PRAYAS

FOR JEE 2022

Periodic Table

Lecture - 02

AMITABH SIR

TOPICS TO BE COVERED

1. Z effect

Extended or Long Form of the Periodic Table

s-Block Elements ↔ | d-Block Elements ↔ | p-block Elements ↔

Metals | Non Metals | Metalloids

Group →	1A (1)	IIA (2)	IIIB (3)	IVB (4)	VB (5)	VIB (6)	VIIB (7)	VIII (8)	VIII (9)	VIII (10)	IB (3)	IIB (3)	IIIA (13)	IVA (14)	VA (15)	VIA (16)	VIIA (17)	0 (18)
Period 1	1 H 1.0079 Hydrogen																	2 He 4.0026 Helium
2	3 Li 6.940 Lithium	4 Be 9.0122 Beryllium											5 B 10.811 Boron	6 C 12.011 Carbon	7 N 14.007 Nitrogen	8 O 15.999 Oxygen	9 F 18.998 Fluorine	10 Ne 20.180 Argon
3	11 Na 22.990 Sodium	12 Mg 24.305 Magnesium											13 Al 26.982 Aluminium	14 Si 28.086 Silicon	15 P 30.974 Phosphorus	16 S 32.066 Sulphur	17 Cl 35.453 Chlorine	18 Ar 39.948 Argon
4	19 K 39.098 Potassium	20 Ca 40.078 Calcium	21 Sc 44.956 Scandium	22 Ti 47.867 Titanium	23 V 50.941 Vanadium	24 Cr 51.996 Chromium	25 Mn 54.938 Manganese	26 Fe 55.847 Iron	27 Co 58.693 Cobalt	28 Ni 58.693 Nickel	29 Cu 63.546 Copper	30 Zn 65.39 Zinc	31 Ga 69.723 Gallium	32 Ge 72.61 Germanium	33 As 74.922 Arsenic	34 Se 78.96 Selenium	35 Br 79.904 Bromine	36 Kr 83.80 Krypton
5	37 Rb 85.468 rubidium	38 Sr 87.62 Strontium	39 Y 88.906 Boron	40 Zr 91.224 Zirconium	41 Nb 92.906 Niobium	42 Mo 95.94 Molybdenum	43 Tc 98 Technetium	44 Ru 101.07 Ruthenium	45 Rh 102.91 Rhodium	46 Pd 106.42 Palladium	47 Ag 107.87 Silver	48 Cd 112.41 cadmium	49 In 114.82 Indium	50 Sn 118.71 Tin	51 Sb 121.76 antimony	52 Te 127.60 Tellurium	53 I 126.90 Iodine	54 Xe 131.29 Xenon
6	55 Cs 132.91 Caesium	56 Ba 137.33 Barium	57 La 138.91 Lanthanum	72 Hf 178.49 Hafnium	73 Ta 180.95 tantalum	74 W 183.84 tungsten	75 Re 186.21 osmium	76 Os 190.23 Osmium	77 Ir 192.22 Iridium	78 Pt 195.08 Platinum	79 Au 196.97 Gold	80 Hg 200.59 Mercury	81 Tl 204.38 Thallium	82 Pb 207.2 Lead	83 Bi 208.98 Bismuth	84 Po 208.98 Polonium	85 At 210 Astatine	86 Rn 222 Radon
7	87 Fr 223 Francium	88 Ra 226 Radium	89 Ac** 227 Actinium	104 Unq 261 Unnilquadium	105 Unp 262 Unnilpentium	106 Unh 266 Unnilhexium	107 Uns 264 Unnilseptium	108 Uno 269 Unniloctium	109 Une 268 Unnilennium	110 Uun 281 Unnilium	111 Uuu 272 Unnilunium	112 Uub 277 Unnilbium						

The symbols for elements 104 109 used in this table are those proposed by the American Chemical Society and 110.112 proposed by IPUAC

