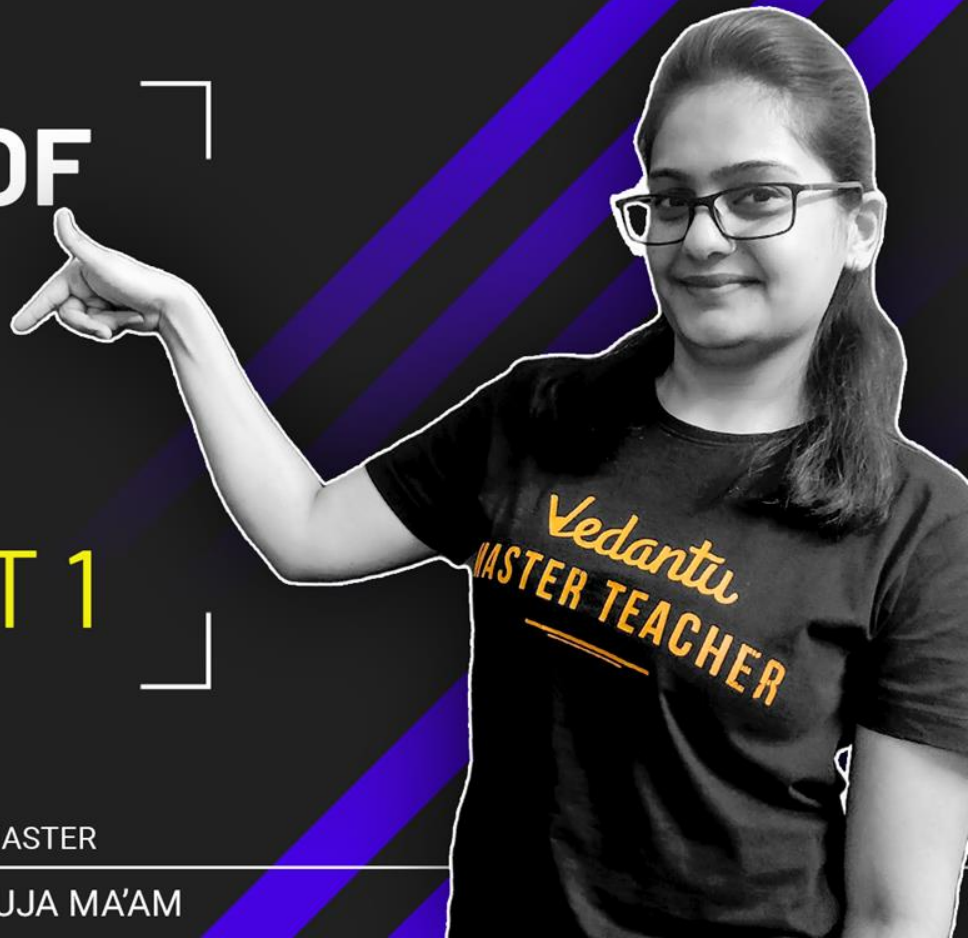




NCERT CHEMISTRY FOR CLASS 11

CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES PART 1



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SAKSHI PAHUJA MA'AM

SAKSHI PAHUJA

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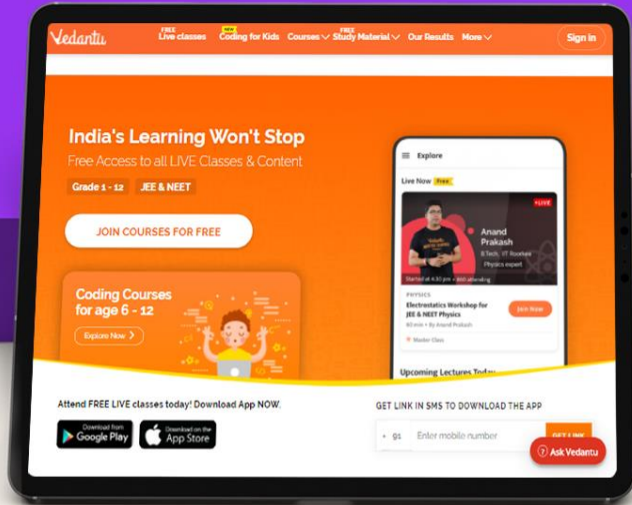


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Classification of Elements and Periodicity in properties

and so on.....

