Class-11th + 12th

Kattar Advanced

EaJEE NOTES

for

INORGANIC CHEMISTRY

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Pyare ARJUNA
Tere PRAYAS se hi
LAKSHYA Bheda Jayega

JEE Main & Advanced
Theory and PYQ's

Best
BACKLOG KILLER
Notes

Contents

मैं ज्वाला हूँ
बुझी राख नहीं,
मैं कर्म के साथ हूँ
किस्मत के हाथ नहीं।

Scan the QR code to access detailed content of 3 chapters of JEE Advanced Syllabus (Hydrogen, s-Block, General Principles and Processes of isolation of Elements).

1 Classification of Elements and Periodicity in Properties

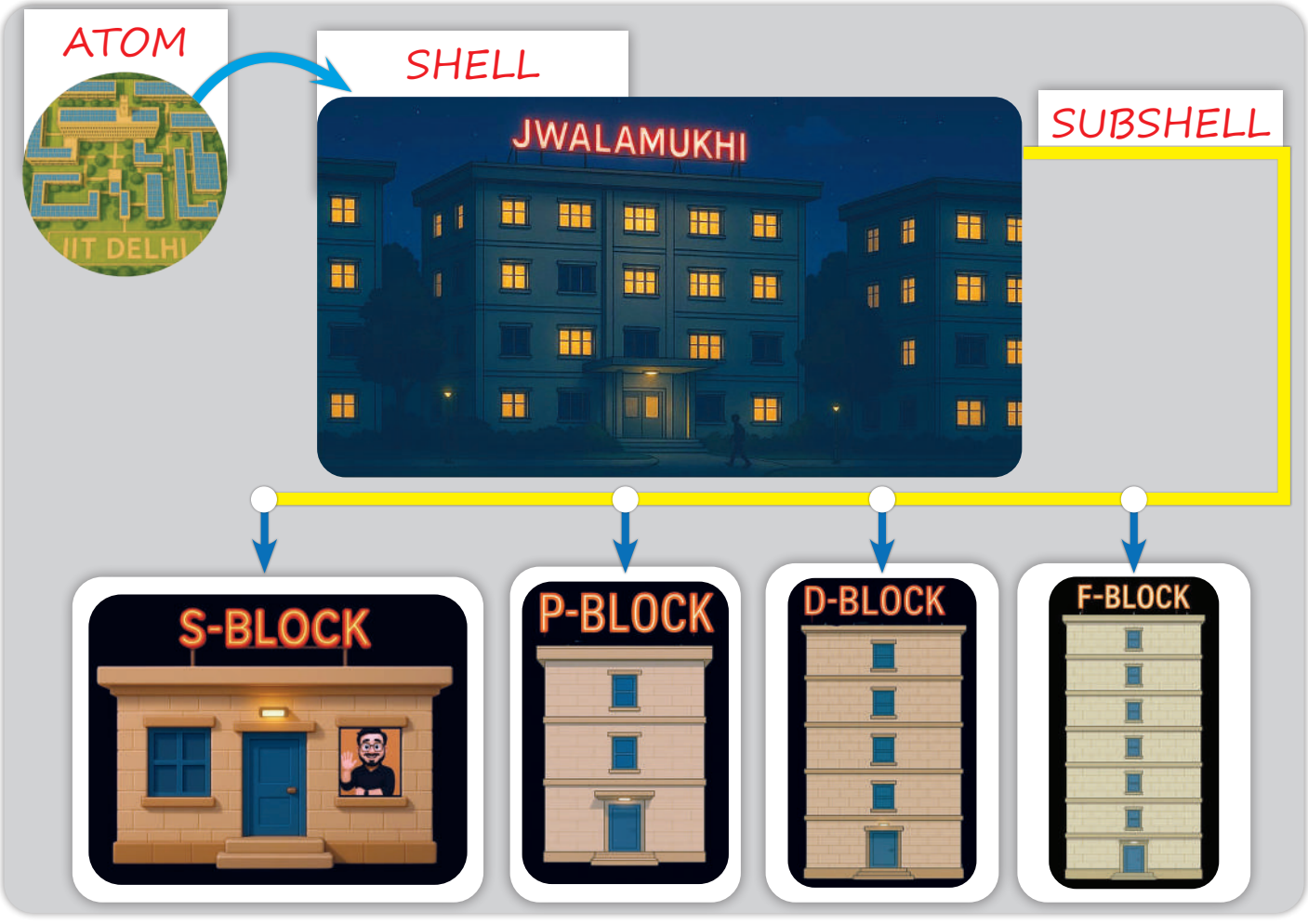
(JEE Advanced)

Syllabus

Modern periodic law and the present form of periodic table; electronic configuration of elements; periodic trends in atomic radius, ionic radius, ionization enthalpy, electron gain enthalpy, valence, oxidation states, electronegativity, and chemical reactivity.

QUANTUM NUMBERS

The set of four numbers required to defined an electron completely in an atom are called quantum numbers. The first three have been derived from Schrodinger wave equation.

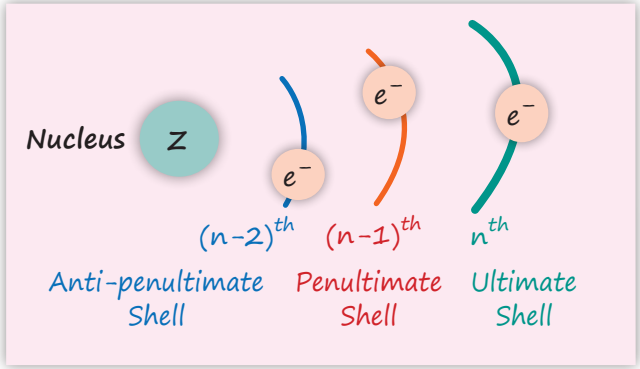


[I] Principal Quantum Number (n)

It describes the size of the electron wave and the total energy of the electron. It has integral values 1, 2, 3, 4... etc. and is denoted by K, L, M, N, ... etc.

Number of subshell present in n^{th} shell = n

n	subshell
1	s
2	s, p
3	s, p, d
4	s, p, d, f



❑ Number of orbitals present in n^{th} shell = n^2

[II] Azimuthal Quantum Number (ℓ)

It describes the shape of electron cloud and the number of subshells in a shell.

♦ It can have values from 0 to [n-1].

♦

Value of l		Subshell
0	→	s
1	→	p
2	→	d
3	→	f
4	→	g

Note

The notations for the sub-energy levels come from the spectroscopic terms that were used to describe the atomic spectra and have the following full form:

s	→ sharp	f	→ fundamental
p	→ principal	g	→ generalized
d	→ diffused		

[III] Magnetic Quantum Number (m)

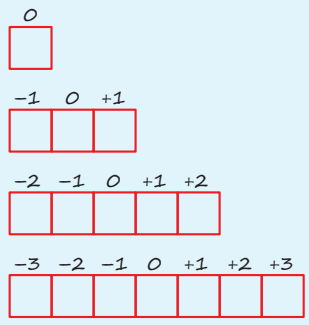
It describes the orientation of an orbital within a subshell. It can have values from $-\ell$ to $+\ell$ including zero, i.e., total $(2\ell + 1)$ values. Each value corresponds to an orbital, s-subshell has one orbital, p-subshell three orbitals (p_x, p_y and p_z), d-subshell five orbitals (d_{xy}, d_{yz}, d_{zx}, $d_{x^2-y^2}$, d_{z^2}) and f-subshell has seven orbitals.