↓ Rf

d-Block

d-Block Elements

IIIB (3)	IVB (4)	VB (5)	VIB (6)	VIIB (7)	VIII (8)	VIII (9)	VIII (10)	IB (3)	IIB (3)
21 **Sc** 44.956 Scandium	22 **Ti** 47.867 Titanium	23 **V** 50.941 Vanadium	24 **Cr** 51.996 Chromium	25 **Mn** 54.938 Manganese	26 **Fe** 55.847 Iron	27 **Co** 58.693 Cobalt	28 **Ni** 58.693 Nickel	29 **Cu** 63.546 Copper	30 **Zn** 65.39 Zinc
39 **Y** 88.906 Boron	40 **Zr** 91.224 Zriconium	41 **Nb** 92.906 Niobium	42 **Mo** 95.94 Molybdenum	43 **Tc** 98 Technetium	44 **Ru** 101.07 Ruthenium	45 **Rh** 102.91 Rhodium	46 **Pd** 106.42 Palladium	47 **Ag** 107.87 Silver	48 **Cd** 112.41 cadmium
57 **La** 138.91 Lanthanum	72 **Hf** 178.49 Hafnium	73 **Ta** 180.95 tantaium	74 **W** 183.84 tungsten	75 **Re** 186.21 osmium	76 **Os** 190.23 Osmium	77 **Ir** 192.22 Iridium	78 **Pt** 195.08 Platinum	79 **Au** 196.97 Gold	80 **Hg** 200.59 Mercury
89 **Ac**** 227 Actinium	104 **Unq** 261 Unniquadium	105 **Unp** 262 Unnipentum	106 **Unh** 266 Unnihenium	107 **Uns** 264 Unniseptium	108 **Uno** 269 Unnioctium	109 **Une** 268 Unniennium	110 **Uun** 281 Unnrium	111 **Uuu** 272 Unnurium	112 **Uub** 277 Ununbium

d-Block

(a) Last electron enters into (n – 1)d orbital are called d-block elements.

(b) The general electronic configuration $(n-1)s^2, p^6, d^{1-10}, ns^{1-2}$

$(n-1)d^{1\text{ to }10}\ ns^{1\text{ or }2}$

(c) The d-block elements are placed in the groups named IIIB, IVB, VB, VIB, VIIB, VIII, IB and IIB.

(d) All of these elements are metals.

(e) d-block elements lies between s & p block elements.

(f) Volatile metal Zn, Cd, Hg

(g) Coin metal Cu, Ag, Au

(h) Noble metal Ag, Au, Hg, Pt

(i) First man made element Tc

(j) Best electricity conductor among metals Ag

(k) Maximum oxidation state +8 (Os, Ru)

(l) Maximum density (Os < Ir)

All transition elements are called d-block elements but vice-versa is not true. Zn, Cd, Hg are d-block elements but not transition elements. Reason d-orbitals are fully field in ground state or in excited state.

Q.S.P.

IB

Cu $\longrightarrow$ +1, +2

Ag $\longrightarrow$ +1, +3

Au $\longrightarrow$ +1 +3

$\overset{+2}{AgF_2}$

$\overset{+5}{AuF_5}$

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

$Zn^{+2} \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^0$

$Cu \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$

$Cu^{+} \rightarrow$ —〃— —〃— $3d^{10} 4s^0$ ✓

$Cu^{+2} \rightarrow$ —〃— —〃— $3d^9 4s^0$

f-Block

6	**Lanthanide series	58 Ce 140.12 Cerium	59 Pr 14091 Praseodymium	60 Nd 144.24 Neodymium	61 Pm 145 Promethium	62 Sm 150.96 Samarium	63 Eu 151.96 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.92 terbium	66 Dy 162.50 dysprosium	67 Ho 164.93 Holmium	68 Er 167.26 Erbium	69 Tm 168.934 Thulium	70 Yb 173.04 Ytterbium	71 Lu 174.97 Lutetium
7	**Actinide Series	90 Th 232.4 Thorium	91 Pa 231.04 protactinium	92 U 238.03 Uranium	93 Np 237 Neptunium	94 Pu 244 Plutonium	95 Am 243 Americium	96 Cm 247 Curium	97 Bk 247 berkelium	98 Cf 251 Californium	99 Es 252 Einsteinium	100 Fm 257 Fermium	101 Md 258 Mendelevium	102 No 259 Nobelium	103 Lr 262 Lawrencium

(a) Last electron enters into (n – 2) f-orbital are called f- block elements.