Si

As

Sc

H

Be

Mo

Mg

Rn

He

Na

Zn



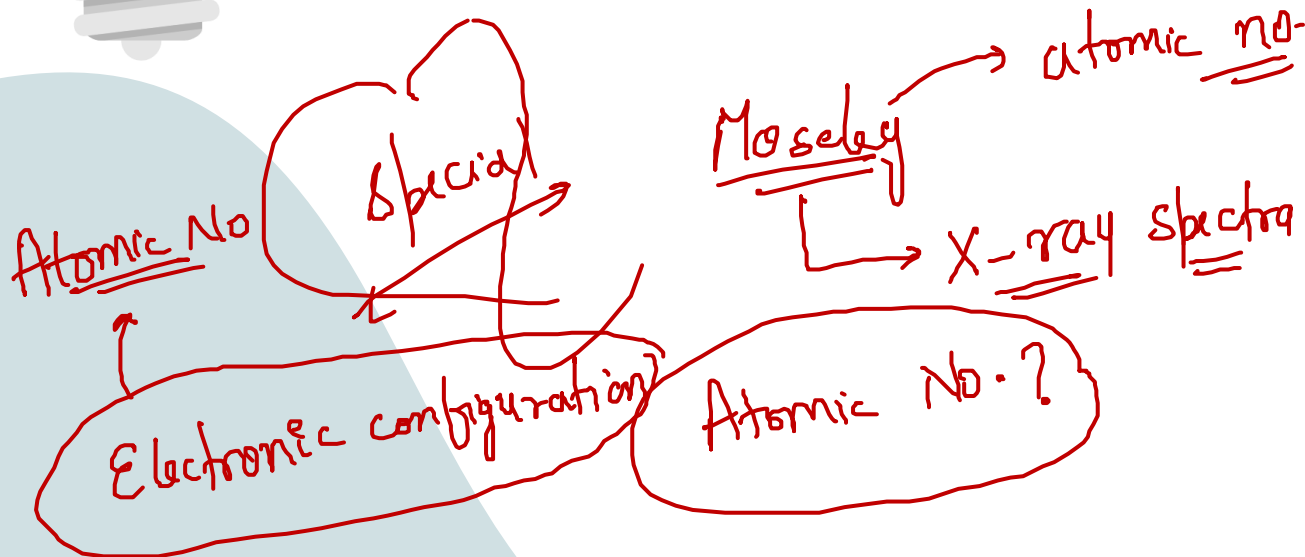
The Periodic Table



"It makes the study of elements and their properties easier.."

Modern Periodic Law

The physical and chemical properties of the elements are periodic functions of their atomic numbers.



Long form of Periodic table

The horizontal rows are called periods and the vertical columns, groups.

