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- Curated by India's Top Educators
- Coverage of Class 11 JEE syllabus
- Enhance conceptual understanding of JEE Main & JEE Advanced subjects
- Systematically designed courses
- Strengthen JEE problem-solving ability

Prashant Jain
Mathematics Maestro

Nishant Vora
Mathematics Maestro

Ajit Lulla
Physics Maestro

Abhilash Sharma
Physics Maestro

Sakshi Vora
Chemistry Maestro

Megha Khandelwal
Chemistry Maestro

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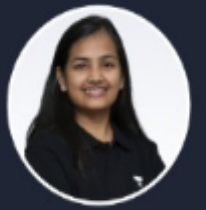
- Quick revision, tips & tricks

Nishant Vora
Mathematic Maestro

Ajit Lulla
Physics Maestro

Sakshi Ganotra
Organic & Inorganic Chemistry Maestro



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Abhilash Sharma
Physics Maestro

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for IIT JEE Main and Advanced 2023 Droppers

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Batch highlights:

- Learn from India's Top Educators
- Coverage of Class 11 & 12 syllabus of JEE
- Deep dive at a conceptual level for JEE Main and JEE Advanced
- Systematic course flow of subjects and related topics
- Strengthening the problem-solving ability of JEE level problems

For more details, contact **8585858585**

Nishant Vora
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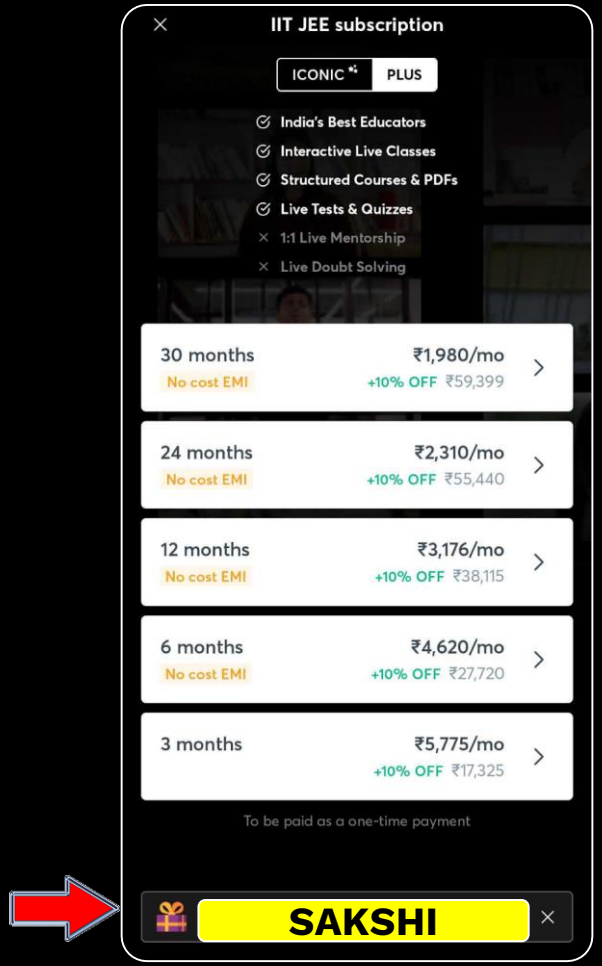
Physics Maestros

Sakshi Vora
Chemistry Maestros

Megha Khandelwal
Chemistry Maestros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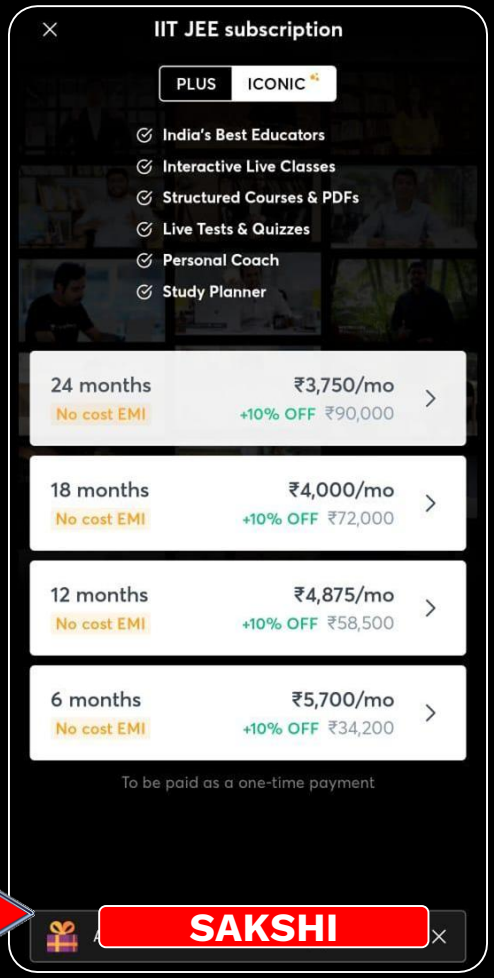
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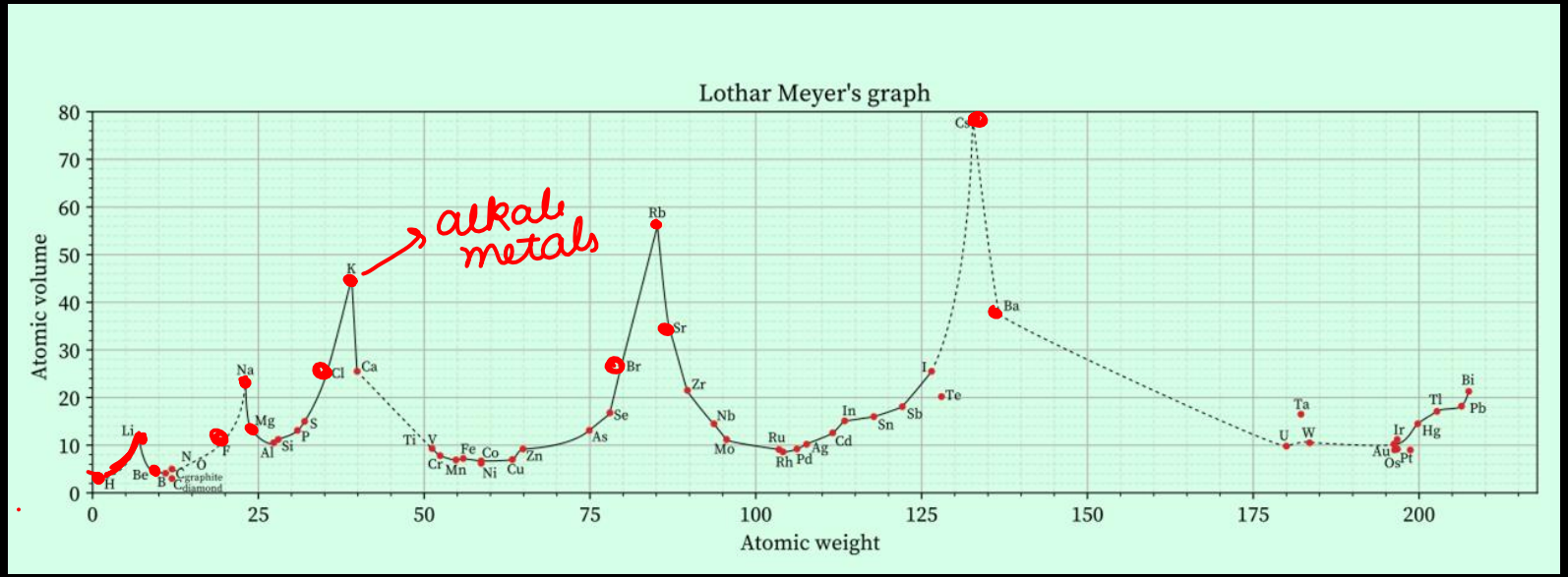
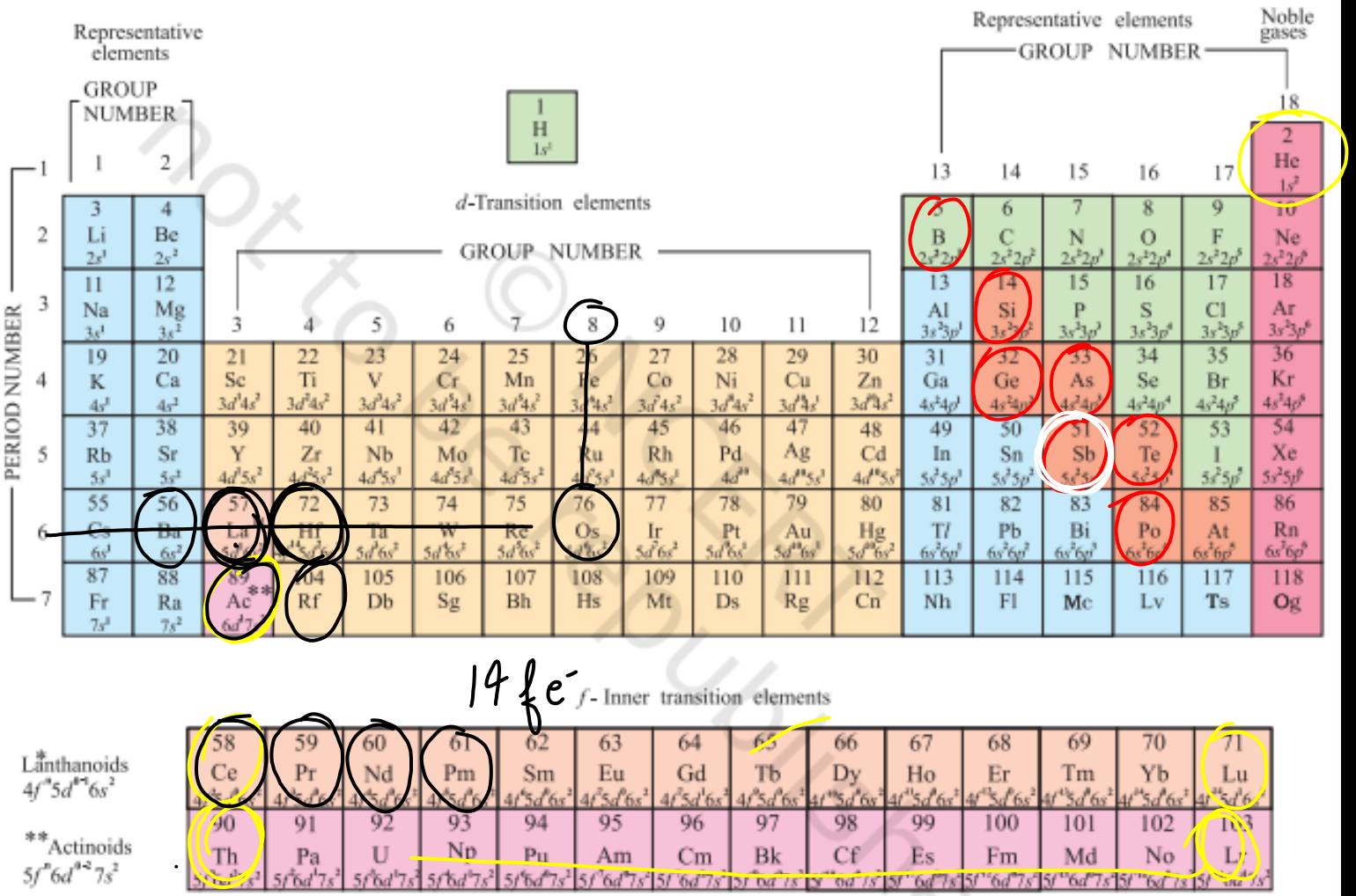
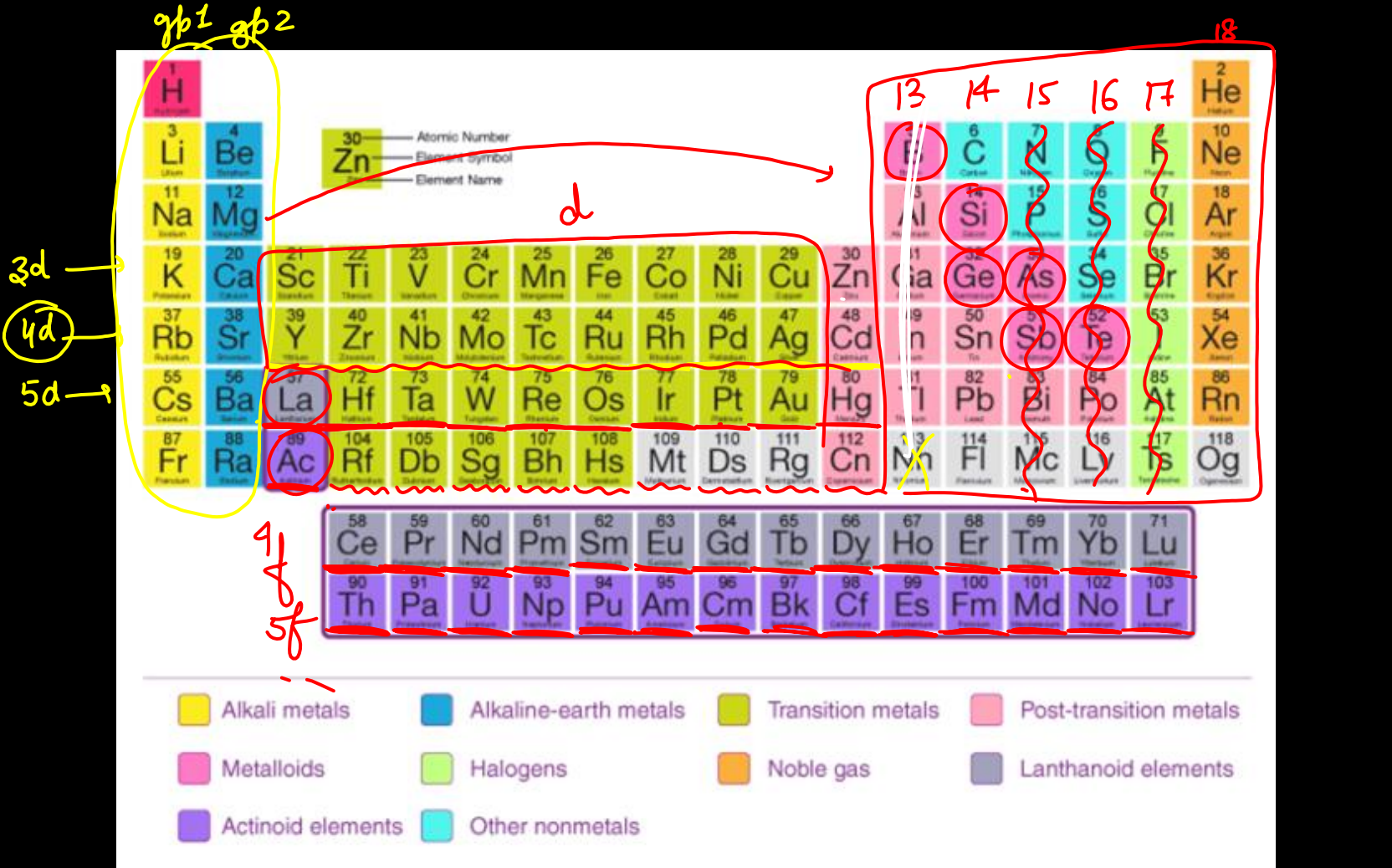
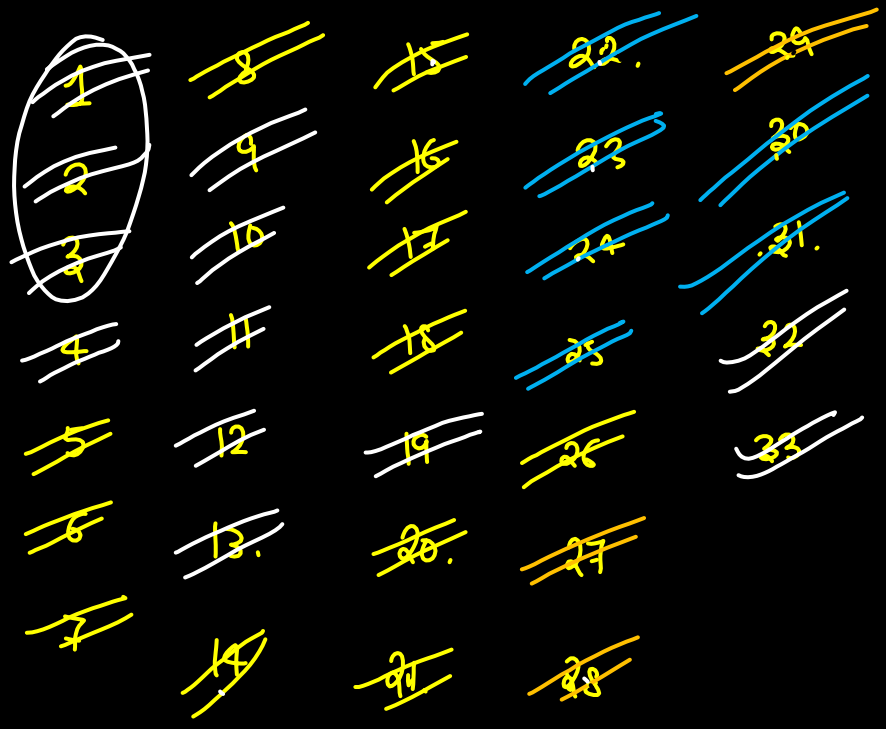