(b) The general electronic configuration of these elements is $(n-2)f^{1-14}$, $(n-1)d^{0-1}$, ns^{1-2}.

(c) Lanthanides: 58 to 71.

(d) Actinides : 90 to 103.

(e) The lanthanides occur in nature in low abundance and therefore, these are called rare earth elements.

(f) All the actinide elements are radioactive.

★(g) Pm is the only synthetic radioactive lanthanide.

★(h) Th, Pa and U first three actinides are natural elements.

(i) Most poisonous element : Pu

★(j) Maximum stable oxidation state +6 (U)

★(k) Maximum unstable oxidation state +7 (Np & Pu)

Q.S.P

(a) 2nd period elements (Li, Be, B) shows diagonal relationship with 3rd period elements (Mg, Al, Si).

(b) 3rd period elements (Na, Mg, Al, Si, P, S, Cl) except inert gases are called typical elements because they represent the properties of other element of their respective groups.

(c) Representative or normal elements

(i) Outermost shell of these elements is incomplete. The number of electrons in the outermost shell is less than eight.

(ii) s and p-block elements except inert gases are called normal or representative elements.

(d) Transuranic Elements :

All the elements after atomic number 92 (i.e. U_{92}) are transuranic elements.

All transuranic elements are radioactive & artificial.

(e) Bridge elements have similar electronic configuration and group nomenclature e.g.

Acc to M.P.T

(f) Atomicity : Number of atoms in a molecule.
Example :

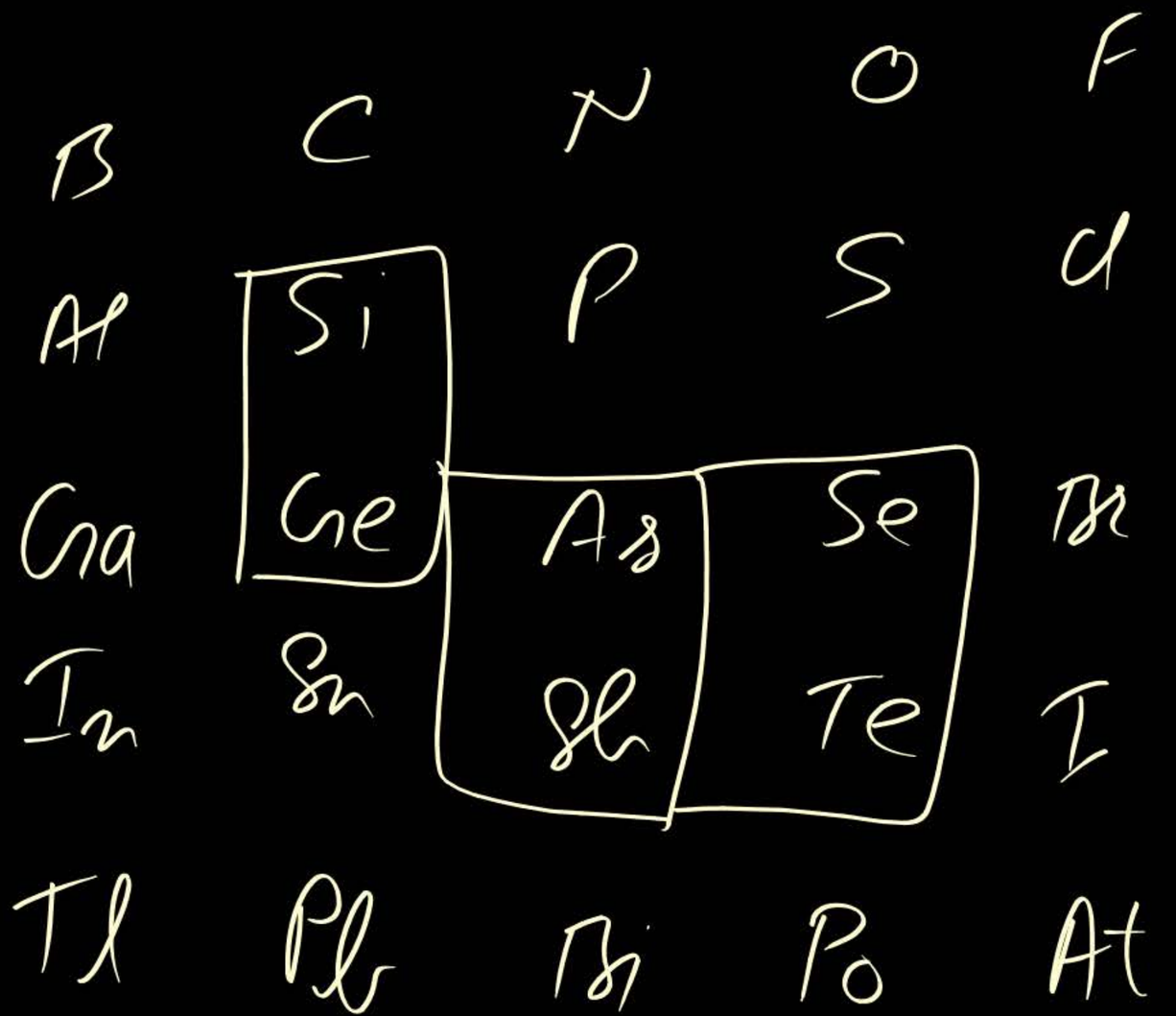
S_8	Se_8	Te_8	Po	
N_2	O_2	H_2	X_2	[X → F, Cl, Br, I]
P_4	As_4	Sb_4	Bi	