Periods → 7

Groups → 1 to 18

PERIOD NUMBER	Representative elements		d-Transition elements										Representative elements					Noble gases
	GROUP NUMBER		GROUP NUMBER										GROUP NUMBER					18
	1	2											13	14	15	16	17	0
	IA	IIA											III B	IV B	V B	VI B	VII B	He
1																		2 H 1s ¹
2	Li 2s ¹	Be 2s ²											5 B 2s ² 2p ¹	6 C 2s ² 2p ²	7 N 2s ² 2p ³	8 O 2s ² 2p ⁴	9 F 2s ² 2p ⁵	10 Ne 2s ² 2p ⁶
3	Na 3s ¹	Mg 3s ²	3 III A	4 IVA	5 VA	6 VIA	7 VII A	8 VIII	9	10	11 IB	12 IIB	13 Al 3s ² 3p ¹	14 Si 3s ² 3p ²	15 P 3s ² 3p ³	16 S 3s ² 3p ⁴	17 Cl 3s ² 3p ⁵	18 Ar 3s ² 3p ⁶
4	K 4s ¹	Ca 4s ²	21 Sc 3d ¹ 4s ²	22 Ti 3d ² 4s ²	23 V 3d ³ 4s ²	24 Cr 3d ⁵ 4s ¹	25 Mn 3d ⁵ 4s ²	26 Fe 3d ⁶ 4s ²	27 Co 3d ⁷ 4s ²	28 Ni 3d ⁸ 4s ²	29 Cu 3d ¹⁰ 4s ¹	30 Zn 3d ¹⁰ 4s ²	31 Ga 4s ² 4p ¹	32 Ge 4s ² 4p ²	33 As 4s ² 4p ³	34 Se 4s ² 4p ⁴	35 Br 4s ² 4p ⁵	36 Kr 4s ² 4p ⁶
5	Rb 5s ¹	Sr 5s ²	37 Y 4d ¹ 5s ²	38 Zr 4d ² 5s ²	39 Nb 4d ⁴ 5s ¹	40 Mo 4d ⁵ 5s ¹	41 Tc 4d ⁵ 5s ²	42 Ru 4d ⁷ 5s ¹	43 Rh 4d ⁸ 5s ¹	44 Pd 4d ¹⁰ 5s ⁰	45 Ag 4d ¹⁰ 5s ¹	46 Cd 4d ¹⁰ 5s ²	47 In 5s ² 5p ¹	48 Sn 5s ² 5p ²	49 Sb 5s ² 5p ³	50 Te 5s ² 5p ⁴	51 I 5s ² 5p ⁵	52 Xe 5s ² 5p ⁶
6	Cs 6s ¹	Ba 6s ²	55 La* 5d ¹ 6s ²	56 Hf* 4f ¹⁴ 5d ² 6s ²	57 Ta 5d ³ 6s ²	58 W 5d ⁴ 6s ²	59 Re 5d ⁵ 6s ²	60 Os 5d ⁶ 6s ²	61 Ir 5d ⁷ 6s ²	62 Pt 5d ⁹ 6s ¹	63 Au 5d ¹⁰ 6s ¹	64 Hg 5d ¹⁰ 6s ²	65 Tl 6s ² 6p ¹	66 Pb 6s ² 6p ²	67 Bi 6s ² 6p ³	68 Po 6s ² 6p ⁴	69 At 6s ² 6p ⁵	70 Rn 6s ² 6p ⁶
7	Fr 7s ¹	Ra 7s ²	87 Ac** 6d ¹ 7s ²	88 Rf	89 Db	90 Sg	91 Bh	92 Hs	93 Mt	94 Ds	95 Rg	96 Cn	107 Nh	108 Fl	109 Mc	110 Lv	111 Ts	112 Og

fI → Fluorine
 Mc → Mendelevium
 Ts — Tennassine
 Og → Oganesson

f- Inner transition elements

Lanthanoids 4f ⁿ 5d ⁰⁻¹ 6s ²	58 Ce 4f ¹ 5d ¹ 6s ²	59 Pr 4f ³ 5d ⁰ 6s ²	60 Nd 4f ⁴ 5d ⁰ 6s ²	61 Pm 4f ⁵ 5d ⁰ 6s ²	62 Sm 4f ⁶ 5d ⁰ 6s ²	63 Eu 4f ⁷ 5d ⁰ 6s ²	64 Gd 4f ⁷ 5d ¹ 6s ²	65 Tb 4f ⁹ 5d ⁰ 6s ²	66 Dy 4f ¹⁰ 5d ⁰ 6s ²	67 Ho 4f ¹¹ 5d ⁰ 6s ²	68 Er 4f ¹² 5d ⁰ 6s ²	69 Tm 4f ¹³ 5d ⁰ 6s ²	70 Yb 4f ¹⁴ 5d ⁰ 6s ²	71 Lu 4f ¹⁴ 5d ¹ 6s ²
** Actinoids 5f ⁿ 6d ⁰⁻² 7s ²	90 Th 5f ⁰ 6d ² 7s ²	91 Pa 5f ² 6d ¹ 7s ²	92 U 5f ³ 6d ¹ 7s ²	93 Np 5f ⁴ 6d ¹ 7s ²	94 Pu 5f ⁶ 6d ¹ 7s ²	95 Am 5f ⁷ 6d ⁰ 7s ²	96 Cm 5f ⁷ 6d ¹ 7s ²	97 Bk 5f ⁹ 6d ¹ 7s ²	98 Cf 5f ¹⁰ 6d ¹ 7s ²	99 Es 5f ¹¹ 6d ¹ 7s ²	100 Fm 5f ¹² 6d ¹ 7s ²	101 Md 5f ¹³ 6d ¹ 7s ²	102 No 5f ¹⁴ 6d ¹ 7s ²	103 Lr 5f ¹⁴ 6d ⁰ 7s ²