Lothar Meyer's graph
Atomic volume
Atomic weight
alkali metals
0
10
20
30
40
50
60
70
80
0
25
50
75
100
125
150
175
200
H
Li
Be
B
C
graphite
diamond
N
O
F
Na
Mg
Al
Si
P
S
Cl
K
Ca
Ti
V
Cr
Mn
Fe
Co
Ni
Cu
Zn
As
Se
Br
Rb
Sr
Zr
Nb
Mo
Ru
Rh
Pd
Ag
Cd
In
Sn
Sb
Te
I
Cs
Ba
Ta
W
U
Au
Os
Ir
Pt
Hg
Tl
Pb
Bi

SERIES	GROUPS OF ELEMENTS								
	0	I	II	III	IV	V	VI	VII	VIII
1	-	Hydrogen H 1.008	-	-					
2	Helium He 4.0	Lithium Li 7.03	Beryllium Be 9.1	Boron B 11.0	Carbon C 12.0	Nitrogen N 14.04	Oxygen O 16.00	Fluorine F 19.0	
3	Neon Ne 19.9	Sodium Na 23.5	Magnesium Mg 24.3	Aluminium Al 27.0	Silicon Si 28.4	Phosphorus P 31.0	Sulphur S 32.06	Chlorine Cl 35.45	
4	Argon Ar 38	Potassium K 39.1	Calcium Ca 40.1	Scandium Sc 44.1	Titanium Ti 48.1	Vanadium V 51.4	Chromium Cr 52.1	Manganese Mn 55.0	Iron Fe 55.9 / Cobalt Co 59 / Nickel Ni 59 (Cu)
5		Copper Cu 63.6	Zinc Zn 65.4	Gallium Ga 70.0	Germanium Ge 72.3	Arsenic As 75	Selenium Se 79	Bromine Br 79.95	
6	Krypton Kr 81.8	Rubidium Rb 85.4	Strontium Sr 87.6	Yttrium Y 89.0	Zirconium Zr 90.6	Niobium Nb 94.0	Molybdenum Mo 96.0	-	Ruthenium Ru 101.7 / Rhodium Rh 103.0 / Palladium Pd 106.5 (Ag)
7		Silver Ag 107.9	Cadmium Cd 112.4	Indium In 114.0	Tin Sn 119.0	Antimony Sb 120.0	Tellurium Te 127.6	Iodine I 126.9	
8	Xenon Xe 128	Caesium Cs 132.9	Barium Ba 137.4	Lanthanum La 139	Cerium Ce 140	-	-	-	
9		-	-	-	-	-	-	-	
10	-	-	-	Ytterbium Yb 173	-	Tantalum Ta 183	Tungsten W 184	-	Osmium Os 191 / Iridium Ir 193 / Platinum Pt 194.9 (Au)
11		Gold Au 197.2	Mercury Hg 200.0	Thallium Tl 204.1	Lead Pb 206.9	Bismuth Bi 208	-	-	
12	-	-	Radium Ra 224	-	Thorium Th 232	-	Uranium U 239		
	R	R_2O	RO	R_2O_3	RO_2	R_2O_5	RO_3	R_2O_7	RO_4
					HIGHER SALINE OXIDES				
					HIGHER GASEOUS HYDROGEN COMPOUNDS				
					RH_4	RH_3	RH_2	RH	


Representative elements
GROUP NUMBER
1
2
Representative elements
Noble gases
GROUP NUMBER
13
14
15
16
17
18
1 H 1s¹
d-Transition elements
GROUP NUMBER
3
4
5
6
7
8
9
10
11
12
PERIOD NUMBER
1
2
3
4
5
6
7
2 He 1s²
3 Li 2s¹
4 Be 2s²
5 B 2s²2p¹
6 C 2s²2p²
7 N 2s²2p³
8 O 2s²2p⁴
9 F 2s²2p⁵
10 Ne 2s²2p⁶
11 Na 3s¹
12 Mg 3s²
13 Al 3s²3p¹
14 Si 3s²3p²
15 P 3s²3p³
16 S 3s²3p⁴
17 Cl 3s²3p⁵
18 Ar 3s²3p⁶
19 K 4s¹
20 Ca 4s²
21 Sc 3d¹4s²
22 Ti 3d²4s²
23 V 3d³4s²
24 Cr 3d⁵4s¹
25 Mn 3d⁵4s²
26 Fe 3d⁶4s²
27 Co 3d⁷4s²
28 Ni 3d⁸4s²
29 Cu 3d¹⁰4s¹
30 Zn 3d¹⁰4s²
31 Ga 4s²4p¹
32 Ge 4s²4p²
33 As 4s²4p³
34 Se 4s²4p⁴
35 Br 4s²4p⁵
36 Kr 4s²4p⁶
37 Rb 5s¹
38 Sr 5s²
39 Y 4d¹5s²
40 Zr 4d²5s²
41 Nb 4d⁴5s¹
42 Mo 4d⁵5s¹
43 Tc 4d⁵5s²
44 Ru 4d⁷5s¹
45 Rh 4d⁸5s¹
46 Pd 4d¹⁰
47 Ag 4d¹⁰5s¹
48 Cd 4d¹⁰5s²
49 In 5s²5p¹
50 Sn 5s²5p²
51 Sb 5s²5p³
52 Te 5s²5p⁴
53 I 5s²5p⁵
54 Xe 5s²5p⁶
55 Cs 6s¹
56 Ba 6s²
57 La* 5d¹6s²
72 Hf 5d²6s²
73 Ta 5d³6s²
74 W 5d⁴6s²
75 Re 5d⁵6s²
76 Os 5d⁶6s²
77 Ir 5d⁷6s²
78 Pt 5d⁹6s¹
79 Au 5d¹⁰6s¹
80 Hg 5d¹⁰6s²
81 Tl 6s²6p¹
82 Pb 6s²6p²
83 Bi 6s²6p³
84 Po 6s²6p⁴
85 At 6s²6p⁵
86 Rn 6s²6p⁶
87 Fr 7s¹
88 Ra 7s²
89 Ac** 6d¹7s²
104 Rf
105 Db
106 Sg
107 Bh
108 Hs
109 Mt
110 Ds
111 Rg
112 Cn
113 Nh
114 Fl
115 Mc
116 Lv
117 Ts
118 Og
14 fe⁻
f- Inner transition elements
*Lanthanoids 4f^n 5d^(0-1) 6s²
58 Ce
59 Pr
60 Nd
61 Pm
62 Sm 4f⁶5d⁰6s²
63 Eu 4f⁷5d⁰6s²
64 Gd 4f⁷5d¹6s²
65 Tb 4f⁹5d⁰6s²
66 Dy
67 Ho
68 Er
69 Tm
70 Yb
71 Lu
**Actinoids 5f^n 6d^(0-2) 7s²
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


gp1
gp2
18
13
14
15
16
17
3d
4d
5d
d
4f
5f
30 Zn
Atomic Number
Element Symbol
Element Name
Alkali metals
Alkaline-earth metals
Transition metals
Post-transition metals
Metalloids
Halogens
Noble gas
Lanthanoid elements
Actinoid elements
Other nonmetals



Metals generally melt at very high temperature. Amongst the following, the metal with the highest melting point will be

A. Hg
B. Ag
C. Ga
D. Cs

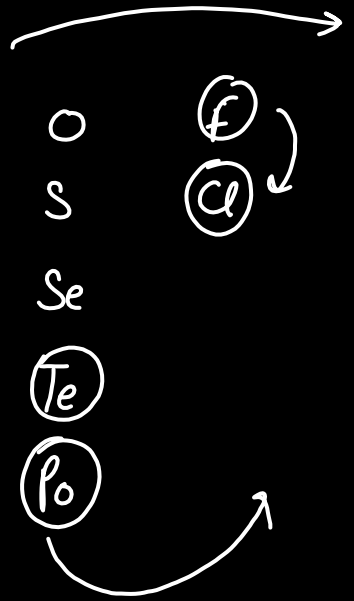
The correct order of electron gain enthalpies of Cl, F, Te and Po is

A. F < Cl < Te < Po

B. Po < Te < F < Cl

C. Te < Po < Cl < F

D. Cl < F < Te < Po



Which of the following elements in considered as a metalloid ?

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A. Sc ✗

B. Pb ✗

C. Bi ✗

D. Te

Assertion (A) : The ionic radii of O^{2-} and Mg^{2+} are same.

Reason (R) : Both O^{2-} and Mg^{2+} are isoelectronic species

In the light of the above statements, choose the correct answer from the options given below

	P	e
O^{2-}	8	10
Mg^{2+}	12	10

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true but (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

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The correct order of increasing ionic radii is

P 12 11 9 8 7

A. $Mg^{2+} < Na^{+} < F^{-} < O^{2-} < N^{3-}$

10 10 10 10 10

B. $N^{3-} < O^{2-} < F^{-} < Na^{+} < Mg^{2+}$

C. $F^{-} < Na^{+} < O^{2-} < Mg^{2+} < N^{3-}$

D. $Na^{+} < F^{-} < Mg^{2+} < O^{2-} < N^{3-}$

Element "E" belongs to the period 4 and group 16 of the periodic table. The valence shell electron configuration of the element, which is just above 'E' in the group is

A. $3s^2.\ 3p^4$

B. $3d^{10}.\ 4s^2\ ,\ 4p^4$

C. $4d^{10}.\ 5s^2,\ 5p^4$

D. $2s^2\ ,\ p4$

PYQ
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2022

4 period
gp 16

4s 3d 4p

$3d\ 4s^2\ 4p^4$

Match List-I with List-II.