(D) → B_{12}

(g) Metalloid : Element which shows both metallic and non-metallic property
Example : Si, Ge, As, Sb, Se, Te

(h) Compound : Made up of two or more than two different type of atom.
Example :

H_2O	oxidane	NH_3	azane	PH_3	phosphane
CH_4	methane	BH_3	borane	PbH_4	plumbane


B C N O F
Al Si P S Cl
Ga Ge As Se Br
In Sn Sb Te I
Tl Pb Bi Po At

Defects

(a) Position of hydrogen in not settled.

(b) Position of helium cannot be justified. It is the only element which belong to s-block but placed in p-block.

(c) Lanthanides & Actinides have not been given space in the main bod of periodic table.

Nomenclature of elements :

(a) IUPAC gave names to elements above atomic number 100 as follows-

0	1	2	3	4	5	6	7	8	9
Nil	Un	Bi	Tri	Quad	Pent	Hex	Sept	Oct	en

(b) In all the elements suffix is – ium.

Ex.

Atomic No.	IUPAC Name	Symbol	Elemental Name	Symbol
101	Unnilunium	Unu	Mendelevium	Md
102	Unnilbium	Unb	Nobelium	No
103	Unniltrium	Unt	Lawrencium	Lr
104	Unnilquadium	Unq	Rutherfordium	Rf
105	Unnilpentium	Unp	Dubnium	Db
106	Unnilhexium	Unh	Seaborgium	Sg
107	Unnilseptium	Uns	Bohrium	Bh
108	Unniloctium	Uno	Hassnium	Hs
109	Unnilennium	Une	Meitnerium	Mt
110	Ununnilium	Uun	Darmstadtium	Ds

Q The atomic number of the element unnilennium is :

[JEE-Main (Sept.) 2020]

A 108

B 109

C 119

D 102

$en \rightarrow 9$

Sol. (B)

Exception of electronic configuration :