NOMENCLATURE OF ELEMENTS WITH ATOMIC NUMBERS > 100

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

→ Name of each digit + sum

109

Unnilennium

Uue

Symbol

→ Abbreviations of each digit
↓
digit
first word of name

Atomic Number	Name	Symbol	IUPAC Official Name	IUPAC 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	Hassium	Hs
109	Unnilennium	Une	Meitnerium	Mt
110	Unnillium	Uun	Darmstadtium	Ds
111	Unununnium	Uuu	Röntgenium*	Rg*
112	Ununbium	Uub	*	*
113	Ununtrium	Uut	+	
114	Ununquadium	Uuq	*	*
115	Ununpentium	Uup	+	
116	Ununhexium	Uuh	*	*
117	Ununseptium	Uus	+	
118	Ununoctium	Uuo	+	

Ques) What would be the IUPAC name and symbol for the element with atomic number 120?

120
↓ ↓ ↓
Unbinilium

Symbol → Ubn

ANSWER
Ubn and unbinilium

ELECTRONIC CONFIGURATIONS OF ELEMENTS AND THE PERIODIC TABLE

How to calculate
no. of elements in
a period

$n \rightarrow \text{max}$

Period No. = Valence shell

9 element

1P \rightarrow 1s \rightarrow 2 elements

2P \rightarrow 2s + 2p \rightarrow 8 elements
4 orbitals

3P \rightarrow 3s 3p \rightarrow 8 elements

H $1s^1$ He $1s^2$

Li Be $1s^2 2s^1 2s^2$

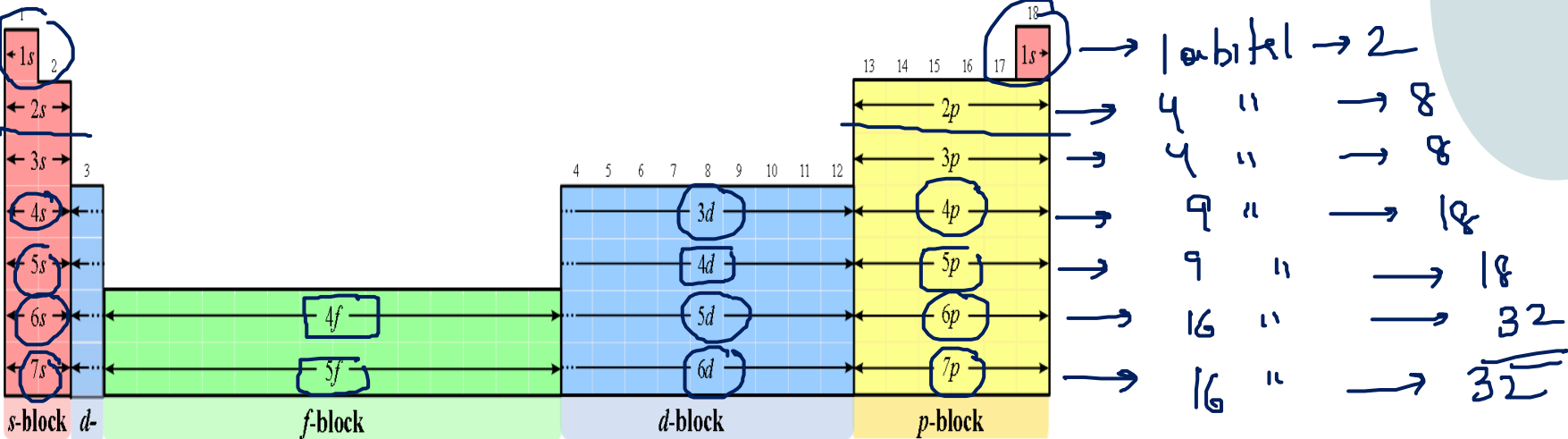
B C N O F Ne $2p^1 \dots 2p^6$

Al Si P S Cl Ar $3p^6$

Na Mg $3s^1$

4th period \rightarrow 4s 3d 4p = 18 elements
 $1 + 5 + 3 = 9$

5th \rightarrow 5s 4d 5p \rightarrow "
6th \rightarrow 6s 4f 5d 6p \rightarrow



No. of elements in a period = 2 (No. of orbitals involved)

Representative elements

GROUP NUMBER

PERIOD NUMBER

1	2											13	14	15	16	17	18