List-I (Oxide)		List-II (Nature)	
(A)	Cl_2O_7	(I)	Amphoteric
(B)	Na_2O	(II)	Basic
(C)	Al_2O_3	(III)	Neutral
(D)	N_2O	(IV)	Acidic

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Choose the **correct** answer from the options given below :

A. (A) – (IV), (B) – (III), (C) – (I), (D) – (II)

B. (A) – (IV), (B) – (II), (C) – (I), (D) – (III)

C. (A) – (II), (B) – (IV), (C) – (III), (D) – (I)

D. (A) – (I), (B) – (II), (C) – (IIII), (D) – (IV)

Assertion A : The first ionization enthalpy for oxygen is lower than that of nitrogen.

Reason R : The four electrons in 2p orbitals of oxygen experience more electron - electron repulsion

In the light of the above statements, choose the correct answer from the options given below.

A. Both A and R are correct and R is the correct explanation of A

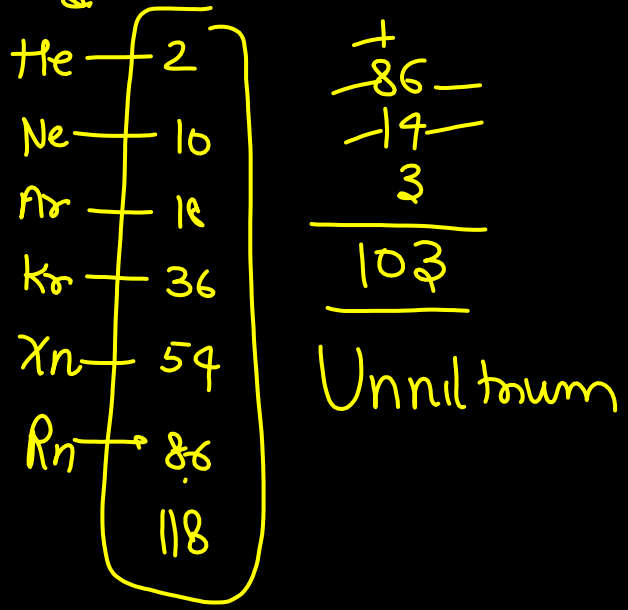
B. Both A and R are correct but R is not the correct explanation of A.

C. A is correct but R is not correct.

D. A is not correct but R is correct

The IUPAC nomenclature of an element with electronic configuration $[Rn]5f^{14}6d^{1}7s^{2}$ is :

A. Unnilibium
B. Unnilunium
C. Unnilquadium
D. unniltrium



The first ionization enthalpies of Be, B, N and O follow the order

A. O < N < B < Be

B. Be < B < N < O

C. B < Be < N < O

D. B < Be < O < N

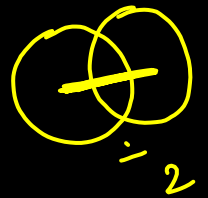
Li < B < Be < C < O < N < F < Ne

Given two statements below :

Statement I : In Cl_2 molecule the covalent radius is double of the atomic radius of chlorine.

Statement II : Radius of anionic species is always greater than their parent atomic radius.

Choose the most appropriate answer from options given below :



A. Both statement I and statement II are correct

B. Both statement I and statement II are incorrect

C. Statement I is correct but statement II is incorrect

D. Statement I is incorrect but statement II is correct

Electronic configurations of four elements A, B, C, D are given below :

A. $3s^2$

B. $3s^2\ 3p^1$

C. $3s^2\ 3p^3$

D. $3s^2\ 3p^4$

A > B

C > D

C > D > A > B

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The correct order of first ionization enthalpy for them is

A. (A) < (B) < (C) < (D)

B. (B) < (A) < (D) < (C)

C. (B) < (D) < (A) < (C)

D. (B) < (A) < (C) < (D)

In which of the following pairs, electron gain enthalpies of constituent elements are nearly the same or identical ?

A. Rb and Cs

B. Na and K

C. Ar and Kr

D. I and At

Choose the correct answer from the options given below :

A. (A) and (B) only

B. (B) and (C) only

C. (A) and (C) only

D. (C) and (D) only

The correct decreasing order for metallic character is

A. Na > Mg > Be > Si > P

B. P > Si > Be > Mg > Na

C. Si > P > Be > Na > Mg

D. Be > Na > Mg > Si > P

Which of the following pair of molecules contain odd electron molecule and an expanded octet molecule ?

A. BCl_3 and SF_6

B. NO and H_2SO_4

C. SF_6 and H_2SO_4

D. BCl_3 and NO

The first ionization enthalpy of Na, Mg and Si, respectively, are : 496, 737 and 786 kJ mol^{-1}. The first ionization enthalpy (kJ mol^{-1}) of Al is :

A. 487

B. 768

C. 577

D. 856

55. The option(s) with only amphoteric oxides is(are)

[Adv. 2017]

(a) Cr_2O_3, BeO, SnO, SnO_2

(b) Cr_2O_3, BeO, SnO, PbO_2

(c) Mn_2O_3, PbO_2, SnO_2

(d) ZnO, Al_2O_3, PbO, PbO_2

Cr^{+3}

a, d.

The 1st, 2nd, and the 3rd ionization enthalpies, I_1, I_2, and I_3, of four atoms with atomic numbers n, $n + 1$, $n + 2$, and $n + 3$, where $n < 10$, are tabulated below. What is the value of n?

[Adv. 2020]

Atomic number	Ionization Enthalpy (kJ/mol)		
	I_1	I_2	I_3
n	1681	3374	6050
$n + 1$	2081	3952	6122
$n + 2$	496	4562	6910
$n + 3$	738	1451	7733

23. Both lithium and magnesium display several similar properties due to the diagonal relationship; however, the one which is incorrect is :

[Main 2017]

(a) Both form basic carbonates
(b) Both form soluble bicarbonates
(c) Both form nitrides
(d) Nitrates of both Li and Mg yield NO_2 and O_2 on heating

22. The correct order of electron affinity is:

[Main Online April 15, 2018 (II)]

(a) O > F > Cl

(b) F > O > Cl

(c) F > Cl > O

(d) Cl > F > O

19. The correct option with respect to the Pauling electronegativity values of the elements is:

[Main Jan. 11, 2019 (II)]

(a) Te > Se

(b) Ga < Ge

(c) Si < Al

(d) P > S

gp 14

O
S
Se
Te
Po

Li Be B C N O F
Na Mg Al Si P S Cl

Ga Ge
In Sn
Tl Pb

18. The correct order of the atomic radii of C, Cs, Al, and S is :

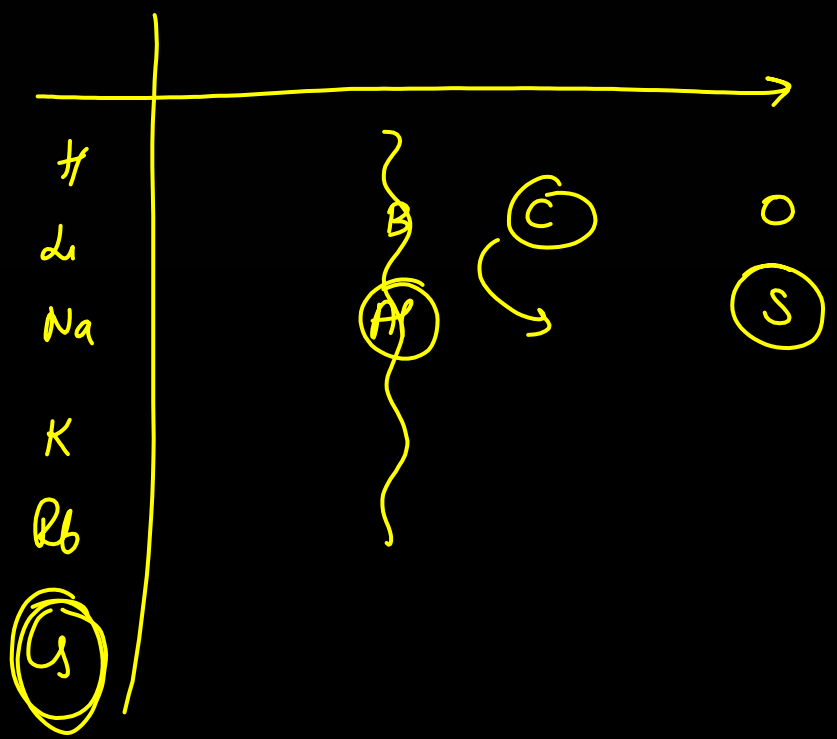
[Main Jan. 11, 2019 (I)]

(a) C < S < Al < Cs

(b) S < C < Cs < Al

(c) S < C < Al < Cs

(d) C < S < Cs < Al



17. In comparison to boron, berylium has:

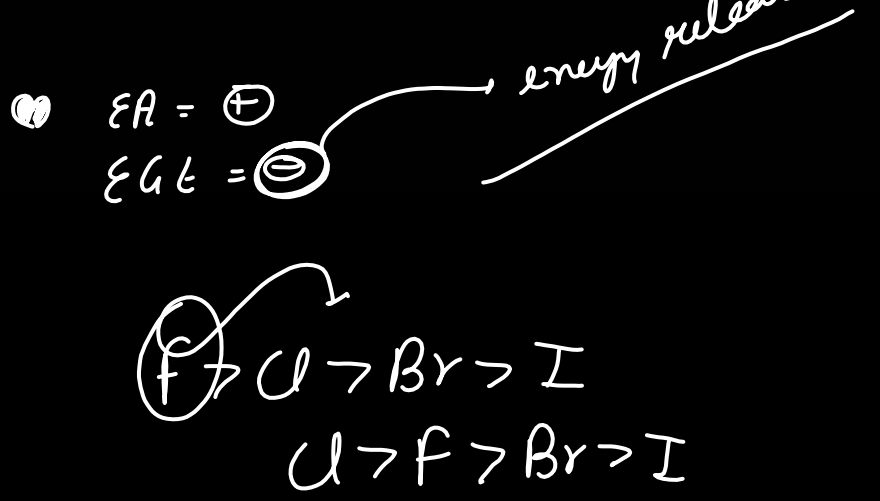
[Main April 12, 2019 (II)]

(a) lesser nuclear charge and lesser first ionisation enthalpy.
(b) greater nuclear charge and lesser first ionisation enthalpy.
(c) greater nulear charge and greater first ionisation enthalpy.
(d) lesser nuclear charge and greater first ionisation enthalpy.

15. The electron gain enthalpy (in kJ/mol) of fluorine, chlorine, bromine and iodine, respectively, are:

[Main Jan. 07, 2020 (I)]

(a) –296, –325, –333 and –349
(b) –349, –333, –325 and –296
(c) –333, –349, –325 and –296
(d) –333, –325, –349 and –296



8. In general, the property (magnitudes only) that shows an opposite trend in comparison to other properties across a period is :

[Main Sep. 02, 2020 (I)]

(a) Ionization enthalpy
(b) Electronegativity
(c) Electron gain enthalpy
(d) Atomic radius

7. The five successive ionization enthalpies of an element are 800, 2427, 3658, 25024 and 32824 kJ mol^{-1}. The number of valence electrons in the element is :

[Main Sep. 03, 2020 (II)]

(a) 5
(b) 4
(c) 3
(d) 2

3. The elements with atomic numbers 101 and 104 belong to, respectively :

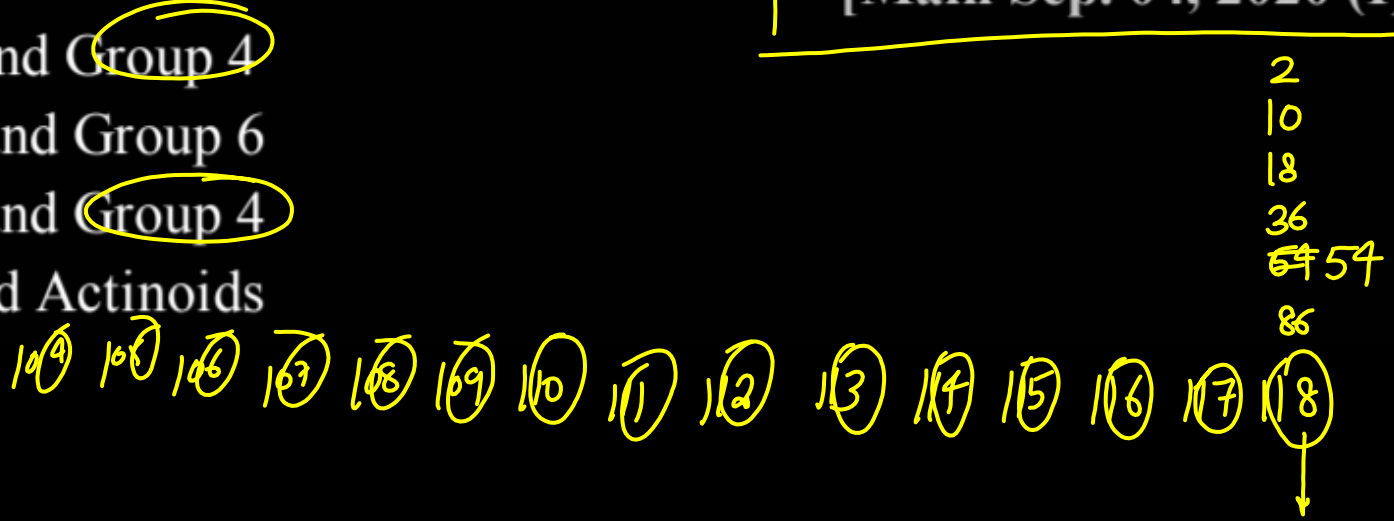
[Main Sep. 04, 2020 (I)]