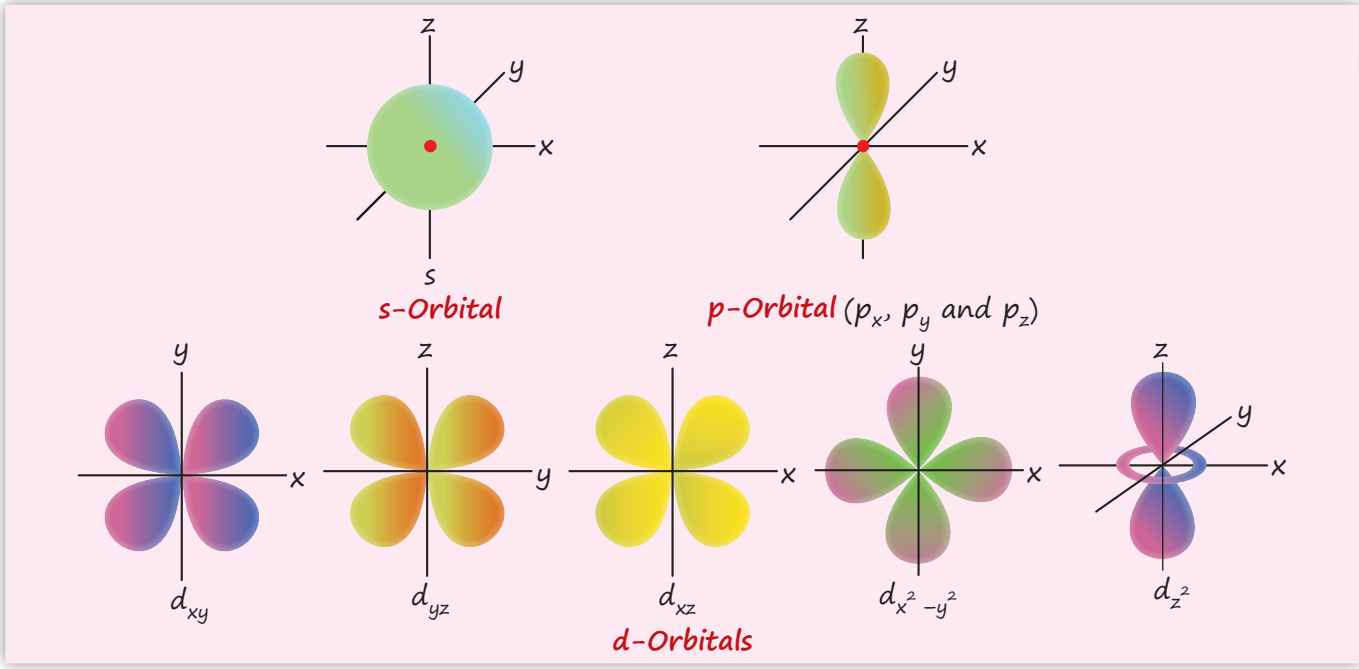
s → ℓ = 0, m = 0

p → ℓ = 1, m = −1, 0, +1

d → ℓ = 2, m = −2, −1, 0, +1, +2

f → ℓ = 3, m = −3, −2, −1, 0, +1, +2, +3

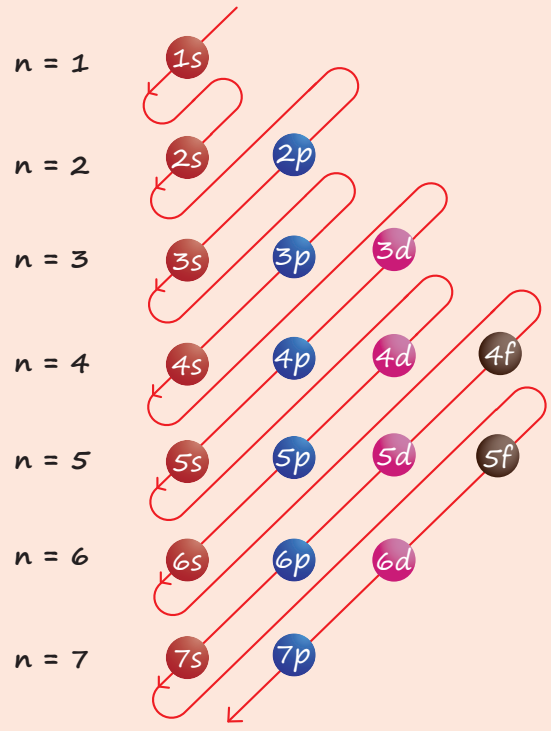




[IV] Spin Quantum Number (s)

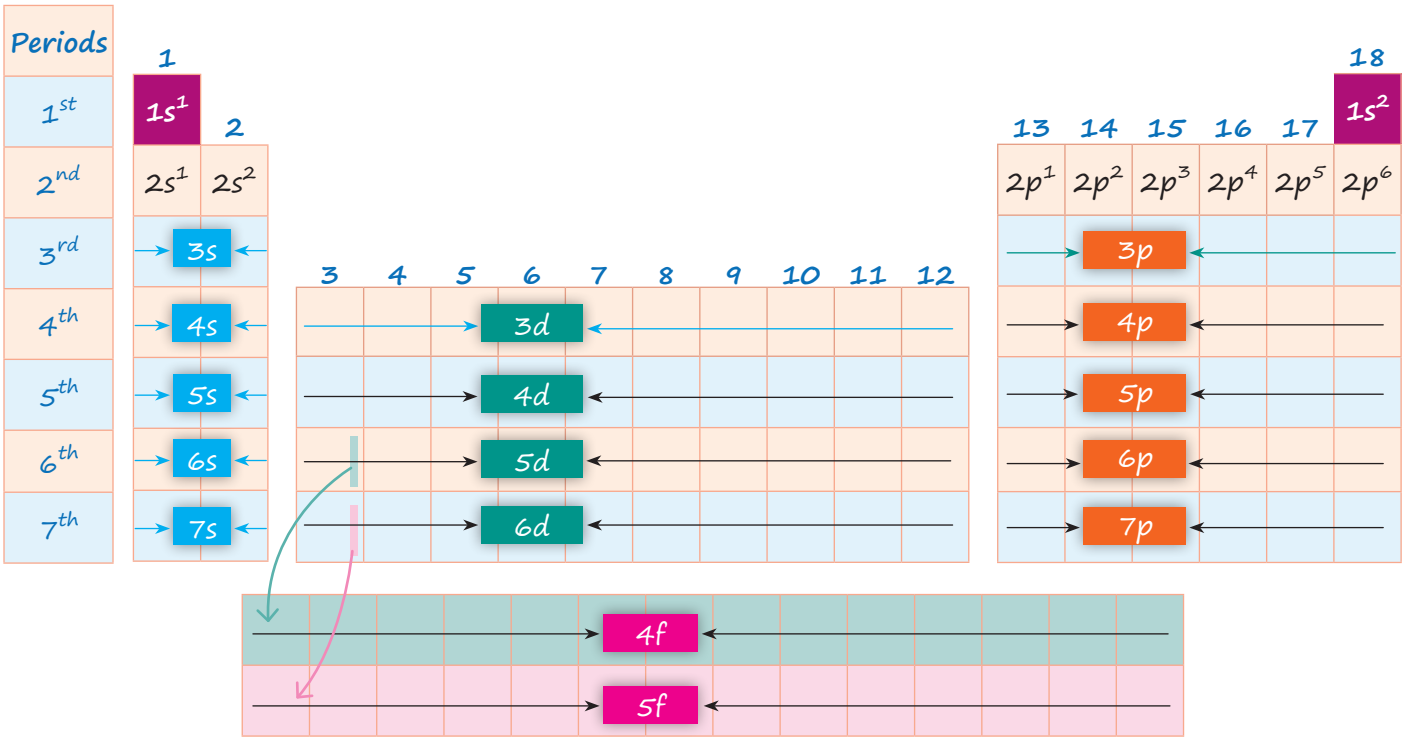
It describes the spin of the electron. It has values +1/2 and −1/2. (+) signifies clockwise spinning and (−) signifies anticlockwise spinning.