(1) $Cr_{24} \rightarrow 1s^2, 2s^2, 2p^6, 3s^2\ 3p^6 3d^5, 4s^1$

(2) $Cu_{29} \rightarrow 1s^2, 2s^2, 2p^6, 3s^2\ 3p^6 3d^{10}, 4s^1$

(3) $Nb_{41} \rightarrow [Kr]4d^4 5s^1$

(4) $Mo_{42} \rightarrow [Kr]4d^5 5s^1$

(5) $Ru_{44} \rightarrow [Kr]4d^7 5s^1$

(6) $Rh_{45} \rightarrow [Kr]4d^8 5s^1$

(7) $Pd_{46} \rightarrow [Kr]4d^{10} 5s^0$

(8) $Ag_{47} \rightarrow [Kr]4d^{10} 5s^1$

(9) $La_{57} \rightarrow [Xe]5d^1 6s^2$

(10) $Ce_{58} \rightarrow [Xe]4f^1 5d^1 6s^2$

(11) $Gd_{64} \rightarrow [Xe]4f^7 5d^1 6s^2$

(12) $Pt_{78} \rightarrow [Xe]4f^{14} 5d^9 6s^1$

(13) $Au_{79} \rightarrow [Xe]4f^{14} 5d^{10} 6s^1$

(14) $Ac_{89} \rightarrow [Rn]6d^1 7s^2$

(15) $Th_{90} \rightarrow [Rn]6d^2 7s^2$

(16) $Pa_{91} \rightarrow [Rn]5f^2 6d^1 7s^2$

(17) $U_{92} \rightarrow [Rn]5f^3 6d^1 7s^2$

(18) $Np_{93} \rightarrow [Rn]5f^4 6d^1 7s^2$

(19) $Cm_{96} \rightarrow [Rn]5f^7 6d^1 7s^2$

(20) $Ds_{110} \rightarrow [Rn]5f^{14} 6d^9 7s^1$

(21) $Rg_{111} \rightarrow [Rn]5f^{14} 6d^{10} 7s^1$

T.S

I Sc ---------- Zn

II Y ---------- Cd

III La ---------- Hg

IV Ac

2, 8, 8, 18, 18, 32

	IA
1	H
2	Li
8	Ne
8	K
18	Rb
18	Cs
32	Fr

	IIA
Be	8
Mg	8
Ca	8
Sr	18
Ba	18
Ra	32

	IIB
30	Zn
48	Cd
80	Hg

18	
32	

B	8
Al	18
Ga	18
In	18
Tl	32

Identification of group, period and block :

The last electron enters in which subshell gives idea of its block.

Period number = Principal quantum number of valence shell electron in ground state electronic configuration. (Higher value of n)

Group number for s block = number of valence shell electrons

Group number for p block = 10 + number of valence shell electrons

Group number for d block = number of electrons [ns + (n – 1)d]

Group number for f-block = 3

Ex → $3d^7 4s^2$ (5th)