(a) Group 11 and Group 4

(b) Actinoids and Group 6

(c) Actinoids and Group 4

(d) Group 6 and Actinoids



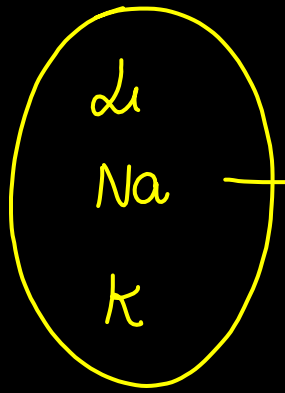

THEORY

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn						

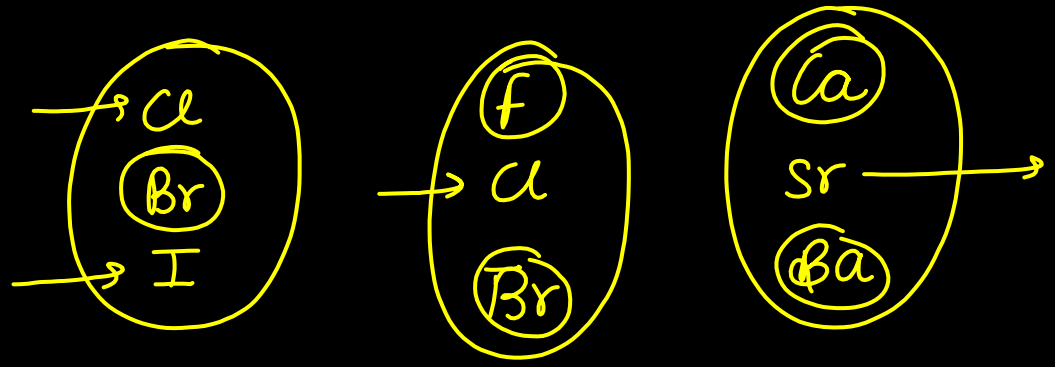
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Dobereiner's triads

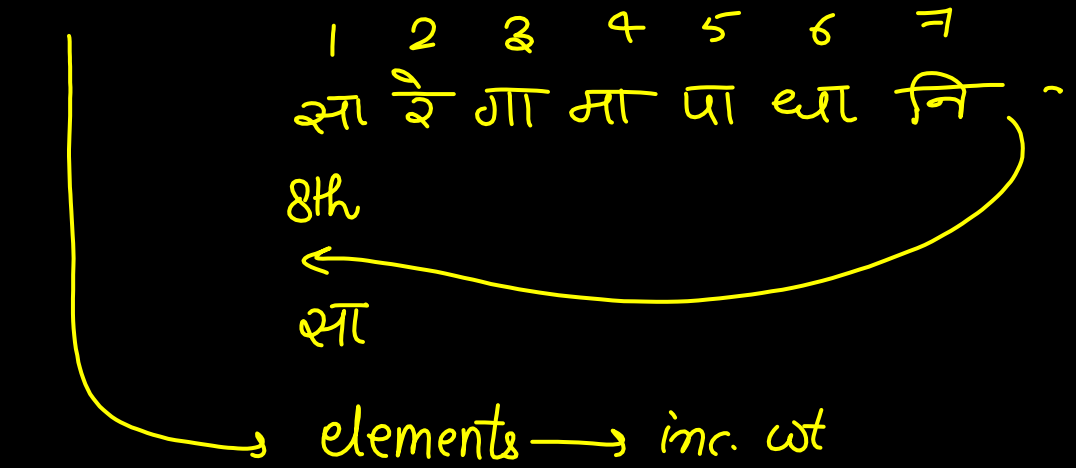
- A
- B
- C



$$\frac{7+39}{2} = \frac{46}{2} = 23$$


Cl
Br
I
F
Cl
Br
Ca
Sr
Ba

Newland's law of Octaves

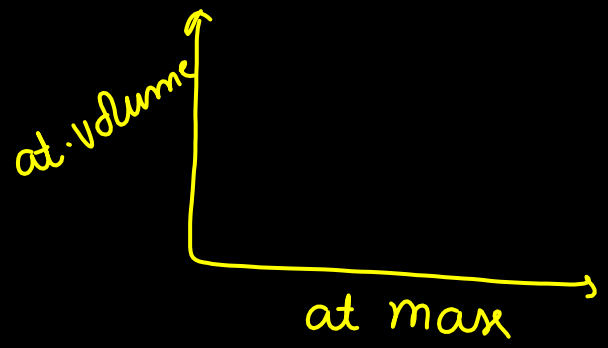


H Li Be B C N O

F Na Mg Al Si P S

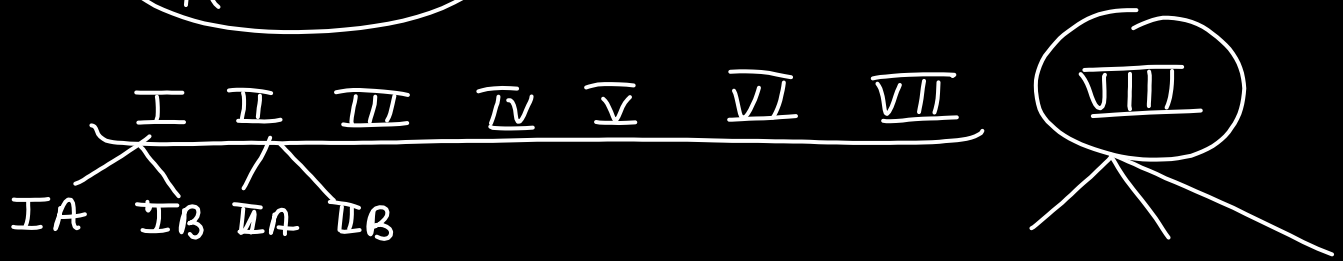
Cl K Ca.

Lothar Meyer



Mendleev's Periodic table

8 groups
12 series



Eka-Aluminium ↔ Gallium
(Al) (Ga)

Eka Boron ↔ Scandium
B Sc

Eka Silicon ↔ Germenium
Si Ge

Eka Manganese ↔ Tc
Mn

Al Ga B Sc
Si Ge Mn Tc

Technetium (Tc)

Drawbacks of Mendleev's Periodic Table

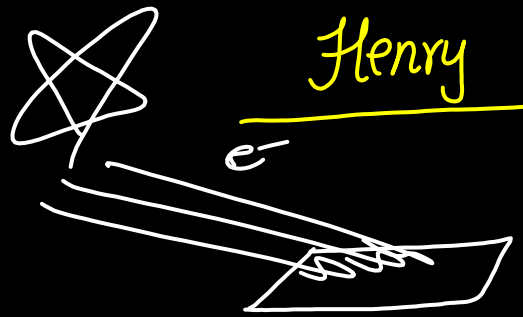
1 hydrogen has Position — O & H

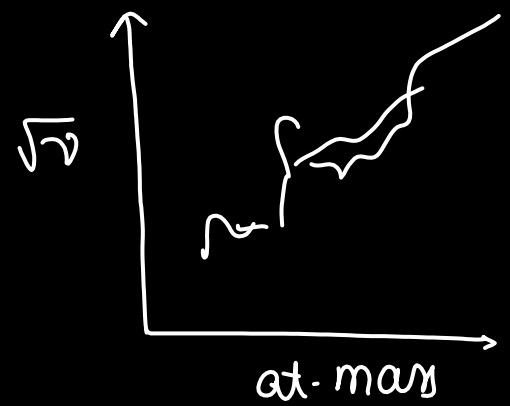
2 Position of isotopes

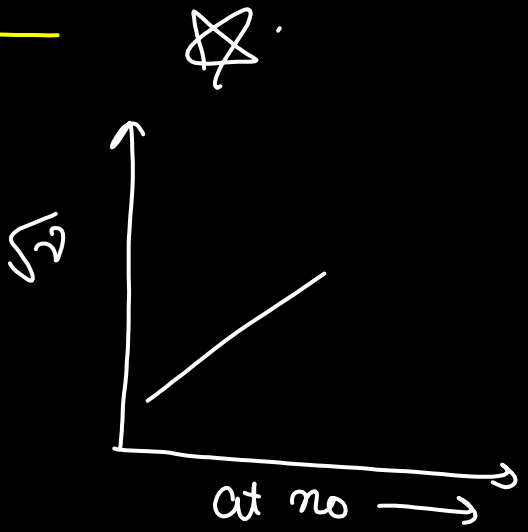
3 Wrong Pos. of elements

U Be In Au Pt

Henry Moseley' experiment







Modern Periodic Table

1. Modern Periodic law
2. e conf
3. gp 18 → column
4. rows → Period → 7

Electronic configuration

① Aufbau's Principle

monoelectronic system → energy (n)

$1s < 2s = 2p < 3s = 3p = 3d < 4s = 4p = 4d = 4f <$

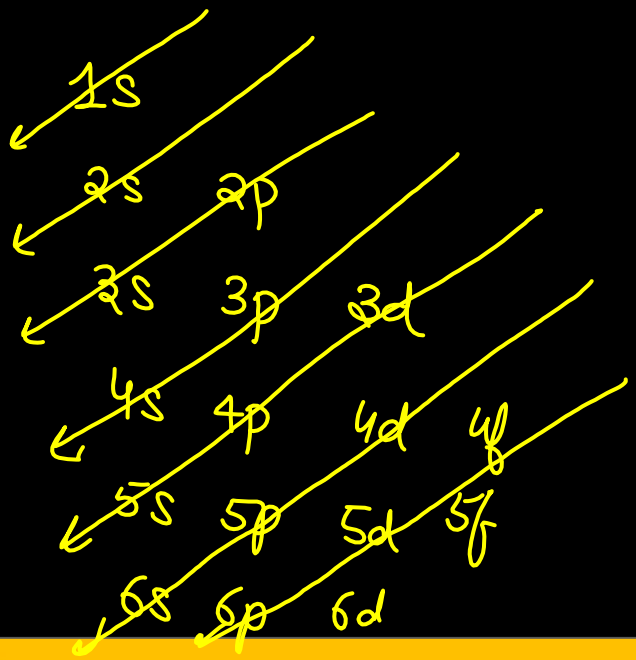
multielectronic species → energy → (n+l)

$1s = 1+0 = ①$ $2s$ $3+0 = ③$

$2s = 2+0 = ②$ $3p$

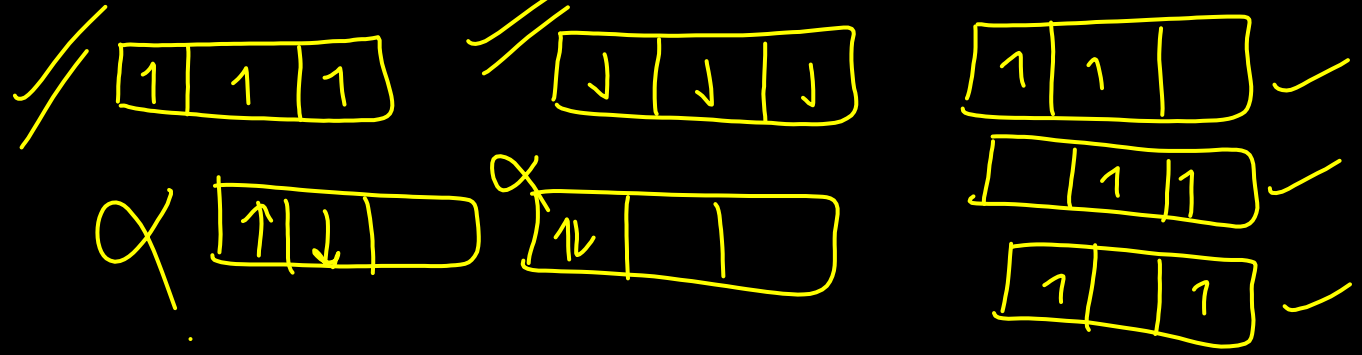
$2p = 2+1 = ③$ $3d$

$1s < 2s < 2p < 3s < \cdots$



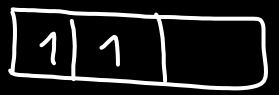
② Hund's rule of maximum multiplicity

The subshells are first filled with the e⁻s of same spin & then the pairing occurs



multiplicity

$2|s|+1$



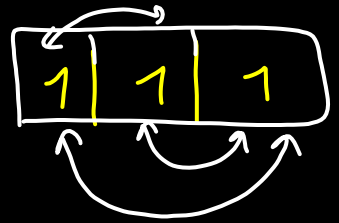
$S = \frac{1}{2} + \frac{1}{2} = 1$ $\quad 2(1)+1 = 3$

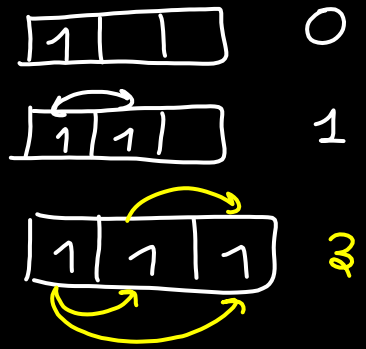
$S = -\frac{1}{2} - \frac{1}{2} = |-1|$ $\quad 2(1)+1 = 3$ ✓