n+l RULE AND MODERN PERIODIC TABLE

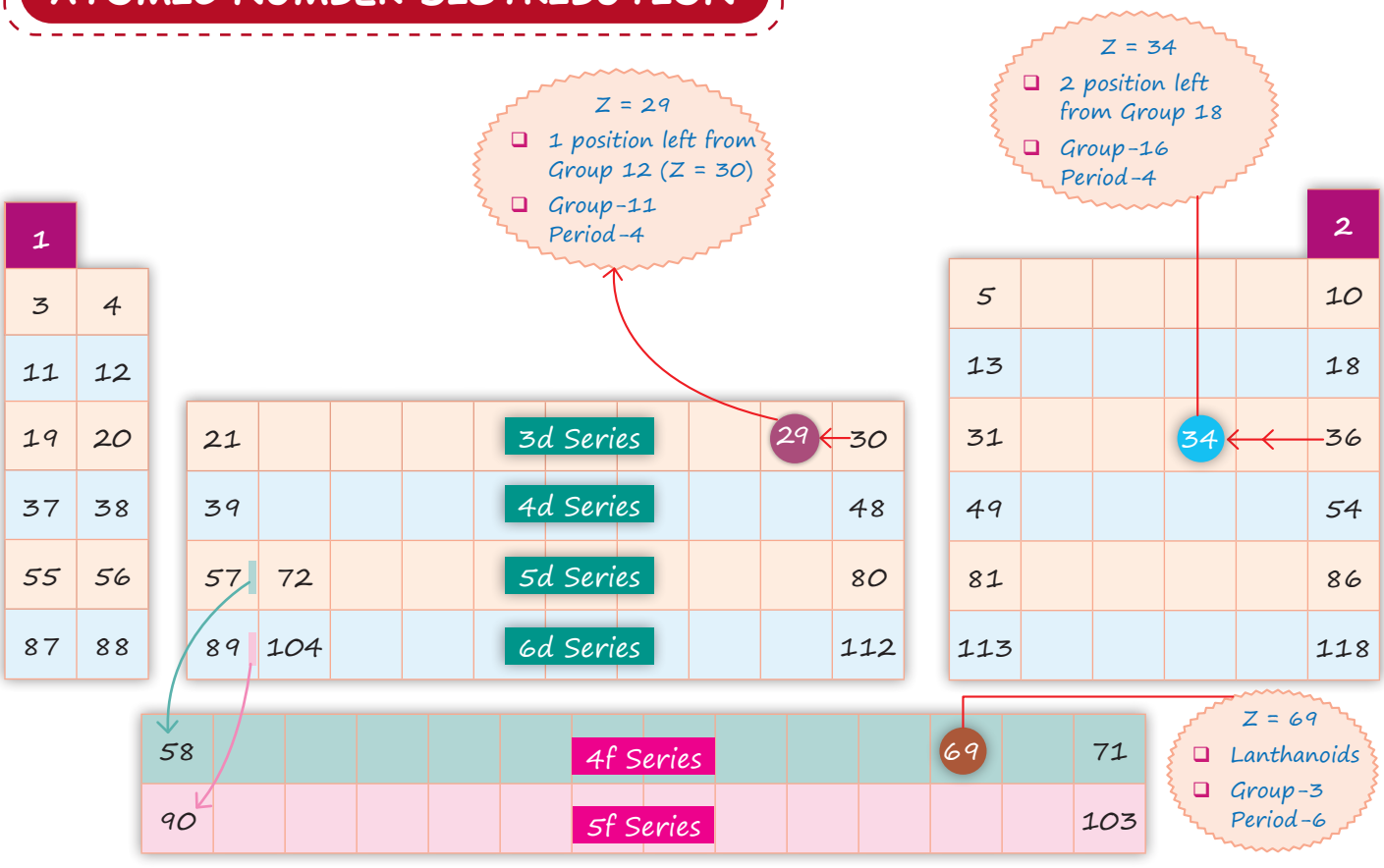


Max. n	Energy Sequence and Set of Subshells				No. of electrons in set of subshell
1	1s				2
2	2s			2p	2 + 6 = 8
3	3s			3p	2 + 6 = 8
4	4s		3d	4p	2 + 10 + 6 = 18
5	5s		4d	5p	2 + 10 + 6 = 18
6	6s	4f	5d	6p	2 + 14 + 10 + 6 = 32
7	7s	5f	6d	7p	2 + 14 + 10 + 6 = 32

Block: s, p, d, f | **7 Periods: Horizontal Rows** | **18 Groups: Vertical Columns**



ATOMIC NUMBER DISTRIBUTION



Period Number	Range
1	1-2
2	3-10
3	11-18
4	19-36
5	37-54
6	55-86
7	87-118

La_{57} $Ce_{58} \longrightarrow Lu_{71}$ Hf_{72}

Ac_{89} $Th_{90} \longrightarrow Lr_{103}$ Rf_{104}

Lanthanoid Series

Period No.	6
Group No.	3

Actinoid Series

Period No.	7
Group No.	3

MODERN PERIODIC TABLE

s-Block (ns) — d-Block (n − 1)d — p-Block (np)

Group / Period	1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 VIII	9 VIII	10 VIII	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1 (1s)	H		Transition metals (d-Block)															He
2 (2s, 2p)	Li	Be											B	C	N	O	F	Ne
3 (3s, 3p)	Na	Mg											Al	Si	P	S	Cl	Ar
4 (4s, 3d, 4p)	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5 (5s, 4d, 5p)	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6 (6s, 4f, 5d, 6p)	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7 (7s, 5f, 6d, 7p)	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og

The Rare Earths, (n − 2)f

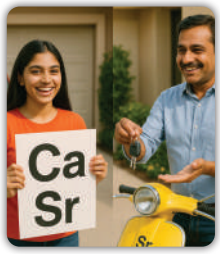
f-Block														
Lanthanide series (4f) Period : 6	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Actinide series (5f) Period : 7	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

