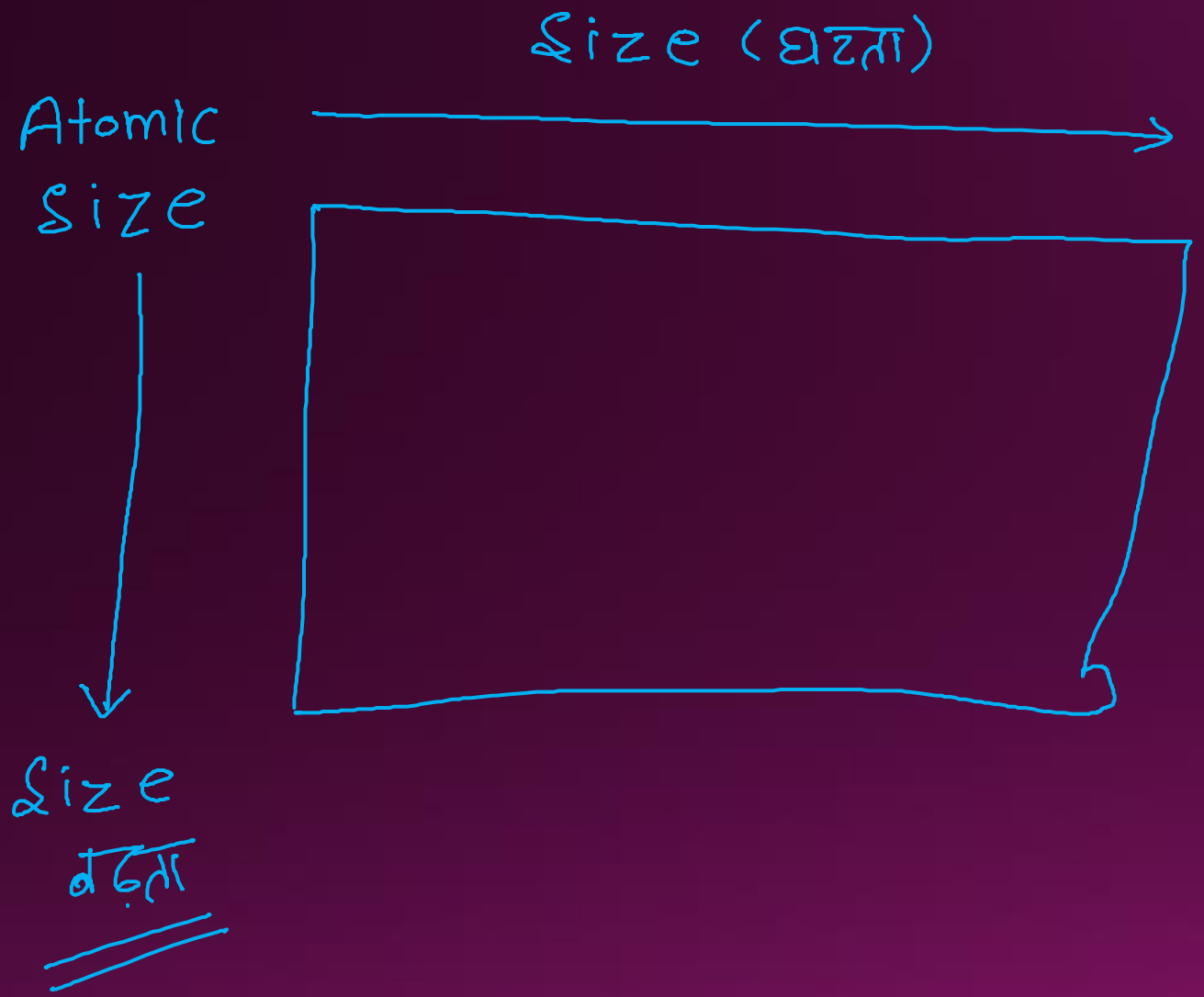
102 No
103 Lr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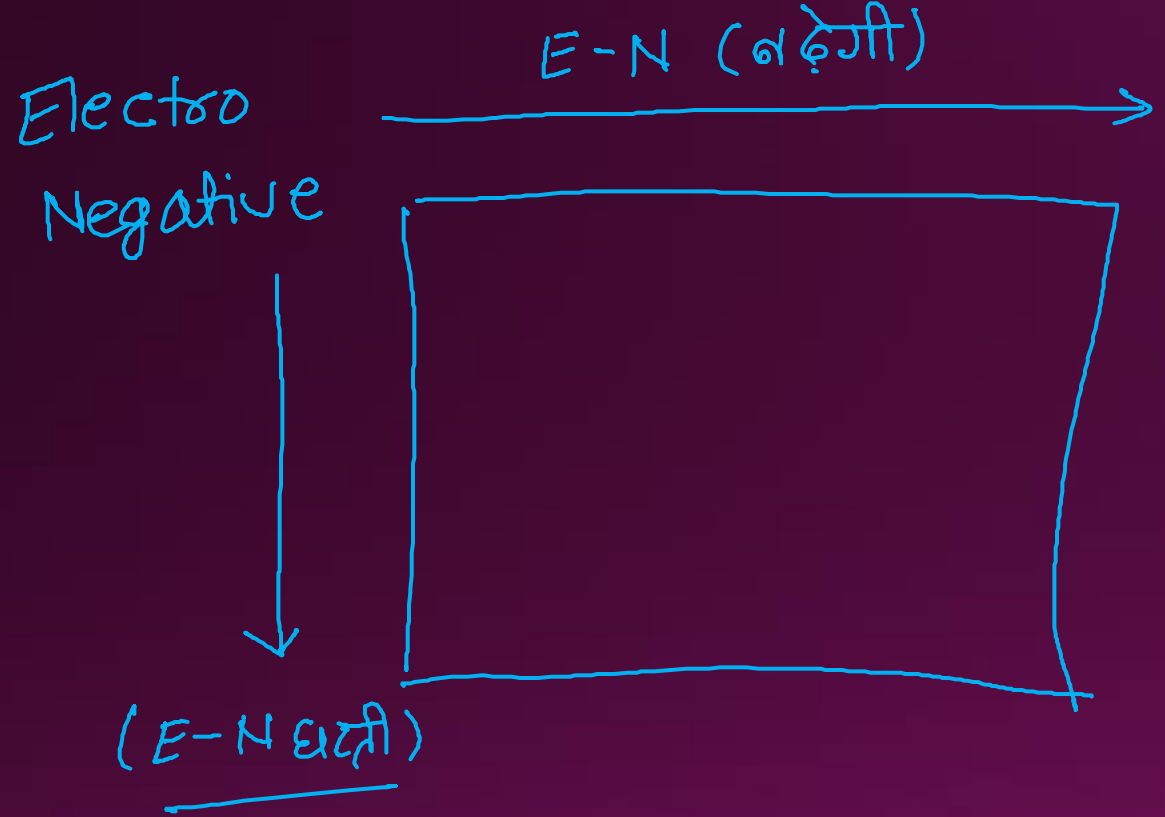
Atomic Size
Size बढ़ता


E-N (बढ़ेगी)
Electro
Negative
(E-N घटती)

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