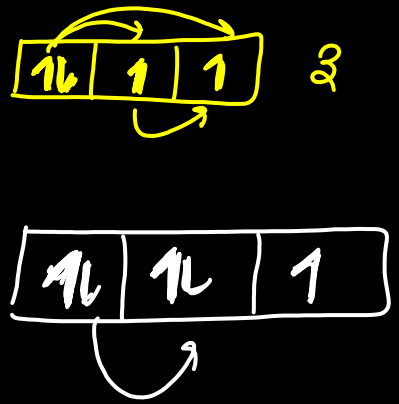
$S = \frac{1}{2} - \frac{1}{2} = 0$ $\quad 2(0)+1 = 1$

$S = \frac{1}{2} - \frac{1}{2} = 0$ $\quad 2(0)+1 = 1$ ✗

exchange energy

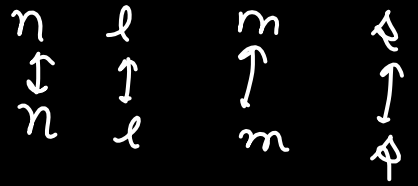



0
1
3


3
3+1= 4

Pauli's exclusion principle

no 2 e⁻s in an atom can have the same set of all the 4 QS No



1 H $1s^1$ 

2 He $1s^2$ 

3 Li $1s^2 2s^1$ 

4 Be $1s^2 2s^2$ 

5. B $1s^2 2s^2 2p^1$ 

6. C $1s^2 2s^2 2p^2$ 

7 N $1s^2 2s^2 2p^3$ 

8 O $1s^2 2s^2 2p^4$ 

9 F $1s^2 2s^2 2p^5$ 

10. Ne $1s^2 2s^2 2p^6$ 

11 Na $[Ne]\,3s^1$

12 Mg $[Ne]\,3s^2$

13. Al $[Ne]\,3s^2 3p^1$

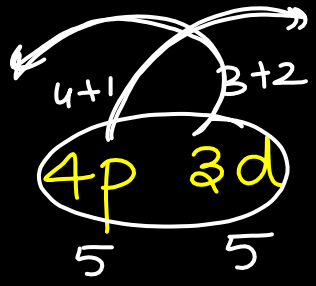
18. Ar $[Ne]\,3s^2 3p^6$

19 K $[Ar]\,4s^1$

1+0=1 2+0=2 2+1 3+0 3+1 4+0

1s 2s 2p 3s 3p 4s

1 2 3 3 4 4



5s 5p

4d 6s 6p 5d 4f ..

$l = 0$ s

$l = 1$ p

$l = 2$ d

$l = 3$ f

21	Sc	$[Ar]\ 4s^2 3d^1$
22	Ti	$[Ar]\ 4s^2 3d^2$
23.	V	$[Ar]\ 4s^2 3d^3$
24	Cr	$[Ar]\ 4s^2 3d^4$
25	Mn	$[Ar]\ 4s^2 3d^5$
26	Fe	$[Ar]\ 4s^2 3d^6$
27.	Co	$4s^2 3d^7$

28 Ni —— $4s^2 3d^8$

~~29 Cu~~ —— $4s^2 3d^9$

30 Zn —— $4s^2 3d^{10}$

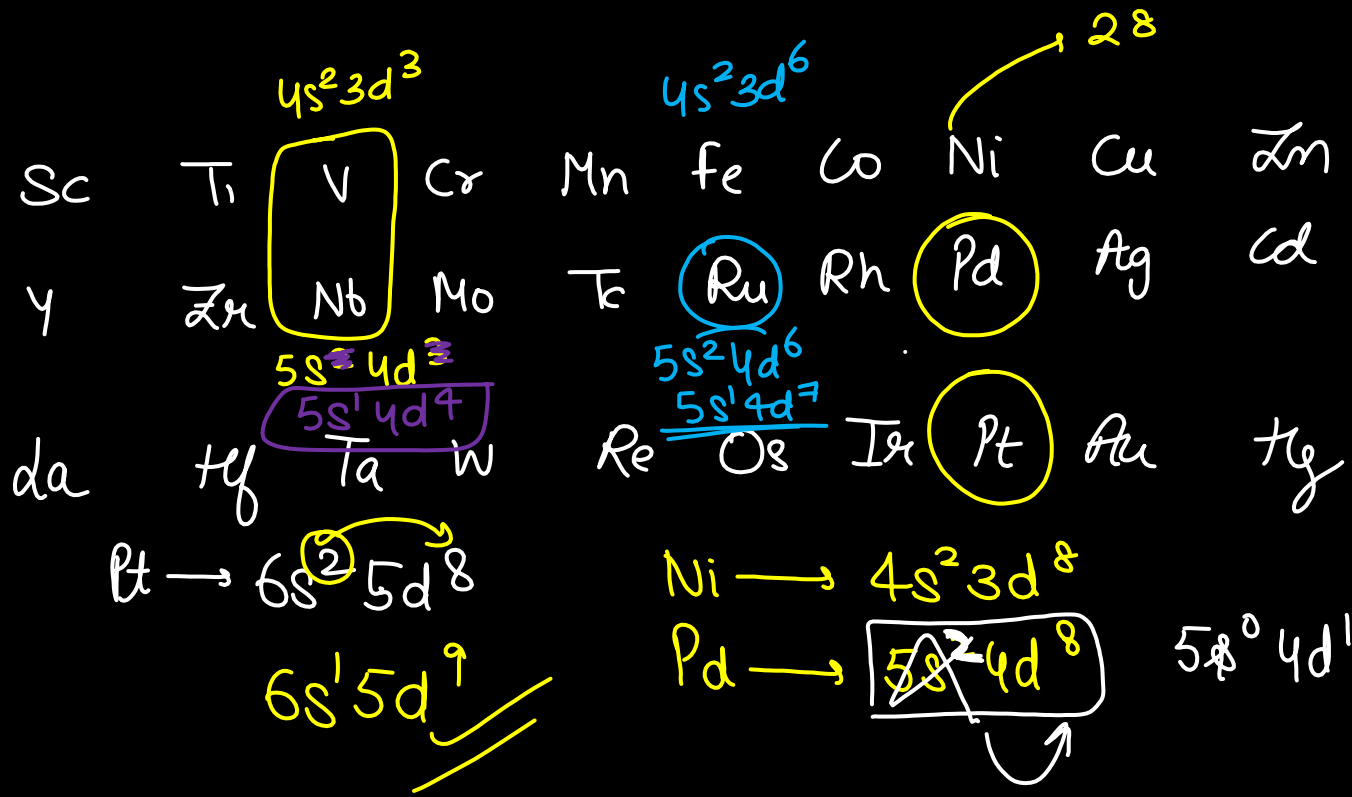
2 baar मार खाता है

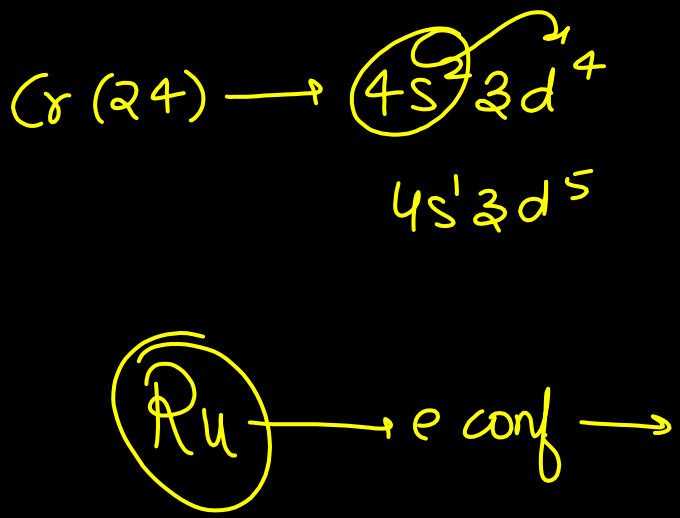
मोती क्यो करेमी २२६ - २१६ पड आगे

Mo Tc Cu Cr Ru Rh Pd Ag

और पिटाई Rangoli बना और numbu बना

Au Pt Rg Nb

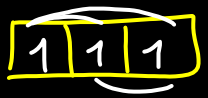

4s²3d³
4s²3d⁶
2 8
Sc Ti V Cr Mn Fe Co Ni Cu Zn
Y Zr Nb Mo Tc Ru Rh Pd Ag Cd
5s² 4d³
5s¹ 4d⁴
5s²4d⁶
5s¹4d⁷
Ra Hf Ta W Re Os Ir Pt Au Hg
Pt → 6s² 5d⁸
6s¹5d⁹
Ni → 4s²3d⁸
Pd → 5s² 4d⁸
5s⁰ 4d¹⁰


Cr (24) → 4s² 3d⁴
4s¹ 3d⁵
Ru → e conf →

symm.

↑

half filled conf



fully filled conf

3+3= 6 exchanges

jee main :
6th Period

6s 4f 5d 6p

ns (n-2)f (n-1)d np

Period

3rd Period	3s	3p
4th Period	4s	3d 4p
5th Period	5s	4d 5p

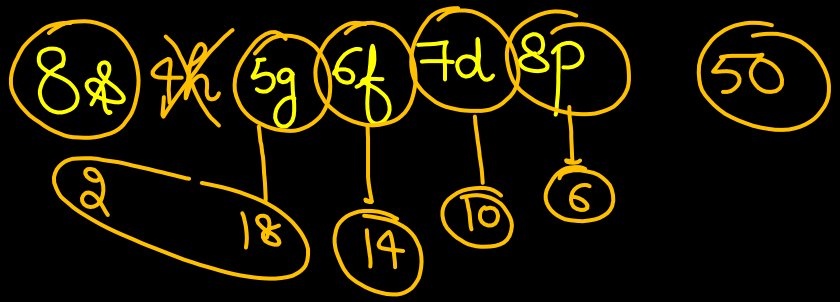
Ions

Zn^{2+}

$Zn \longrightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$

$Zn^{2+} \longrightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$ ~~$4s^2$~~

Q. 8th period ⟶ how many elements



$n=4$
$l=0,1,2,3$

$l=0$ s
1 p
2 d
3 f
4 g
5 h

Q1. gp 1 → alkali metals

Q2 gp 2 → alkaline earth metals

Q3 gp 18 → noble gases

Q4. gp 17 → halogen → Salts

Q5 gp 16 → chalcogen → oxide

Q6. gp 17 → pnictogens

Q7. Coinage – Cu, Ag, Au

Q8. gp 1, gp 2 ⟶ s-block ⟶ last e^- → s orbital

Q9. gp 1 ⟶ ns^1

Q10. gp 2 ⟶ ns^2

Q11. He $\longrightarrow$ $1s^2$ $\longrightarrow$ P-block

Q12 & Q13. { Soft metals $\longrightarrow$ weak metallic bond
Silvery

Q14. P-blocks $\longrightarrow$ gp 13 — gp 18 — last e⁻ - P orbital

Is $ns^2 np^{1-6}$

main group elements

↓

s + p together

s-block metals

p-block non-metals

★ metalloids

Te Ge Sb B Se As

★ non-metal → only RT → $Br_2(l)$

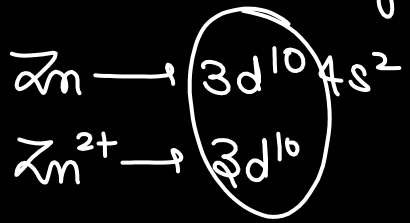
★ nth shell → outermost shell
(n-1)th shell → Penultimate shell