4f → Lath. 5f Act. → IIIB

S-Block ns^1 / ns^2

$n \rightarrow$ Period

no of $e^- \rightarrow$ gr no

Q ⇒ $4s^1$

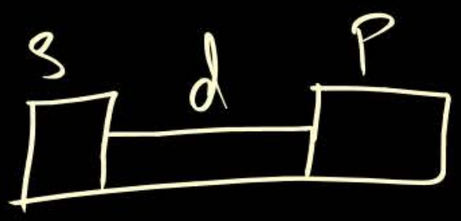
$4^{th} \rightarrow$ Period

gr $\rightarrow$ IA

Block $\rightarrow$ S

P-Block

$ns^2 np^{1 \text{ to } 6}$



$12+x$ → no of e^- in P orbital

$n \rightarrow$ Period

Block → P

no of e^- in $ns+np$

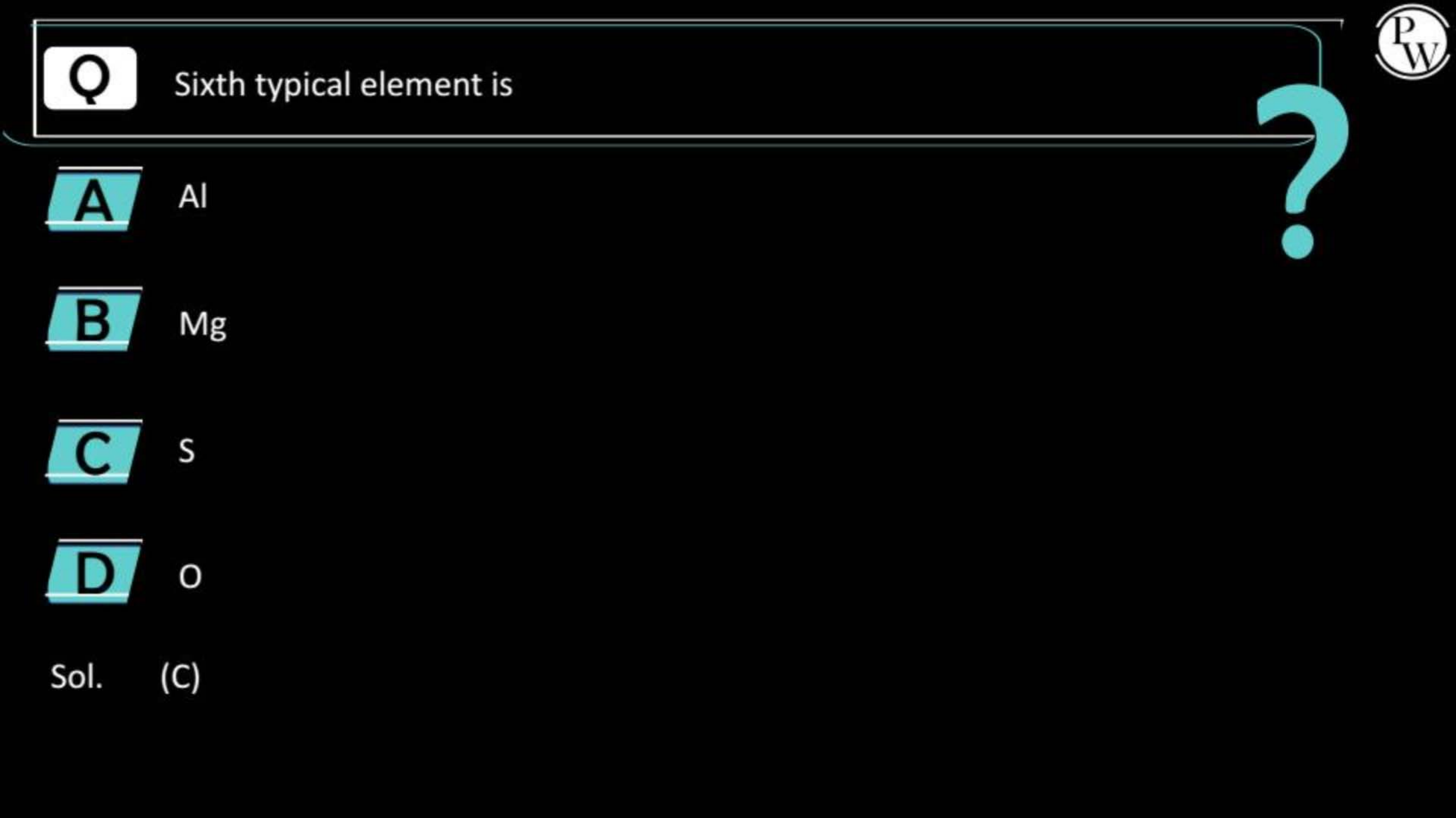
$3s^2 3p^3$

Period → 3

Block → P

gr no → V A / 15

Q Sixth typical element is



A Al

B Mg

C S

D O

Sol. (C)

Q Which of the following statement is wrong

A All the actinides are synthetic (man made) elements

B In the Lanthanides last electron enters in 4f orbitals

C 3^{rd} period elements are typical elements

D Lanthanum is d-block element

Sol. (A)

Q According to the Periodic law of elements, the variation in properties of elements is related to their **[AIEEE-2003]**