देशी जुगाड़

Alkali Metals (Group-1)

HLiNa ne Ki Rb Cs Fariyad

Alkaline Earth Metals (Group-2)



Beti Mage Car Scooter Baap Razi

Group-13: Boron Family

Bengan Alu Gajar In Thaila

Group-14: Carbon Family

Cahei Sita Ge Suno Prabhu

Group-15: Nitrogen Family

Nana Patekar Aishwarya Sb Bimar

Group-16: Oxygen Family

O S Se Te Po

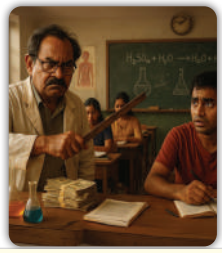
Group-17: Halogen Family

Fir Cal* Bahar I Aunty

Group-18: Inert Gas Family

Heena Neena Aur Kareena Xerox Rangeen

1st Transition Series: 3d Series



Science Ticher Very Cruel Mange Fees Copy Niha Cukker Zindabad

2nd Transition Series: 4d Series

Yari Zra Nibhana Mout Tc Rukawat Rah Pde Age Cudo

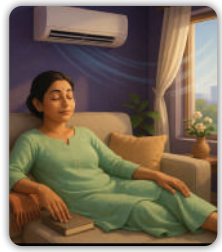
3rd Transition Series: 5d Series

La HafTa Warna Re Osama Idher Pitayi Aur Hogi

4th Transition Series: 6d Series

Ac Rutherford Dube Sagar me Bohr Hs Mat Darse Royga Caun

Group-3



ScYLa Ac me rahti hai

Group-4

Tina Zor Haaf Rafi* hai

Group-5

Vo Nabab Tha Dabang

Group-6

Crying Moti Wife

Group-7

Maan Tac* Rekha

Group-8 and 9

Fer* Rouya Osama Con* Rahega Iran me

Group-10, 11, 12

Nahi Padoge to Pitoge

Cyu Aage Aau

Zindagi Cadbury Hogyi

Lanthanoids → Ist Inner Transition Series (Part of Group 3)

Cene Pr Nadiyan Prem Ki Samayi Eu Gadgad Tab Dyl Ho gya Engineer Tum Yebhi Lu

Actinoids → IInd Inner Transition Series (Part of Group 3)

Thor Ke Papa ne U bola Nepal me Purane Am Cam Bikenge Cafe me jana Ease Farmana Madam Noodles Lare

Place of Hydrogen is not fixed in Periodic Table because it shares properties with both alkali metals and halogens.

IUPAC NAME, COMMON NAME AND POSITION OF ELEMENTS HAVING ATOMIC NUMBER 101 TO 118

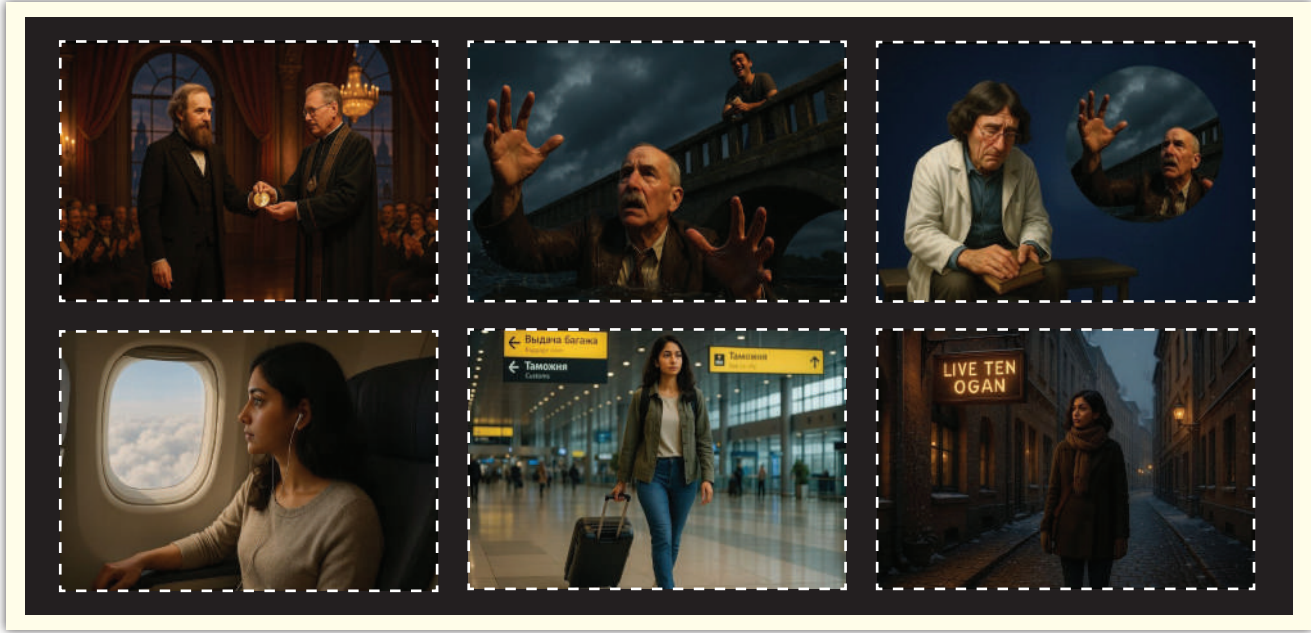
Digit	Name	Abbreviation
0	nil	n
1	un	u
2	bi	b
3	tri	t
4	quad	q
5	pent	p
6	hex	h
7	sept	s
8	oct	o
9	enn	e

Suffix – ium	
101 :	Unnilunium (Unu)
102 :	Unnilbium (Unb)
105 :	Unnilpentium (Unp)
110 :	Ununnilium (Uun)
118 :	Ununoctium (Uuo)
119 :	Ununennium (Uue)

Z = 143
IUPAC Name
↓
Unquadtrium
UQT

Atomic Number 101 to 118

1. Mendeleev [101] ko mila Nobel [102] in Lowrence [103]
2. Rutherford [104] Dube [105] Sea [106] me Bohr [107] Hass [108] Meit [109]
3. Dar [110] se Roe [111] Coper [112]
4. Niho [113] Fle [114] to Mosco [115] to Live [116] Ten [117] Ogan [118]



Atomic Number	Name
101	Mendelevium (Md)
102	Nobelium (No)
103	Lawrencium (Lr)
104	Rutherfordium (Rf)
105	Dubnium (Db)
106	Seaborgium (Sg)
107	Bohrium (Bh)
108	Hassium (Hs)
109	Meitnerium (Mt)

Atomic Number	Name
110	Darmstadtium (Ds)
111	Roentgenium (Rg)
112	Copernicium (Cn)
113	Nihonium (Nh)
114	Flerovium (Fl)
115	Moscovium (Mc)
116	Livermorium (Lv)
117	Tennessine (Ts)
118	Oganesson (Og)

Position in Periodic Table

	101	102	103
Period No.	→ 7		
Group No.	→ 3	(Part of actinoids)	

	104	105	106	107	.....	118
Group No. →	4th	5th	6th	7th		18th
Period No. →	7					

1. The IUPAC symbol for the element with atomic number 119 would be- [8 April, 2019 (Shift-2)]

(a) Unh (b) Uue (c) Uun (d) Une

Sol. (b)