★ d block (n-1)d

★ (n-2)th shell → anti penultimate

* Zn, Cd, Hg → d block elements ✓
Transition metals ✗

* Incomplete d-orbital in gnd state/excited



* general e conf

$$(n-1)d^{1-10}\, ns^{1-2}$$

* f- block elements

↳ inner transition elements

IUPAC names of elemenents with At no Z > 100

0	nil	n
1	un	u
2	bi	b
3	tri	t
4	Quad	Q
5	Pent	P
6	hex	h
7	Sept	S
8	Oct	O
9	enn	e

104 Unnilquadium

Unq

110 Ununnilium

Uun

Identification of Position of element

e- conf

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$

Block : last e^- ⟶ subshell ⟶ p-block

Period ⟶ max. Pricipal Q no ⟶ 4th Period

group ⟶ 2+5+10 = 17

group

(s) gp no = no of ns e^-

(p) gp no = (ns + np) + 10

(d) gp no = $n_s + (n-1)d$

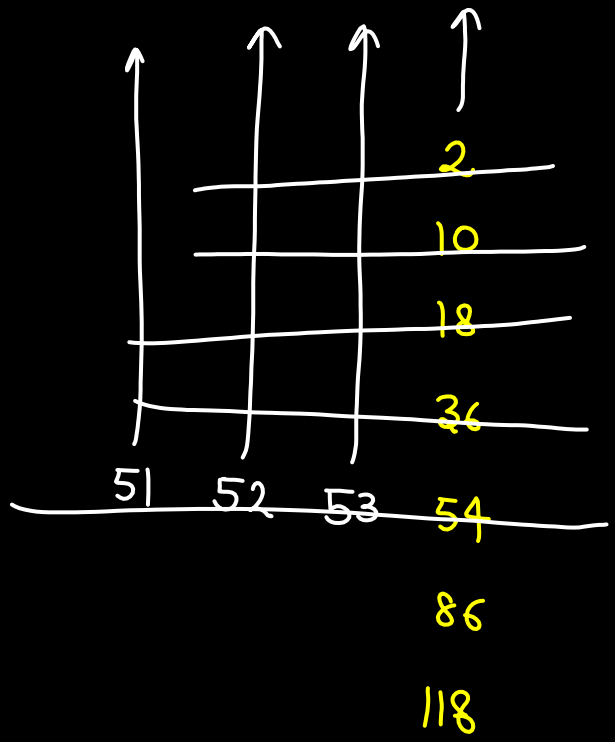
(f) gp no = 3

Atomic no

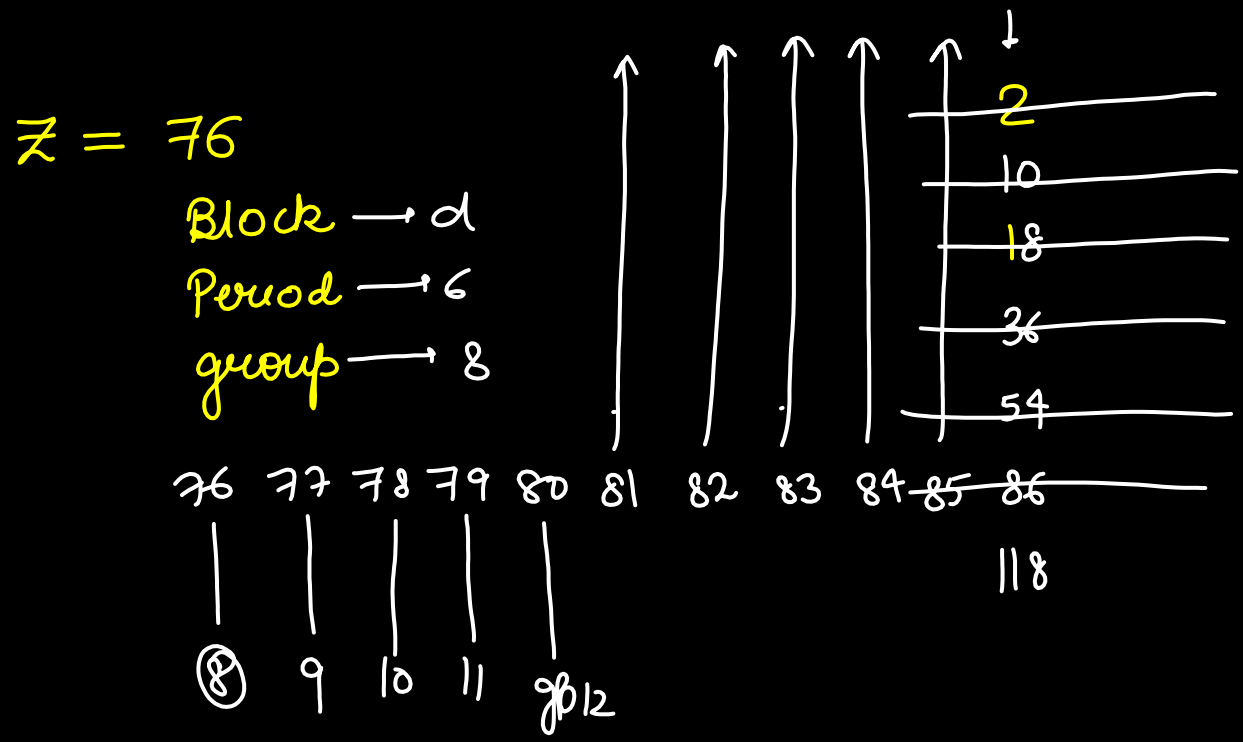
Lanthanum → 57

f-block (58 to 71, 90 to 103)

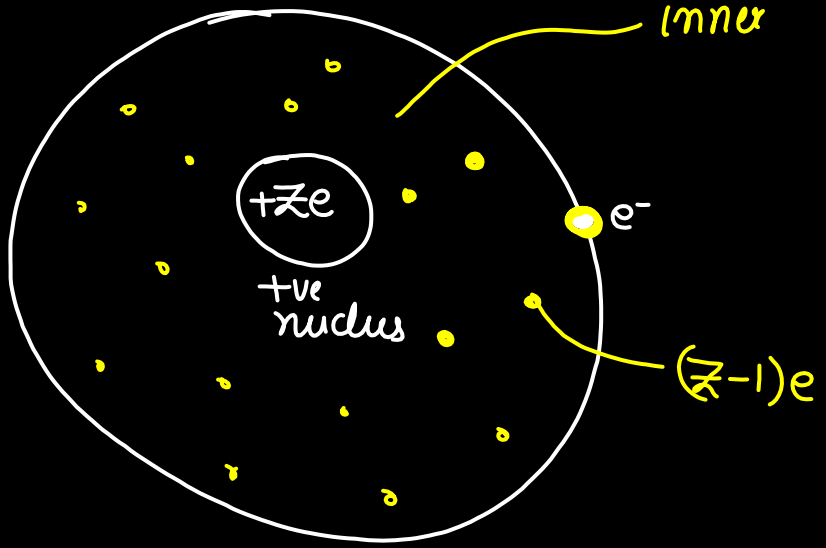
Actinium → 89



(51)
Period 5
Block P
gp 15

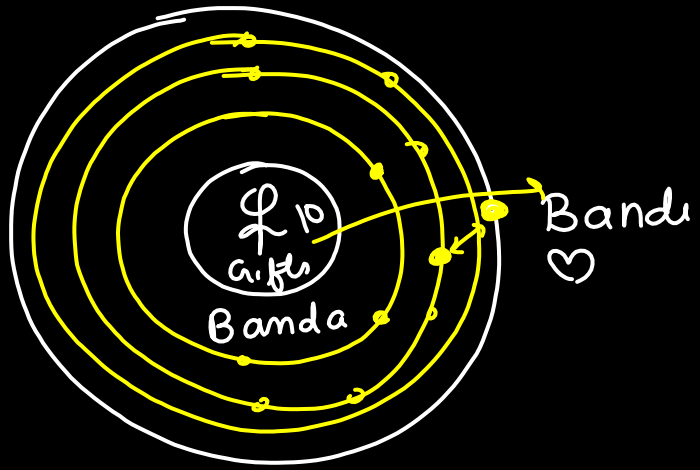

Z = 76
Block → d
Period → 6
group → 8
1
2
10
18
36
54
118
76 77 78 79 80 81 82 83 84 85 86
8 9 10 11 12

Effective nuclear charge



$$Z_{eff} = Z - \sigma$$

Shielding const/
Screening const



⑧ = 10 − 2

Screening/
Shielding

s > p > d > f

② ⑭

Isoelectronic species

* Same no of e^-

	Al^{3+}	Mg^{2+}
P=	13	12
e^-=	10	10
	Z_{eff} ↑	Z_{eff} ↓

s and p-block

in a period (left to right)

- Z_{eff} ↑
- no of shells → same
- force of att ∝ $\frac{\text{charge}}{\text{size}}$ ↑ ≈
- f_{att} ↑

d and f-block

left to right in a period

- Z_{eff} ↑
- no of shell ~ same
- Atl ↓

Top to bottom.

s-block

- Z_{eff} ↑
- no of shells ↑
- FOA ↓

p-block

Z_{eff} ↑↑↑ } FOA ↑
size ↑

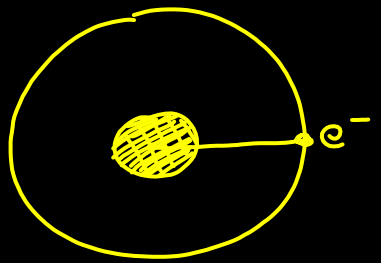
Z_{eff} ↑× } FOA ↓
size ↑↑↑

d-block

Z_{eff} ↑↑↑↑

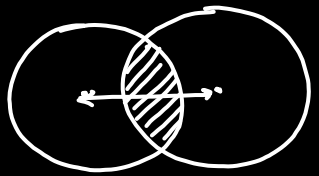
FOA ↑↑

Atomic radius



1. Covalent radius
2. metallic radius
3. Vandurwaal rad
4. Ionic Rad

Covalent Radius



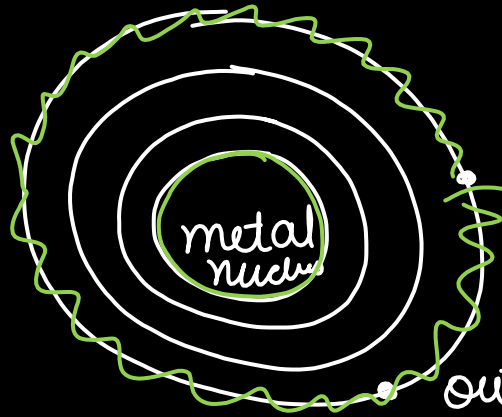
$$\frac{\text{dis b/w 2 Nuclei}}{2}$$

Covalent bonded atom

H_2 

$$r_H = \frac{d}{2}$$

Metallic Radius.



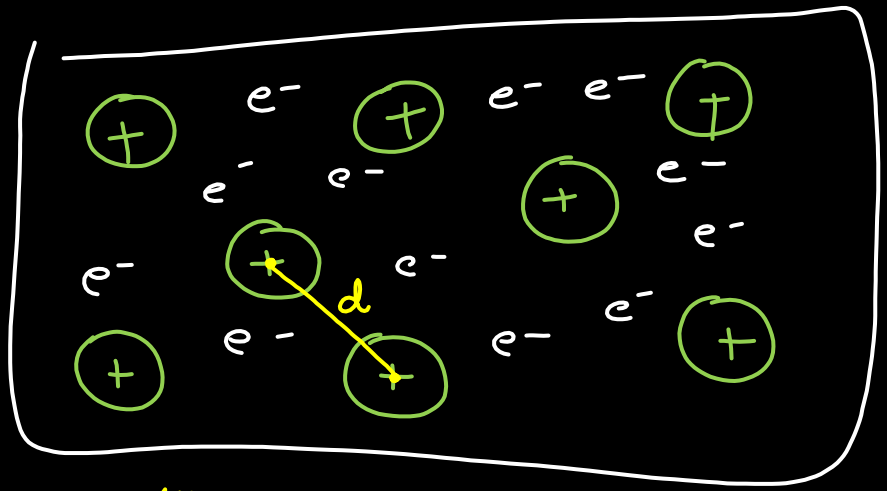
remove

Metallic bonding

e⁻ sea model.

Kernel → +ve

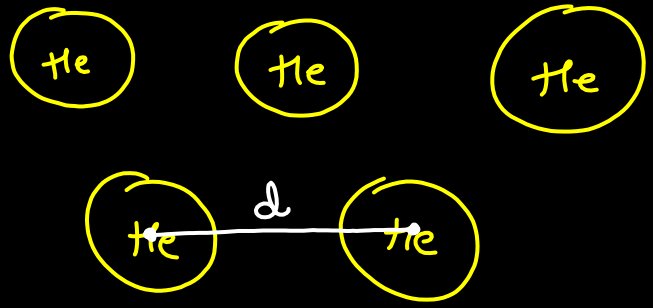
metal nucleus + all e⁻s other than valence e⁻



Metallic Radius $= \frac{d}{2}$

Vandurwaal radius

non-bonded atoms / inert gases

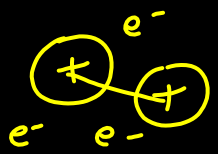


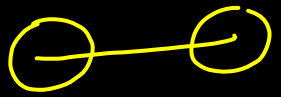
$\frac{d}{2}$

Ionic radius

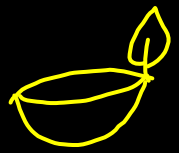
A		A^+		A^-	
Protons = (Z)	12	Z	12	Z	12
e^- = (Z)	12	Z - 1	11	Z + 1	13

$$A^+ < A < A^-$$





covalent << metallic << vandrwaal rad



Factors ⟷ Atomic Radius

1. Z_{eff} ↑
   Fatt ↑
   dis ↓
   atomic Rad ↓

2. no. of shells ↑
   Fatt ↓
   dis ↑
   atomic rad ↑

C—C C=C C≡C

Bond multiplicity bonds ↑ att ↑ At rad ↓

TRENDZ

Li > Be > B > C > N > O > F < Ne

In a period 1 to r

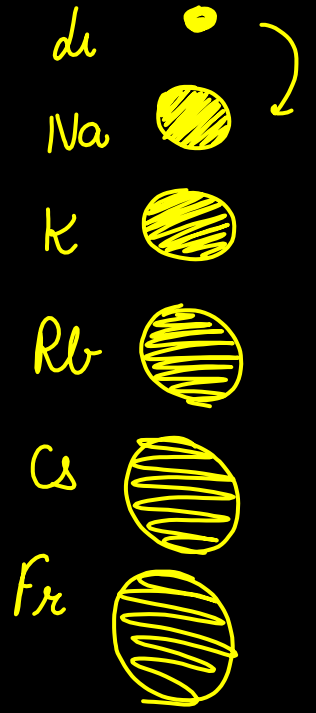
Z_{eff} ↑

I_P ↑

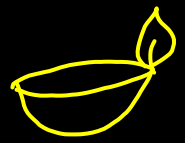
no of shells =

at Rad ↓

Trends



down the gp
no. of shells ↑
→ Zeff ↑
→ Fati ↓
Size ↑



Trendz

group 13

$B < Al > Ga < In < Tl$

B
↓
Al — size ↑
↓
Ga — 3d e⁻s → Poor shielding
↓
In — 4d, more e⁻s → Shielding ↓
↓
Tl