A Nuclear masses

B Atomic numbers

C Nuclear neutron-proton number ratio

D Atomic masses

Sol. (B)

Q In the long form of the periodic table, the valence shell electronic configuration of $5s^2 5p^4$ corresponds to the element present in:

[JEE-MAIN 2015 (On-Line)]

A Group 16 and period 5

B Group 17 and period 6

C Group 17 and period 5

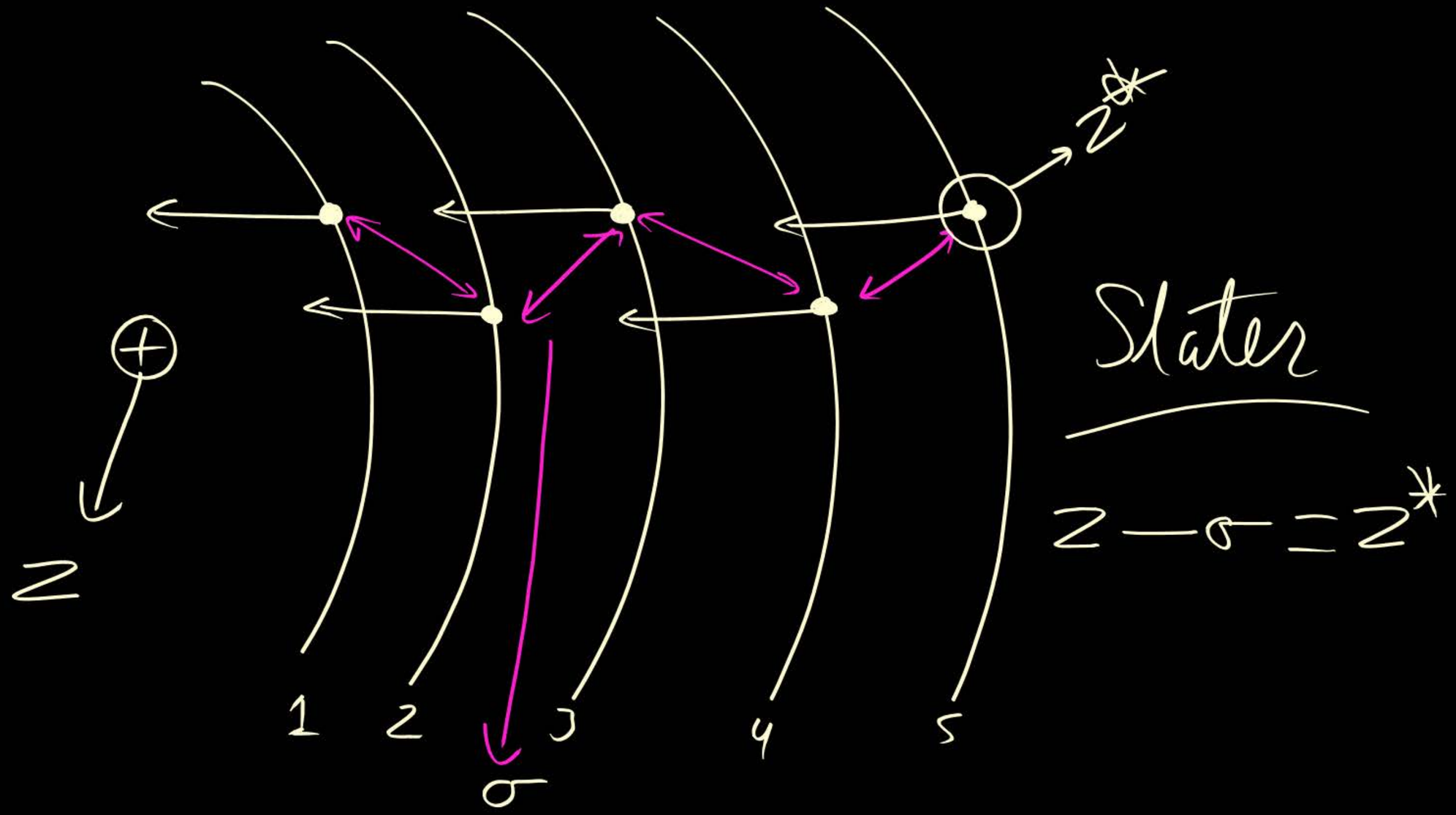
D Group 16 and period 6

$5s^2 5p^4$

16

Sol. (A)