2. Lanthanoids and Actinoids are present in which of the following group-

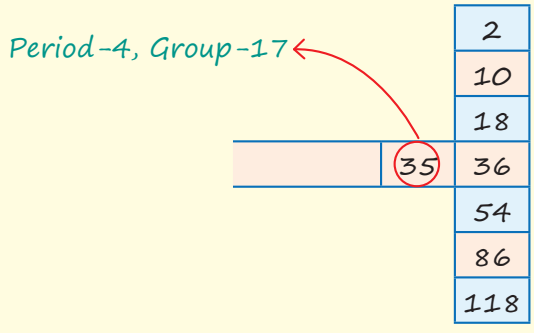
(a) Group 1 (b) Group 3 (c) Group 17 (d) Group 18

Sol. (b)

3. If the atomic number of an element is 35, it will be placed in the periodic table in the-

(a) Group 1 (b) Group 3 (c) Group 17 (d) Group 18

Sol. (c)



4. **Match List-I with List-II** [30 Jan, 2023 (Shift-1)]

List-I (Atomic Number)		List-II (Block of Periodic Table)	
(A)	37	(i)	p-block
(B)	78	(ii)	d-block
(C)	52	(iii)	f-block
(D)	65	(iv)	s-block

Choose the correct answer from the options given below:

(a) A-ii, B-iv, C-i, D-iii

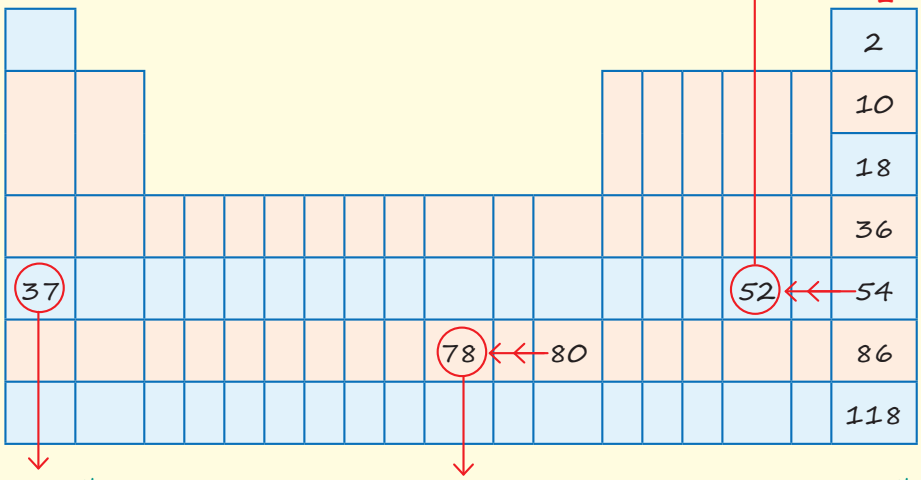
(b) A-i, B-iii, C-iv, D-ii

(c) A-iv, B-iii, C-ii, D-i

(d) A-iv, B-ii, C-i, D-iii

Sol. (d) A-iv, B-ii, C-i, D-iii

- Lanthanoids (58 < 65 < 71)
  - ♦ 6^{th} period
  - ♦ 3^{rd} group
  - ♦ f-block



- 5^{th} period
- 16^{th} group (p-block)
- 5^{th} period
- 1^{st} group (s-block)
- 2 position left to Z = 80 (12^{th} group)
- 10^{th} group, 6^{th} period

5. **The element with atomic number 117, 119 , 120 , 91 will be-** [30 Jan, 2023 (Shift-1)]

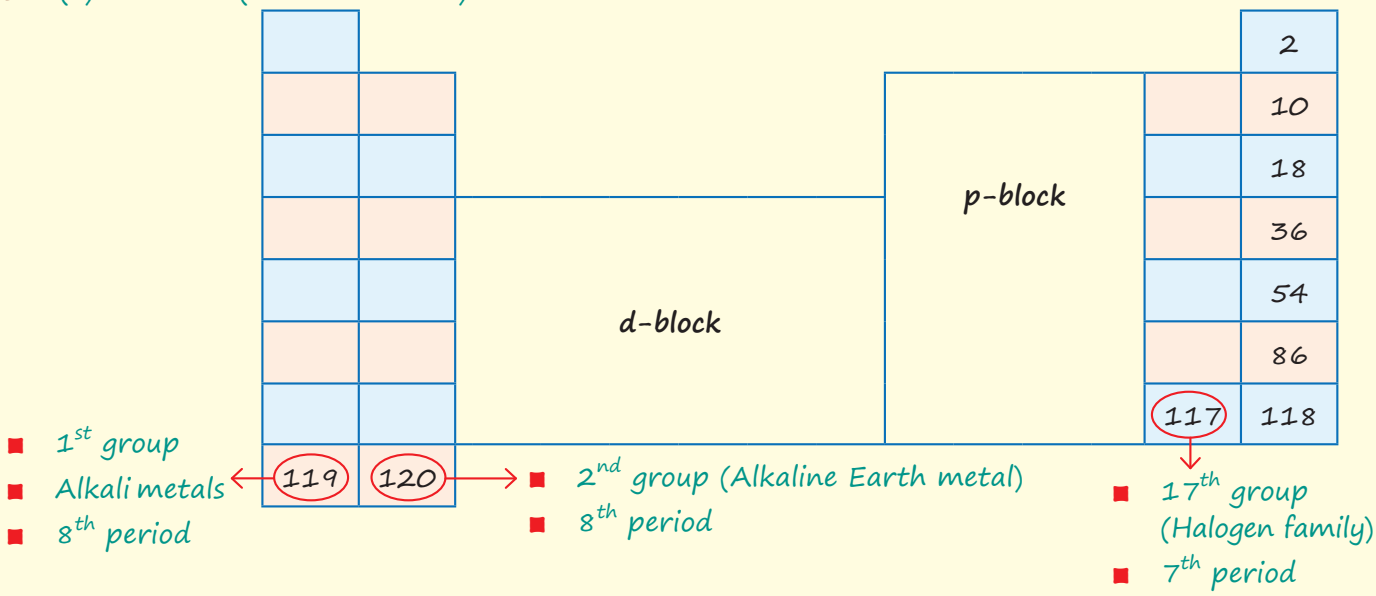
(a) Alkali's

(b) Halogen, Alkali, Alkaline earth metal & Lanthanide

(c) Halogen, Alkali, Alkaline earth metal & Actinide

(d) Transition element, Halogen, Alkali, Alkaline earth metal

Sol. (c) Actinoids (90 < 91 < 103)



6. The elements with atomic number 101 and 104 belong to, respectively- [4 Sept, 2020 (Shift-1)]

(a) Actinoids and Group 4 (b) Group 11 and Group 4

(c) Group 6 and Actinoids (d) Actinoids and Group 6

Sol. (a)

7. Identify the incorrect match.

Name		IUPAC Official Name	
(A)	Unnilunium	(i)	Mendelevium
(B)	Unniltrium	(ii)	Lawrencium
(C)	Unnilhexium	(iii)	Seaborgium
(D)	Unununium	(iv)	Darmstadtium

(a) A-(i) (b) B-(ii) (c) C-(iii) (d) D-(iv)

Sol. (d) Unununium [111] → Roentgenium

8. The element with Z = 120 (not yet discovered) will be an/a [12 Jan, 2019 (Shift-2)]

(a) Transition metal (b) Inner transition metal

(c) Alkaline earth metal (d) Alkali metal

Sol. (c)

METAL, NON-METAL AND METALLOID

Metal

$M \rightarrow M^+ + e^-$

- The metals are characterised by their nature of readily giving up the electron(s) and form shining lustre.
- Metals comprises more than 78% of all known elements and appear on the left hand side of the periodic table.
- Metals are usually solids at room temperature (except Hg, Ga).
- They have high melting and boiling points and are good conductors of heat and electricity.