1A	2A	<i>d</i> -Transition elements										III B	IV B	V B	VI B	VII B	Noble gases
3	4											5	6	7	8	9	10
Li $2s^1$	Be $2s^2$											B $2s^2 2p^1$	C $2s^2 2p^2$	N $2s^2 2p^3$	O $2s^2 2p^4$	F $2s^2 2p^5$	Ne $2s^2 2p^6$
11	12	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Na $3s^1$	Mg $3s^2$	III A	IVA	VA	VIA	VII A	VIII			IB	II B	Al $3s^2 3p^1$	Si $3s^2 3p^2$	P $3s^2 3p^3$	S $3s^2 3p^4$	Cl $3s^2 3p^5$	Ar $3s^2 3p^6$
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K $4s^1$	Ca $4s^2$	Sc $3d^1 4s^2$	Ti $3d^2 4s^2$	V $3d^3 4s^2$	Cr $3d^5 4s^1$	Mn $3d^5 4s^2$	Fe $3d^6 4s^2$	Co $3d^7 4s^2$	Ni $3d^8 4s^2$	Cu $3d^{10} 4s^1$	Zn $3d^{10} 4s^2$	Ga $4s^2 4p^1$	Ge $4s^2 4p^2$	As $4s^2 4p^3$	Se $4s^2 4p^4$	Br $4s^2 4p^5$	Kr $4s^2 4p^6$
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb $5s^1$	Sr $5s^2$	Y $4d^1 5s^2$	Zr $4d^2 5s^2$	Nb $4d^4 5s^1$	Mo $4d^5 5s^1$	Tc $4d^5 5s^2$	Ru $4d^7 5s^1$	Rh $4d^8 5s^1$	Pd $4d^{10} 5s^1$	Ag $4d^{10} 5s^1$	Cd $4d^{10} 5s^2$	In $5s^2 5p^1$	Sn $5s^2 5p^2$	Sb $5s^2 5p^3$	Te $5s^2 5p^4$	I $5s^2 5p^5$	Xe $5s^2 5p^6$
55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs $6s^1$	Ba $6s^2$	La* $5d^1 6s^2$	Hf $4f^1 5d^2 6s^2$	Ta $5d^3 6s^2$	W $5d^4 6s^2$	Re $5d^5 6s^2$	Os $5d^6 6s^2$	Ir $5d^7 6s^2$	Pt $5d^9 6s^1$	Au $5d^{10} 6s^1$	Hg $5d^{10} 6s^2$	Tl $6s^2 6p^1$	Pb $6s^2 6p^2$	Bi $6s^2 6p^3$	Po $6s^2 6p^4$	At $6s^2 6p^5$	Rn $6s^2 6p^6$
87	88	89	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
Fr $7s^1$	Ra $7s^2$	Ac** $6d^1 7s^2$	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og