Trendz

group 14

B C
Al Si
Ga ~ Ge
In Sn
Tl Pb

Z_{eff} ↑
Size ↑
f ↓

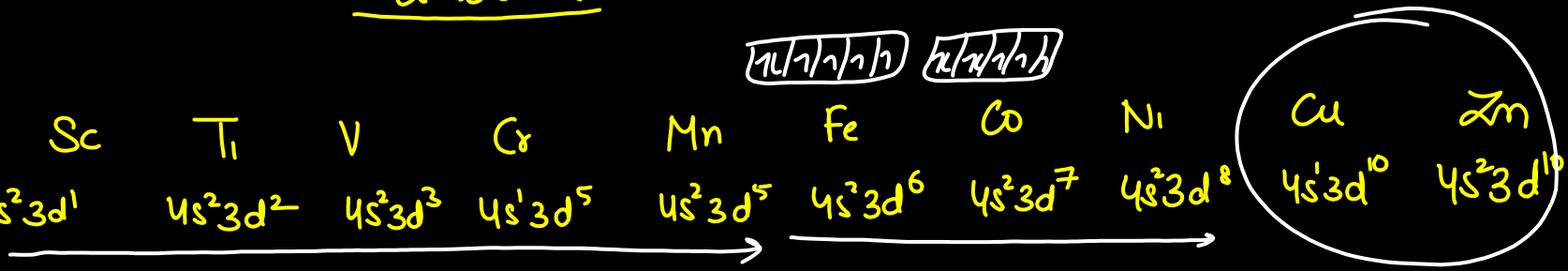
C < Si < Ge < Sn < Pb

group 15

N < P < As < Sb < Bi

Trends of d-block

Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
$4s^2 3d^1$	$4s^2 3d^2$	$4s^2 3d^3$	$4s^1 3d^5$	$4s^2 3d^5$	$4s^2 3d^6$	$4s^2 3d^7$	$4s^2 3d^8$	$4s^1 3d^{10}$	$4s^2 3d^{10}$

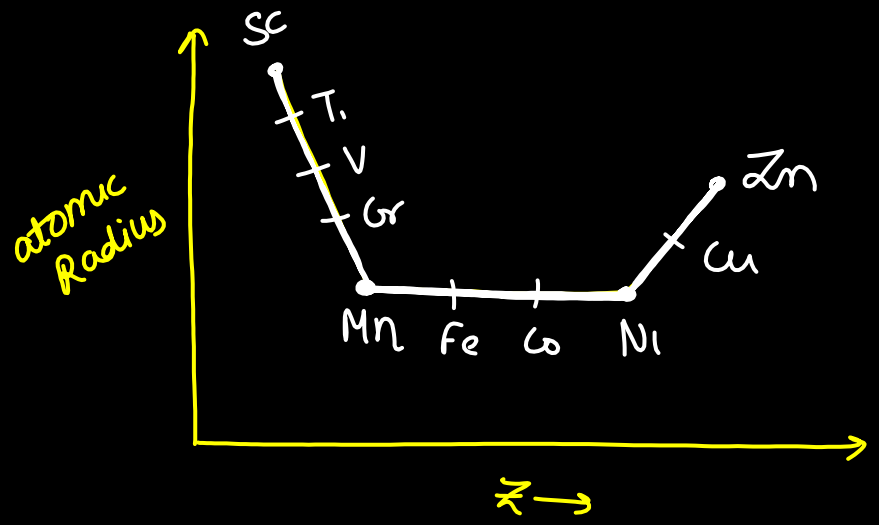


l to r, d e^- ↑, d = Poor shielders, Z_{eff} ↑ size ↓

l to r, no of unpaired e^-, metallic bond ↑, att ↑, size ↓

#SVshortcut

Boat graph
नाव



Trendz:

3d → 4d

Z_{eff} ↑

no of shells ↑ → dominating

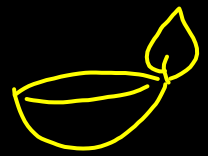
4d → 5d

no of shells ↑

4f e^- → V.V V poor shielding

Z_{eff} ↑↑↑ → dominating

★ 3d < 4d ≃ 5d



Trendz

4f series

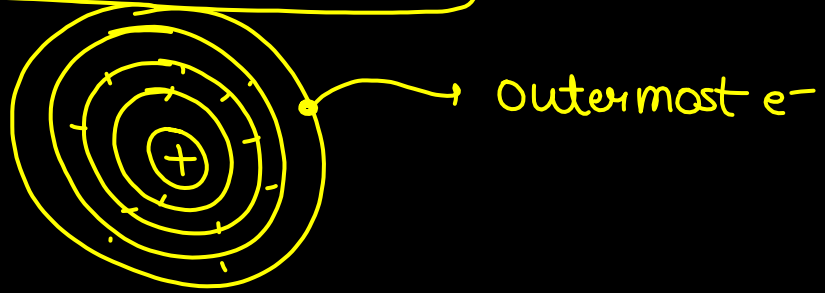
La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu

l to r
no of e^- ↑
Poor shielding
Z_{eff} ↑
no of shells same
Fall ↑
size ↓

Lanthanoid Contraction
Actinide Contraction

Ionization energy

atom, ground state, Gaseous isolated



Successive I.E

$A \longrightarrow e^- + A^+ \quad IE_1$

$A^+ \longrightarrow e^- + A^{2+} \quad IE_2$

$A^{2+} \longrightarrow e^- + A^{3+} \quad IE_3$

$IE_1 < IE_2 < IE_3$

factors ⟷ I.E

1 Z_{eff}

Z_{eff} ↑
atd ↑
I.E. ↑

2 Size ↑
atd ↓
I E ↓

Special 234

Sp 234

Penetration Power $s > p > d > f$

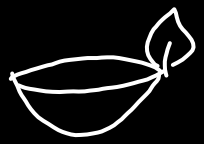
पड़ोसी

Be > B

$1s^2 2s^2$ > $1s^2 2s^2 2p^1$

Mg > Al

$1s^2 2s^2 2p^6 3s^2$



half / fully

If N > 0

Trends

IE

Li < Be > B < C < N > O < F < Ne

s^1 s^2 s^2p^1 p^2 p^3 p^4 p^5 p^6

α. to r

Z_{eff} ↑ size ↓ I.E ↑

Li < B < Be < C < O < N < F < Ne

Trends

Li
Na
K
Rb
Cs

- down the gp
- no of shells ↑
- Z_{eff} ↑
- fall ↓ (dominating)
- Size ↑
- IE ↓

Li > Na > K > Rb > Cs

Trend 2

यहाँ पर Be > Mg > Ca > Sr > Ba > Ra

या (actually) Be > Mg > Ca > Sr > Ba < Ra

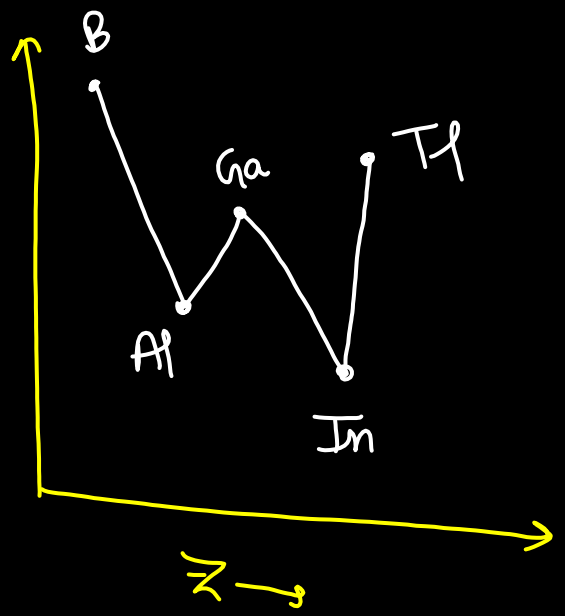
Trendz.

IE

B) Size ↑ att ↓ IE ↓
Al)
Zeff ↑ Size ↓ IE ↑
Ga)
Size ↑ IE ↓
In)
4f e⁻
Tl)
Zeff ↑ att ↑ IE ↑ → W

B > Tl > Ga > Al > In

W sv shortcut



Trends

group 14

$C > Si > Ge > Sn > Pb$

$C > Si > Ge > Sn < Pb$

→ 4f e⁻

group 15

$N > P > As > Sb > Bi$

Inert Pair Effect

6th Period

ns^2np^1

ns^2np^2

gp 13

+1 +3

Al	+3
Ga	+3 +1
In	+3 +1
Tl	+1

gp 14

Si	+4 +2
Ge	+4 +2
Sn	+4 +2
Pb	+2

+4

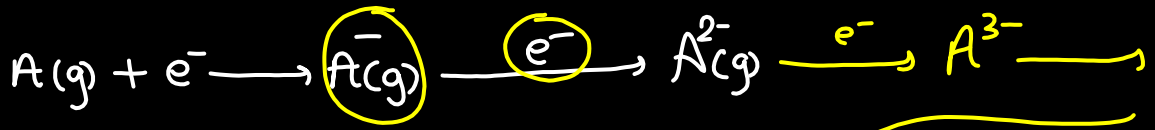
Electron-affinity

$A(g) + e^- \longrightarrow A^-(g)$

Gaseous isolated atom ground state

energy released, EA ⊕

energy req, EA ⊖



Both are possible

EA	EA
⊕	⊖
♥	X
energy release	energy req

EA = ⊖

energy required.

Electron gain enthalpy

EGE

ΔH_{eg}

✡ Change in enthalpy when a gaseous isolated atom gains an e^-

$$A + e^- \longrightarrow A^- \xrightarrow{e^-} A^{-2} \xrightarrow{e^-} A^{-3}$$

energy released: $\Delta H = \ominus$

energy required: $\Delta H = \oplus$

$\Delta H = \oplus$

$\Delta H = \oplus$

Factors ⟷ Electron affinity

1. Z_{eff} ↑
   att ↑ ⟹ ⚡ ↑
   EA ↑

2. size ↑
   att ↓
   ⚡ ↓
   EA ↓

3. half filled / fully filled already stable
   ⚡ ↓
   EA ↓

Li > Be < B

$1s^2 2s^1$ $1s^2 2s^2$ $1s^2 2s^2 2p^1$

C > N < O

$2s^2 2p^2$ $2s^2 2p^3$ $2s^2 2p^4$

Penetration Power

s >> p > d > f

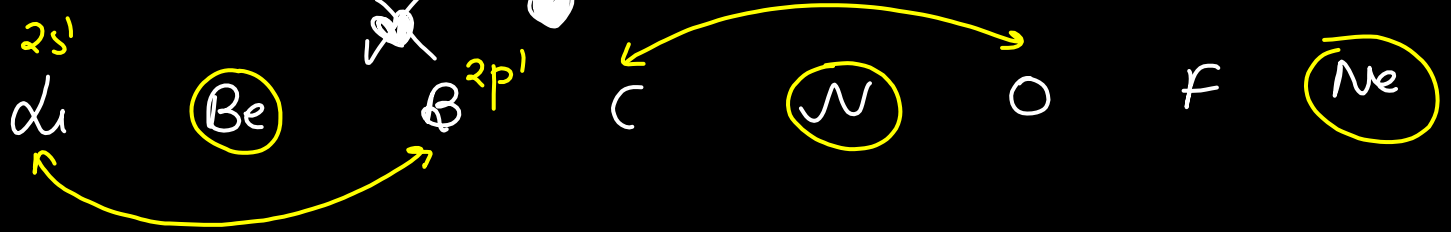
Li > B

$1s^2 2s^1$ $1s^2 2s^2 2p^1$

Trend 2

In a period, EA

-ve +ve



Ne < Be < N < B < Li < C < O < F

E.A

2nd & 3rd Period

f — Size f < Cl

Cl — ea — F < Cl

C N O F — ea

Si P S Cl

Trendz.

group 17

यहाँ F > Cl > Br > I

पर Cl > F > Br > I

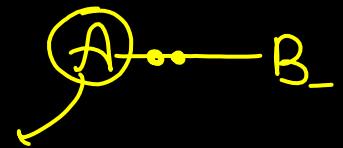
group 16.