Non-metal

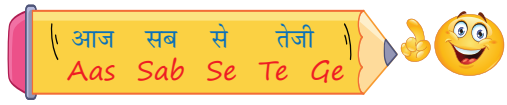
$N + e^- \rightarrow N^-$

- Non-metals do not lose electrons but take up electrons to form corresponding anions.
- Non-metals are located at the top right hand side of the periodic table.
- Non-metals are usually solids, liquids or gases at room temperature with low melting and boiling points. They are poor conductors of heat and electricity.

Metalloids (Semi-metals)

It has been found that some elements which lie at the border of metallic and nonmetallic behavior, possess the properties that are characteristic of both metals and non-metals. These elements are called semi-metals or metalloids.

Examples - As, Sb, Se, Te, Ge



s-BLOCK

Alkali Metals (Group-1) General electronic configuration ⇒ [Inert gas] ns^1	
n = 2	Li_3 : [He] $2s^1$
n = 3	Na_{11} : [Ne] $3s^1$
n = 4	K_{19} : [Ar] $4s^1$
n = 5	Rb_{37} : [Kr] $5s^1$
n = 6	Cs_{55} : [Xe] $6s^1$

Alkaline Earth Metals (Group-2) General electronic configuration ⇒ [Inert gas] ns^2
Be_4 : [He] $2s^2$
Mg_{12} : [Ne] $3s^2$
Ca_{20} : [Ar] $4s^2$
Sr_{38} : [Kr] $5s^2$
Ba_{56} : [Xe] $6s^2$

When shells upto (n – 1) are completely filled and the last electron enters the s-orbital of the outermost (n^{th}) shell, the elements of this class are called s-block elements.

- Group 1 & 2
- General electronic configuration : [inert gas] ns^{1-2}
- s-block elements lie on the extreme left of the periodic table.
- This block includes metals.

p-BLOCK

Group-13: [Inert Gas] ns^2np^1	Group-14: [Inert Gas] ns^2np^2
B_5 : [He] $2s^2\ 2p^1$	C_6 : [He] $2s^2\ 2p^2$
Al_{13} : [Ne] $3s^2\ 3p^1$	Si_{14} : [Ne] $3s^2\ 3p^2$
Ga_{31} : [Ar] $4s^2\ 3d^{10}\ 4p^1$	Ge_{32} : [Ar] $4s^2\ 3d^{10}\ 4p^2$
In_{49} : [Kr] $5s^2\ 4d^{10}\ 5p^1$	Sn_{50} : [Kr] $5s^2\ 4d^{10}\ 5p^2$
Tl_{81} : [Xe] $6s^2\ 4f^{14}\ 5d^{10}\ 6p^1$	Pb_{82} : [Xe] $6s^2\ 4f^{14}\ 5d^{10}\ 6p^2$
Nh_{113} : [Rh] $7s^2\ 5f^{14}\ 6d^{10}\ 7p^1$	Fl_{114} : [Rn] $7s^2\ 5f^{14}\ 6d^{10}\ 7p^2$

Period No. / Group No.	Group 15 (Pnictogens)	Group 16 (Chalcogens)	Group 17 (Halogens)	Group 18 (Inert gas)
1.				He: $1s^2$
2.	N: [He] $2s^2\ 2p^3$	O: [He] $2s^2\ 2p^4$	F: [He] $2s^2\ 2p^5$	Ne: [He] $2s^2\ 2p^6$
3.	P: [Ne] $3s^2\ 3p^3$	S: [Ne] $3s^2\ 3p^4$	Cl: [Ne] $3s^2\ 3p^5$	Ar: [Ne] $3s^2\ 3p^6$
4.	As: [Ar] $4s^2\ 3d^{10}\ 4p^3$	Se: [Ar] $4s^2\ 3d^{10}\ 4p^4$	Br: [Ar] $4s^2\ 3d^{10}\ 4p^5$	Kr: [Ar] $4s^2\ 3d^{10}\ 4p^6$
5.	Sb: [Kr] $5s^2\ 4d^{10}\ 5p^3$	Te: [Kr] $5s^2\ 4d^{10}\ 5p^4$	I: [Kr] $5s^2\ 4d^{10}\ 5p^5$	Xe: [Xe] $5s^2\ 4d^{10}\ 5p^6$
6.	Bi: [Xe] $6s^2\ 4f^{14}\ 5d^{10}\ 6p^3$	Po: [Xe] $6s^2\ 4f^{14}\ 5d^{10}\ 6p^4$	At: [Xe] $6s^2\ 4f^{14}\ 5d^{10}\ 6p^5$	Rn: [Xe] $6s^2\ 4f^{14}\ 5d^{10}\ 6p^6$

When shells upto (n – 1) are completely filled and differentiating electron enters the p-orbital of the n^{th} orbit, elements of this class are called p-block elements.

- Group 13 to 18
- General electronic configuration: [inert gas] $ns^2\ np^{1-6}$
- p-block elements lie on the extreme right of the periodic table.
- This block includes some metals, all non-metals and metalloids.
- **Representative Elements: s + p block elements except inert gas elements.**

d-BLOCK ELEMENTS

Series name ↓ | Group →	3		4	5	6	7	8	9	10	11	12
3d-series	Sc_{21}		Ti_{22}	V	Cr	Mn	Fe	Co	Ni	Cu	Zn_{30}
4d-series	Y_{39}		Zr_{40}	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd_{48}
5d-series	La_{57}	4f Series	Hf_{72}	Ta	W	Re	Os	Ir	Pt	Au	Hg_{80}
6d-series	Ac_{89}	5f Series	Rf_{104}	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn_{112}

Electronic Configuration

- 3d series: [Ar] 4s 3d
- 4d series: [Kr] 5s 4d
- 5d series: [Xe] 6s 5d : for La
  [Xe] 6s 5d $4f^{14}$: from Hf → Hg
- 6d series: [Rn] 7s 6d : for Ac
  [Rn] 7s 6d $5f^{14}$: from Rf → Cn

देशी जुगाड़ For Electronic Configuration of 11 Elements

Rahgir(Rg) Kyu(Cu) Aage(Ag) Aau(Au) Pitayi(Pt) Croge(Cr), Nabab(Nb) Mout(Mo) Rukawat(Ru) Rah(Rh) Padegi(Pd)