Electronic Configurations in Periods

f- Inner transition elements

*Lanthanoids $4f^0 5d^0 6s^2$	58 Ce $4f^0 5d^1 6s^2$	59 Pr $4f^1 5d^0 6s^2$	60 Nd $4f^2 5d^0 6s^2$	61 Pm $4f^5 5d^0 6s^2$	62 Sm $4f^6 5d^0 6s^2$	63 Eu $4f^7 5d^0 6s^2$	64 Gd $4f^7 5d^1 6s^2$	65 Tb $4f^9 5d^0 6s^2$	66 Dy $4f^{10} 5d^0 6s^2$	67 Ho $4f^{11} 5d^0 6s^2$	68 Er $4f^{12} 5d^0 6s^2$	69 Tm $4f^{13} 5d^0 6s^2$	70 Yb $4f^{14} 5d^0 6s^2$	71 Lu $4f^{14} 5d^1 6s^2$
**Actinoids $5f^0 6d^0 7s^2$	90 Th $5f^0 6d^2 7s^2$	91 Pa $5f^1 6d^1 7s^2$	92 U $5f^3 6d^1 7s^2$	93 Np $5f^4 6d^1 7s^2$	94 Pu $5f^6 6d^1 7s^2$	95 Am $5f^7 6d^1 7s^2$	96 Cm $5f^7 6d^2 7s^2$	97 Bk $5f^9 6d^1 7s^2$	98 Cf $5f^{10} 6d^1 7s^2$	99 Es $5f^{11} 6d^1 7s^2$	100 Fm $5f^{12} 6d^1 7s^2$	101 Md $5f^{13} 6d^1 7s^2$	102 No $5f^{14} 6d^1 7s^2$	103 Lr $5f^{14} 6d^2 7s^2$

s block



p block



d block

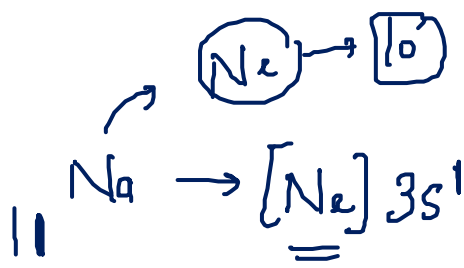


f block



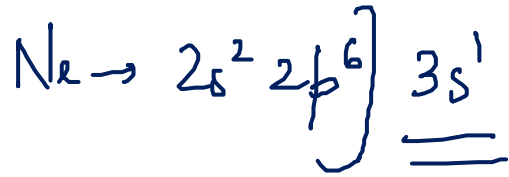
Electronic Configurations in Groups

Elements in the same vertical column or group have similar valence shell electronic configurations, the same number of electrons in the outer orbitals, and similar properties.



Atomic number	Symbol	Electronic configuration
3	Li	$1s^2 2s^1$ (or) $[\text{He}] 2s^1$
11	Na	$1s^2 2s^2 2p^6 3s^1$ (or) $[\text{Ne}] 3s^1$
19	K	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$ (or) $[\text{Ar}] 4s^1$
37	Rb	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 5s^1$ (or) $[\text{Kr}] 5s^1$
55	Cs	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10} 5s^2 5p^6 6s^1$ (or) $[\text{Xe}] 6s^1$
87	Fr	$[\text{Rn}] 7s^1$

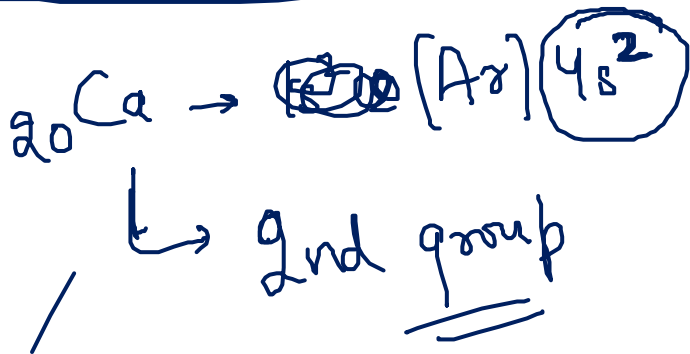
→ Choose nearest noble gas ⇒ lies in one period lower



Valence $e^- \rightarrow$ s-orbitals

ns^{1-2}

Group No. = Valence e^- s



s block

- Group 1 (alkali metals) and Group 2 (alkaline earth metals)
- ns^1 and ns^2 outermost electronic configuration
- reactive metals with low ionization enthalpies
- Form 1+ ion (in the case of alkali metals) or 2+ ion (in the case of alkaline earth metals)