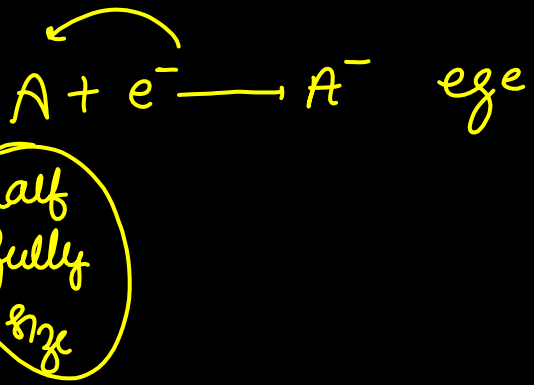
यहाँ O > S > Se > Te

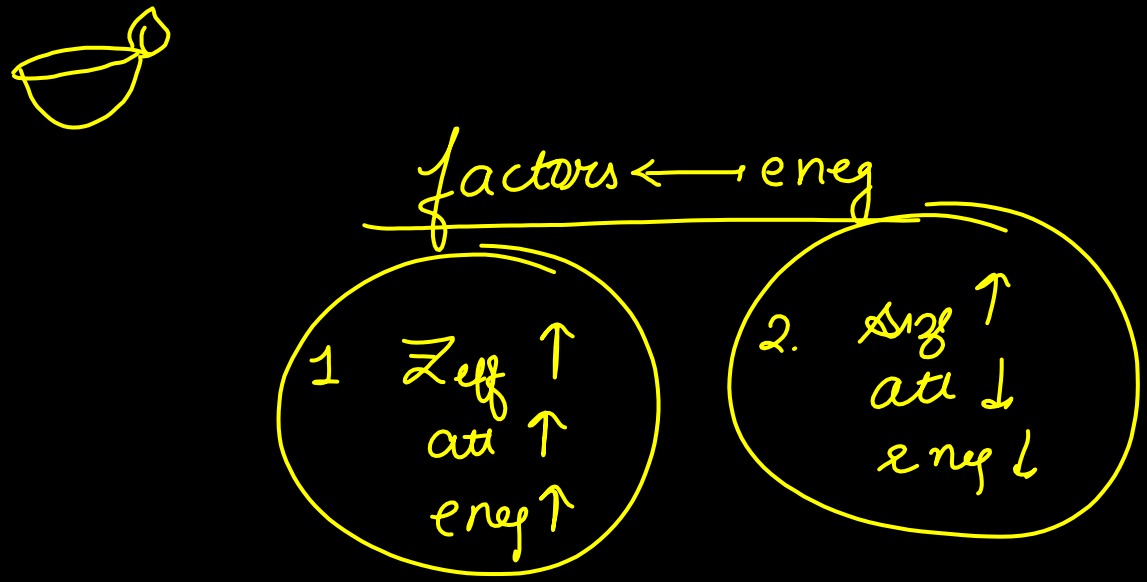
पर S > Se > Te > Po > O

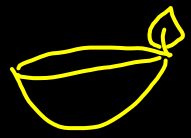
Electronegativity

covalently bonded





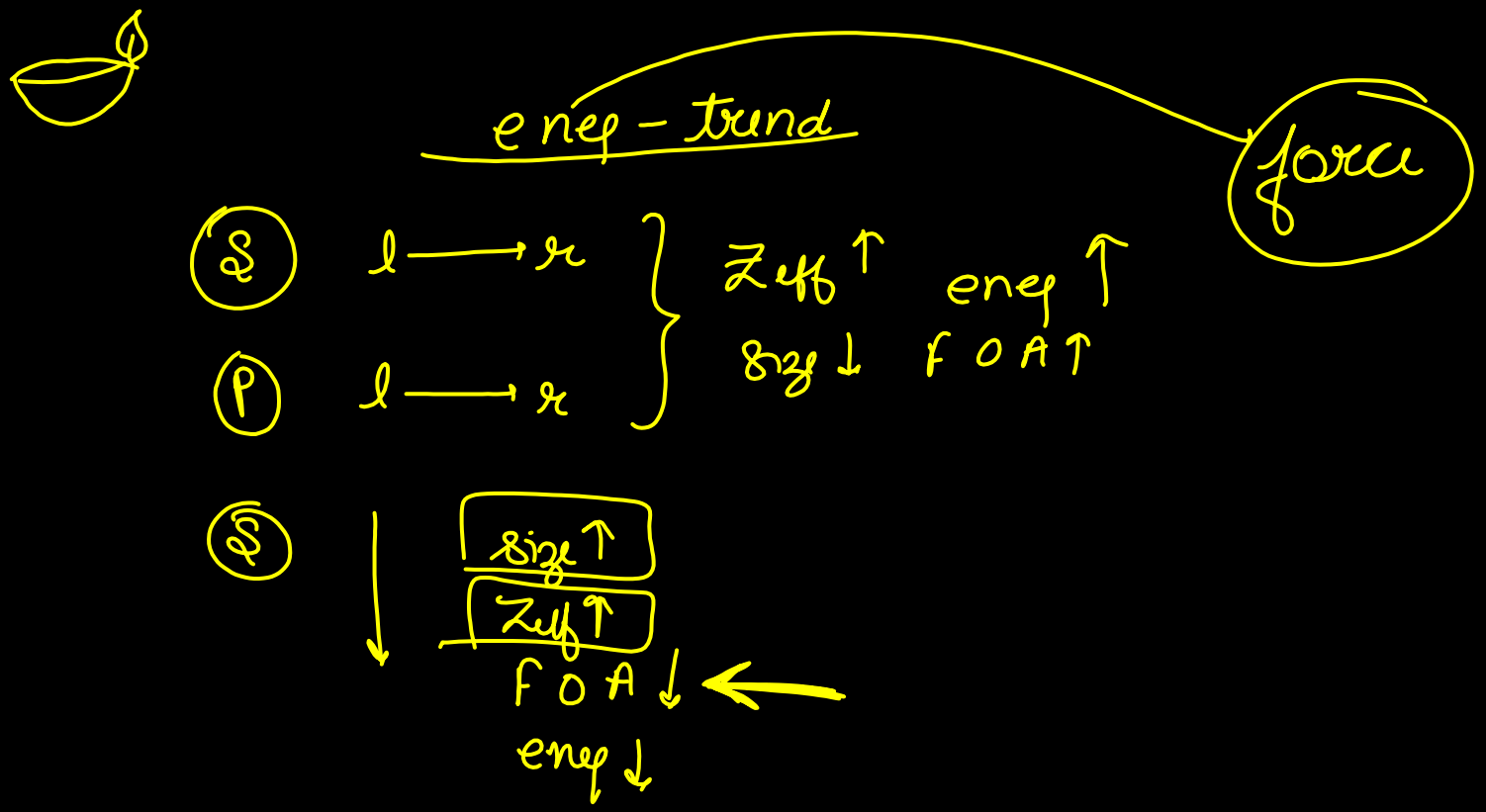

factors ← energy
1 Zeff ↑
at ↑
energy ↑
2. size ↑
at ↓
energy ↓



d

gp 13 | gp 14 | gp 15 | gp 16

$B > Al < Ga < In < Tl$ | $C > Si \simeq Ge \simeq Sn < Pb$ | $N > P > As > Sb \simeq Bi$ | $O > S > Se > Te > Po$


energy - trend
force
S
l → r
P
l → r
Zuf ↑
size ↓
energy ↑
FOA ↑
S
size ↑
Zuf ↑
FOA ↓
energy ↓

d- block

↓

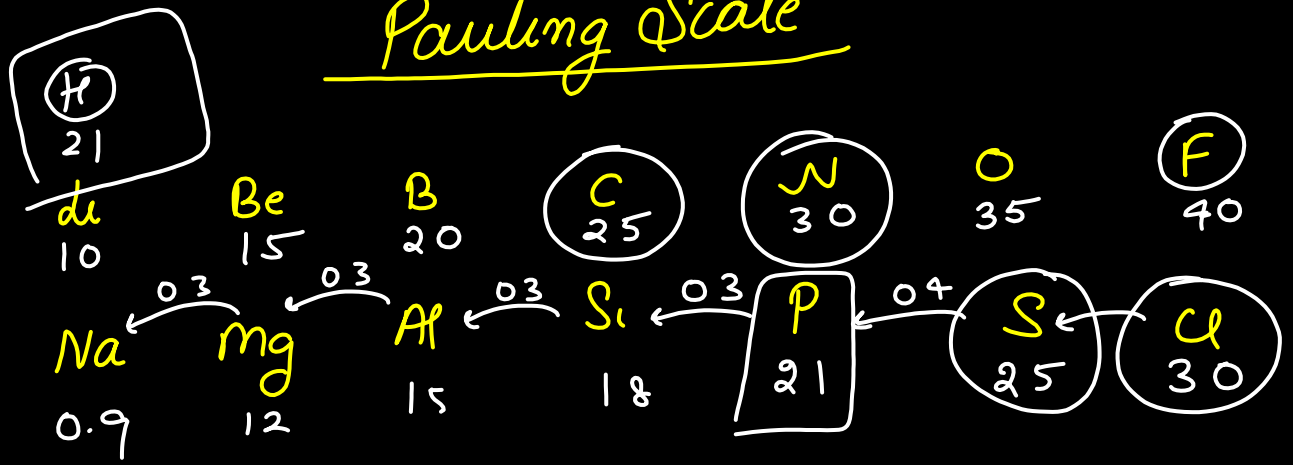
Z_{eff} ↑
r o A ↑
ener ↑

P- block → gp 13

↓

Z_{eff} ↑
r o A ↓

Pauling Scale



Br
2.8

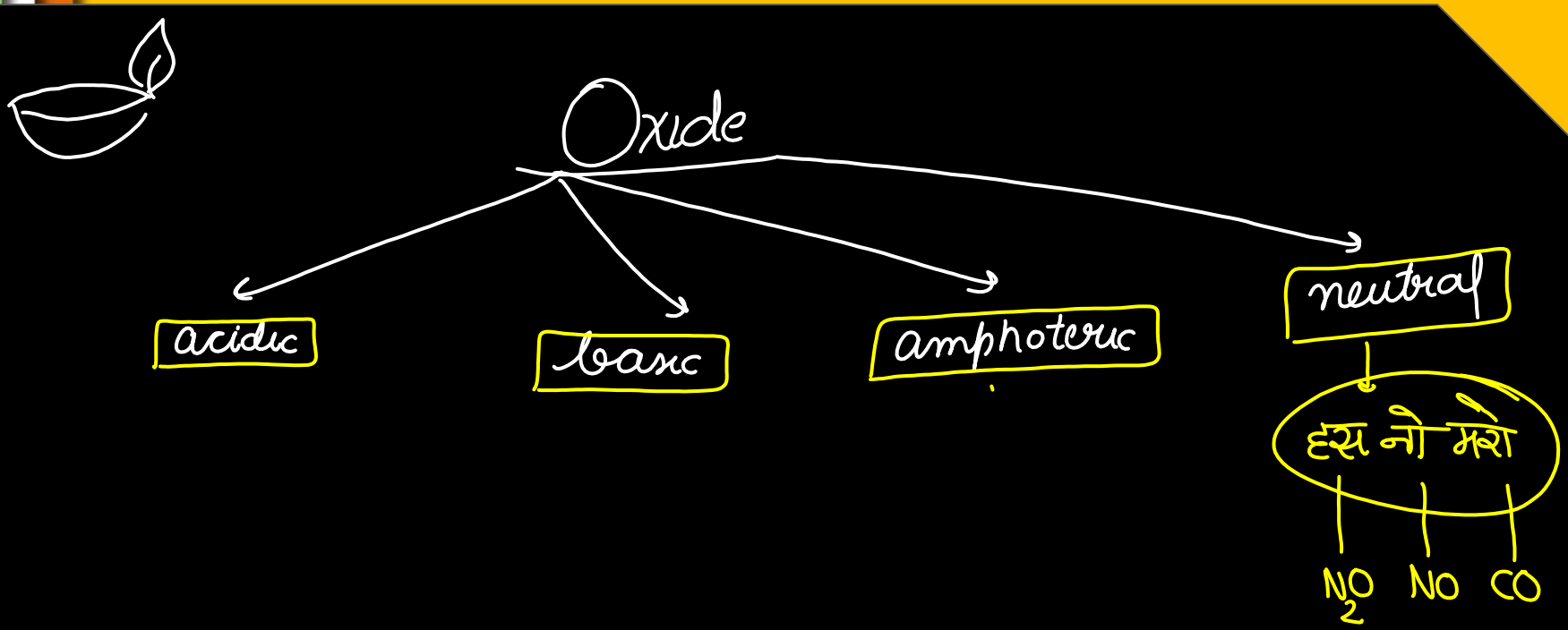
I
2.6

enel

C → N

S → C

P → H


Oxide
acidic
basic
amphoteric
neutral
इस नो मेरो
N_2O
NO
CO

amphoteric oxide

Zindo ho Be Al
गाकर सुनाओ
वरना सब आसानी से
पागल मान लेंगे
& 4 baar मार पिटेगी

Zn Be Al
Ga Cr^{3+} Sn
V^{+5} Sb^{+3} As^{+3}
Pb M^{+4}

Basic oxide

Metal

MOB

1 metal / non-metal / metalloid

2 metal ⟶

→ +1, +2, +3 — basic

+4 ⟶ ampho

5, 6, 7 ⟶ acidic

3 non-metal ⟶ NMOA

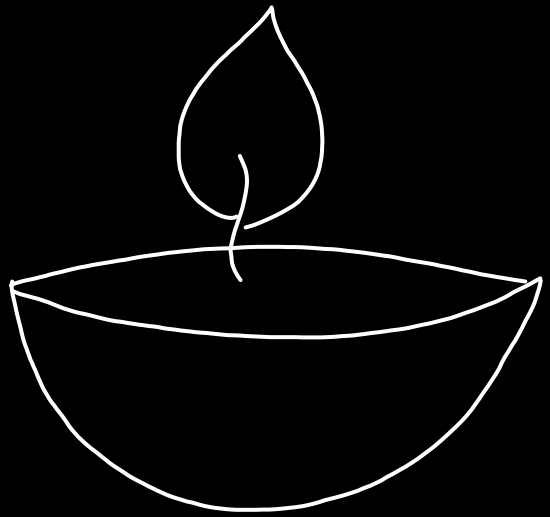
N modi aaO Ahm

4 metalloid

↳ ampho ✓

acidi ✓

–



HAPPY DIWALI