Rg	Cu	Ag	Au	Pt	Cr	Nb	Mo	Ru	Rh
				ns^1					

Pd
ns^0

Sc $4s^2\ 3d^1$	Ti $4s^2\ 3d^2$	V $4s^2\ 3d^3$	Cr $4s^1\ 3d^5$	Mn $4s^2\ 3d^5$	Fe $4s^2\ 3d^6$	Co $4s^2\ 3d^7$	Ni $4s^2\ 3d^8$	Cu $4s^1\ 3d^{10}$	Zn $4s^2\ 3d^{10}$
Y $5s^2\ 4d^1$	Zr $5s^2\ 4d^2$	Nb $5s^1\ 4d^4$	Mo $5s^1\ 4d^5$	Tc $5s^2\ 4d^5$	Ru $5s^1\ 4d^7$	Rh $5s^1\ 4d^8$	Pd $5s^0\ 4d^{10}$	Ag $5s^1\ 4d^{10}$	Cd $5s^2\ 4d^{10}$
La $6s^2\ 5d^1$	Hf $6s^2\ 5d^2\ 4f^{14}$	Ta $6s^2\ 5d^3\ 4f^{14}$	W $6s^2\ 5d^4\ 4f^{14}$	Re $6s^2\ 5d^5\ 4f^{14}$	Os $6s^2\ 5d^6\ 4f^{14}$	Ir $6s^2\ 5d^7\ 4f^{14}$	Pt $6s^1\ 5d^9\ 4f^{14}$	Au $6s^1\ 5d^{10}\ 4f^{14}$	Hg $6s^2\ 5d^{10}\ 4f^{14}$
Ac $7s^2\ 6d^1$	Rf $7s^2\ 6d^2\ 5f^{14}$	Db $7s^2\ 6d^3\ 5f^{14}$	Sg $7s^2\ 6d^4\ 5f^{14}$	Bh $7s^2\ 6d^5\ 5f^{14}$	Hs $7s^2\ 6d^6\ 5f^{14}$	Mt $7s^2\ 6d^7\ 5f^{14}$	Ds $7s^2\ 6d^8\ 5f^{14}$	Rg $7s^1\ 6d^{10}\ 5f^{14}$	Cn $7s^2\ 6d^{10}\ 5f^{14}$

- Group : 3 to 12
- General electronic configuration : [inert gas] $ns^{0-2}\ (n-1)d^{1-10}$ (except, Pd : $4d^{10}5s^0$)

When outermost (n^{th}) and penultimate shells $(n-1)^{th}$ shells are incompletely filled and differentiating electron enters the (n – 1) d orbitals (d-orbital of penultimate shell) then elements of this class are called d-block elements.

- All the transition elements are metals.

1^{st} Transition Series	2^{nd} Transition Series
3d series	4d series
10 elements	10 elements
Starts from $_{21}Sc$ – $_{30}Zn$.	Starts from $_{39}Y$ – $_{48}Cd$
Filling of electrons takes place in 3d subshell.	Filling of electrons takes place in 4d subshell.

3^{rd} Transition Series	4^{th} Transition Series
5d series	6d series
10 elements	10 elements
Starts from $_{57}La$, $_{72}Hf$ – $_{80}Hg$.	Starts from $_{89}Ac$, $_{104}Rf$ – $_{112}Uub$.
Filling of electrons takes place in 5d subshell.	Filling of electrons takes place in 6d subshell.

Transition Metals

The elements whose atoms or simple ions contain partially filled d-orbitals are called transition metals.

1. Sc is a transition metal because Sc has partially filled d-orbitals.

   $Sc : [Ar]\ 4s^2\ 3d^1$

2. Zn is not a transition metal because Zn and Zn^{2+} both have filled d-orbitals.

   $Zn : [Ar]\ 4s^2\ 3d^{10}$
   $Zn^{2+} : [Ar]\ 3d^{10}$

3. Cu is a transition metal because Cu^{2+} has partially filled d-orbitals.

   $Cu : [Ar]\ 4s^1\ 3d^{10}$
   $Cu^{2+} : [Ar]\ 3d^9$

Note

- Zn, Cd, Hg are not considered as transition elements because they have filled 'd^{10} configuration' in atomic (M) and ionic (M^{2+}) form.
- All transition elements are d-block elements but not all d-block elements are transition elements.
  - **Elements in Liquid State at STP** – Hg (metal), Br_2 (Non-metal)
  - **Metals in Liquid State (at T < 40°C)** – Rubi (Rb) Mar (Hg) Gayi (Ga) Fir (Fr) se (Cs)

f-BLOCK ELEMENTS

The f-block consists of the two series, lanthanoids (the fourteen elements following lanthanum) and actinoids (the fourteen elements following actinium).

Lanthanoids	Ce_{58}	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu_{71}
Actinoids	Th_{90}	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr_{103}

- They are metals
- All f-block elements belong to 3rd group.

1st Inner Transition Series – 4f series	2nd Inner Transition Series– 5f series
14 elements – $_{58}Ce$ to $_{71}Lu$	14 elements – $_{90}Th$ to $_{103}Lr$
Filling of electrons takes place in 4f subshell.	Filling of electrons takes place in 5f subshell.

Transuranium Elements $Z > 92$

- The elements coming after uranium are called transuranium elements.

General electronic configuration : [Inert gas] ns^2 $(n-2)f^{1-14}$ $(n-1)d^{0-1}$

- When n, (n–1) and (n–2) shells are incompletely filled and last electron enters into f-orbital of anti-penultimate $(n-2)^{th}$ shell, elements of this class are called f-block elements.
- They are also called as inner transition elements as they contain three incomplete outermost shells and were also referred to as rare earth elements since their oxides were rare in earlier days.

9. The element Z = 114 has been discovered recently. It will belong to which of the following family/ group and electronic configuration?

(a) Carbon family, $[Rn]5f^{14}6d^{10}7s^27p^2$ (b) Oxygen family, $[Rn]5f^{14}6d^{10}7s^27p^4$

(c) Nitrogen family, $[Rn]5f^{14}6d^{10}7s^28p^6$ (d) Halogen family, $[Rn]5f^{14}6d^{10}7s^27p^5$

Sol. (a)

10. Which of the following is representative group of elements in the periodic table?

(a) Lanthanum (La) (b) Argon (Ar)

(c) Chromium (Cr) (d) Aluminium (Al)

Sol. (d)

11. If Z is given (Z = 32, 57, 71, 87), then what will be Period number, Group number, Block, Family, Electronic Configuration?

Sol. **Z = 32**
- p-Block
- Group Number - 14
- Period - 4 (Carbon family)
- EC ≡ $[Ar]\ 4s^2\ 3d^{10}\ 4p^2$

Z = 57
- d-Block
- Group Number - 3
- Period Number - 6
- EC ≡ $[Xe]\ 6s^2\ 5d^1$

Z = 71
- f-Block (Lanthanoids)
- Group Number - 3
- Period Number - 6
- EC ≡ $[Xe]\ 6s^2\ 5d^1\ 4f^{14}$

Z = 87
- Alkali metal
- s-Block
- Group 1 [7^{th} Period]
- EC ≡ $[Rn]\ 7s^1$

Note

If electronic configuration of an element is given and you have to find the position of element in periodic table then add all electrons and find atomic number (For neutral element → Total no. of electrons = atomic number).