SCREENING EFFECT (s) AND EFFECTIVE NUCLEAR CHARGE (Z_{eff}) :



(a) Valence shell electron suffer force of attraction due to nucleus and force of repulsion due to inner shell electrons.

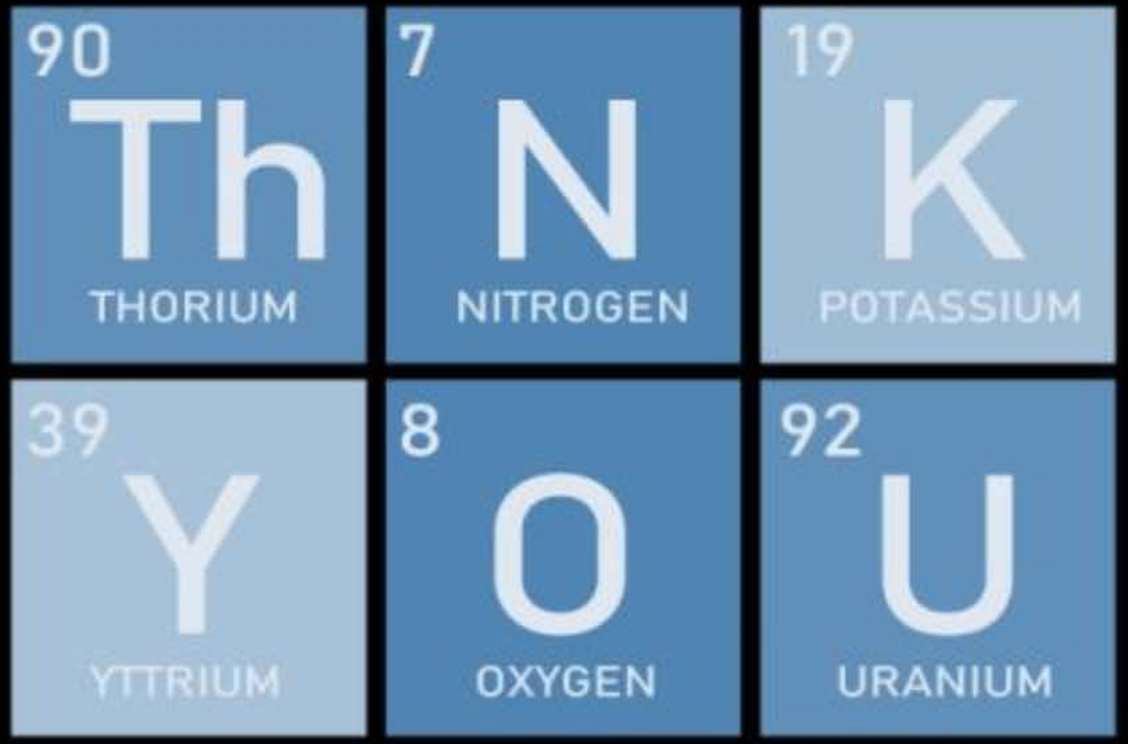
(b) The decrease in force of attraction on valence electron due to inner shell electron is called **screening effect** or **shielding effect**

(c) Due to screening effect, net attractive force felt by the test electron is measured by effective nuclear charge, (Z_{eff})

(d) If nuclear charge = Z, then effective nuclear charge = $Z - \sigma$

(Where σ 'sigma' is called screening/shielding constant)

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


90
Th
THORIUM
7
N
NITROGEN
19
K
POTASSIUM
39
Y
YTTRIUM
8
O
OXYGEN
92
U
URANIUM