- Through atomic number, you can find the position of element.

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

[23 July, 2022 (Shift-1)]

(a) Unnilbium (b) Unnilunium (c) Unnilquadium (d) Unniltrium

Sol. (d) Total number of electrons = 86 +14 + 1 + 2 = 103 [IUPAC Name - Unniltrium]

13. **An atom has electronic configuration $1s^{2}2s^{2}2p^{6}3s^{2}3p^{6}3d^{3}4s^{2}$, you will place it in-**

(a) fifth group (b) fifteenth group (c) second group (d) third group

Sol. (a) Total number of electrons = 2 + 2 + 6 + 2 + 6 + 3 + 2 = 23

14. **The characteristics of element X, Y and Z with atomic numbers, respectively, 33, 53 and 83 are:**

[16 March, 2021 (Shift-2)]

(a) X and Y are metalloids and Z is a metal

(b) X is a metalloid, Y is a non-metal and Z is a metal

(c) X, Y and Z are metals.

(d) X and Z are non-metals and Y is metalloid

Sol. (b) Metalloid X → 33 [As] Non-metal Y → 53 [I] Metal Z → 83 [Bi]

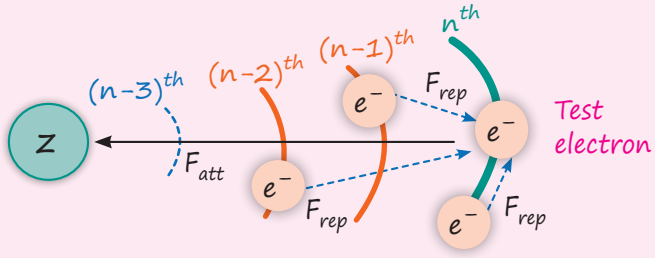
EFFECTIVE NUCLEAR CHARGE

$F_{effective} = F_{att.} - F_{rep.}$

$Z_{eff} = Z - \sigma$

Z_{eff} = औकात of Nucleus

σ = Atomic number → Shielding constant, Screening constant, Slater's constant



- Number of inner shell electrons ↑ ⇒ σ ↑ ⇒ Z_{eff} ↓

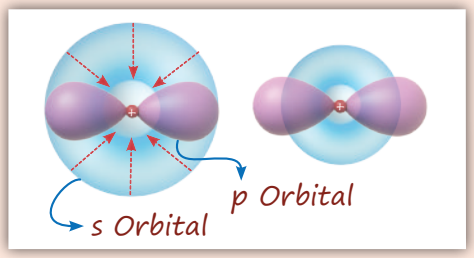
- There is a reduction in nuclear charge due to presence of screen b/w test electron and nucleus.

  Screening/Shielding Effect: The phenomenon where inner electrons in an atom reduce the attractive force of the nucleus on outer electrons. These inner electrons effectively "screen or shield" the outer electrons from the full nuclear charge.

- **Effective nuclear charge (Z_{eff}):** The net positive charge experienced by an electron in a multi-electron atom, which is less than the full nuclear charge due to shielding by inner electrons.

PENETRATION EFFECT

- Penetration Power means the ability of an electron in an orbital to get close to the nucleus.
- The Penetration effect of s-orbital is the maximum because it is closer to the nucleus than the p, d, and f-orbitals.



Due to spherical shape of s orbital, it is more attracted towards nucleus (centre of sphere) than p orbital having dumb bell shape.

Closeness to the nucleus : $s > p > d > f$

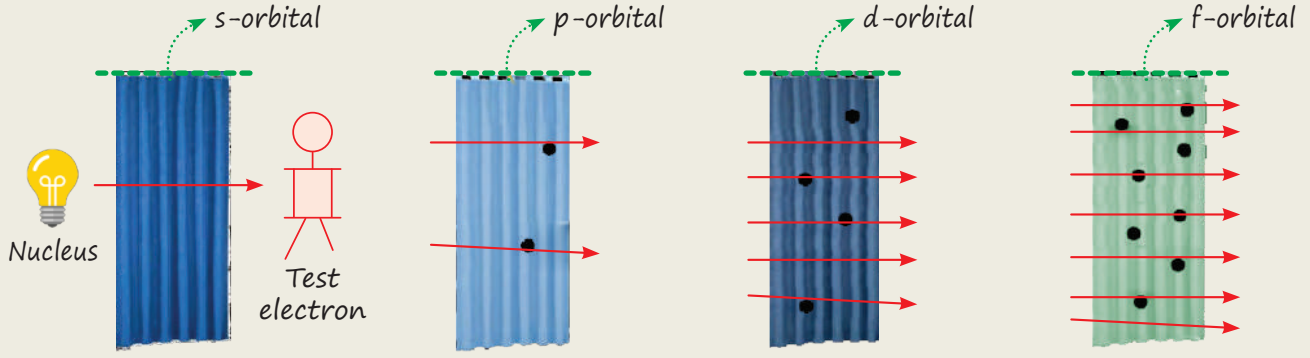
Penetration effect : $s > p > d > f$

Screening effect/Shielding effect : $s > p > \boxed{d > f}$

Poor shielding

Contribution of subshell in shielding constant (σ) :

$ns > np > nd > nf$



1 Electron System	More than 1 Electron System
H, He^+, Li^{2+} E 2s 2p 1s 2s & 2p subshells are degenerate.	2p 2s 1s 2s and 2p subshells are non-degenerate

15. The order of screening effect of electrons of s, p, d and f orbitals of a given shell of an atom on its outer shell electrons is :

(a) $s > p > d > f$ (b) $f > d > p > s$ (c) $p > d > s > f$ (d) $f > p > s > d$

Sol. (a)

16. Screening effect is not observed in :

(a) He^+ (b) Li^{2+} (c) Be^{3+} (d) In all cases

Sol. (d) Screening effect is not observed in 1 electron system.

About the Author

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With **10+ years of teaching experience**, Mr. Om Pandey is a renowned name in the field of Chemistry. A remarkable academic achiever, he secured an outstanding **AIR 100 in IIT JAM and AIR 13 & 49 in JRF**, reflecting his exceptional proficiency and deep-rooted expertise in Chemistry.

Currently teaching at Physics Wallah, Mr. Pandey has transformed the way students learn and understand Chemistry. He is especially known for his expertise in teaching **Kattar JEE Advanced**, where his focused approach and deep conceptual clarity have helped countless students crack one of the toughest exams in the country.

In addition to his teaching accomplishments, Mr. Pandey is the author of **'The Catalyst for Chemistry'**, a book designed for Class XII Board students. This book has helped a large number of students excel in their exams by simplifying complex concepts and offering effective strategies for mastering the subject.

His passion for teaching and commitment to excellence have guided thousands of students, shaping the careers of top engineers from IITs, NITs, and IIITs, as well as future doctors. His unique teaching style, coupled with his ability to simplify complex concepts, has earned him immense respect among students and peers alike.

One of his key philosophies in teaching is reflected in his popular saying, **"PYARE ♥ Chemistry samjhi ja sakti hai, bas TEACHER ke explanation me dum hona chahiye."** This belief drives his dedication to ensuring every student finds Chemistry both understandable and enjoyable.

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