Alkali - metals



s-BLOCK

1 2

1s

2s

3s

4s

5s

6s

7s

Li	Be
Na	Mg
K	Ca
Rb	Sr
Cs	Ba
Fr	Ra



s block

- Metallic character and the reactivity increase as we go down the group
- Never found pure in nature

$$\underline{13} \rightarrow \underline{18}$$

Valence e^- enters p-orbitals

$$13 \rightarrow 18$$

$$\text{Group No} \rightarrow \underline{10} + \text{No. of valence } \underline{\underline{e^-s}}$$

$$\text{Gen config} \rightarrow ns^2 np^{1-6}$$

p block

- Group 13 to 18
- (s block + p block) are called the Representative Elements or Main Group Elements.
- $ns^2 np^1$ to $ns^2 np^6$
- At the end of each period is a noble gas element with a closed valence shell $ns^2 np^6$ configuration

Chalcogens
halogens → Salt forming

p-BLOCK

	13	14	15	16	17	18
						He
2p	B	C	N	O	F	Ne
3p	Al	Si	P	S	Cl	Ar
4p	Ga	Ge	As	Se	Br	Kr
5p	In	Sn	Sb	Te	I	Xe
6p	Tl	Pb	Bi	Po	At	Rn
7p	Nh	Fl	Mc	Lv	Ts	Og

2p⁶
3p⁶

ns² np¹⁻⁶

p block

- The halogens (Group 17) and the chalcogens (Group 16)
- Have highly negative electron gain enthalpies
- Non-metallic character increases as we move from left to right across a period and metallic character increases as we go down the group

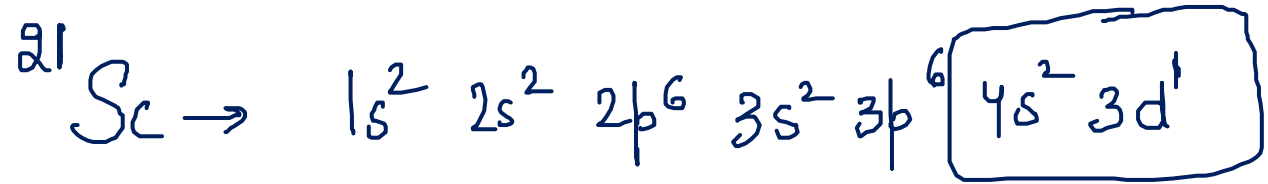
~~Group~~

Valence e^-
enters the
d-subshell

d block(Transition elements)

- Group 3 to 12
- $(n-1)d^{1-10}ns^{0-2}$
- Coloured ions, exhibit variable valence (oxidation states), paramagnetism and used as catalysts

Group No. = No. of ns e^- s
+ no. of (n-1) d e^- s



$2+1 = \textcircled{3} \quad \textcircled{ns^2} \quad \textcircled{(n-1)d^1}$

d-BLOCK

	3	4	5	6	7	8	9	10	11	12
3d	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
4d	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd
5d	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg
6d	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn

Valence e^- enters f-subshell

4f → Lanthanoids

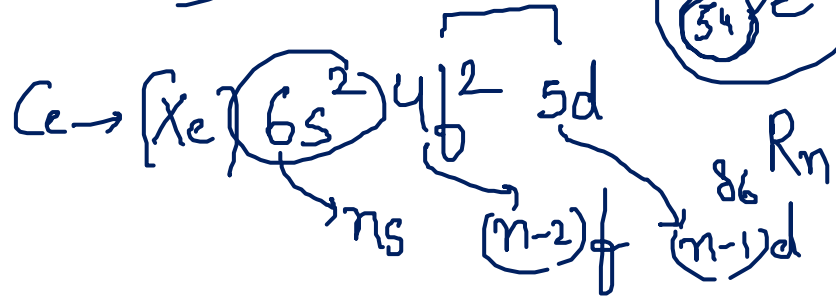
5f → Actinoids

Ce
Z = 58

2 He
10 Ne
18 Ar
36 Kr

54 Xe

5s² 5p⁶



f-Block Elements (Inner-Transition Elements)

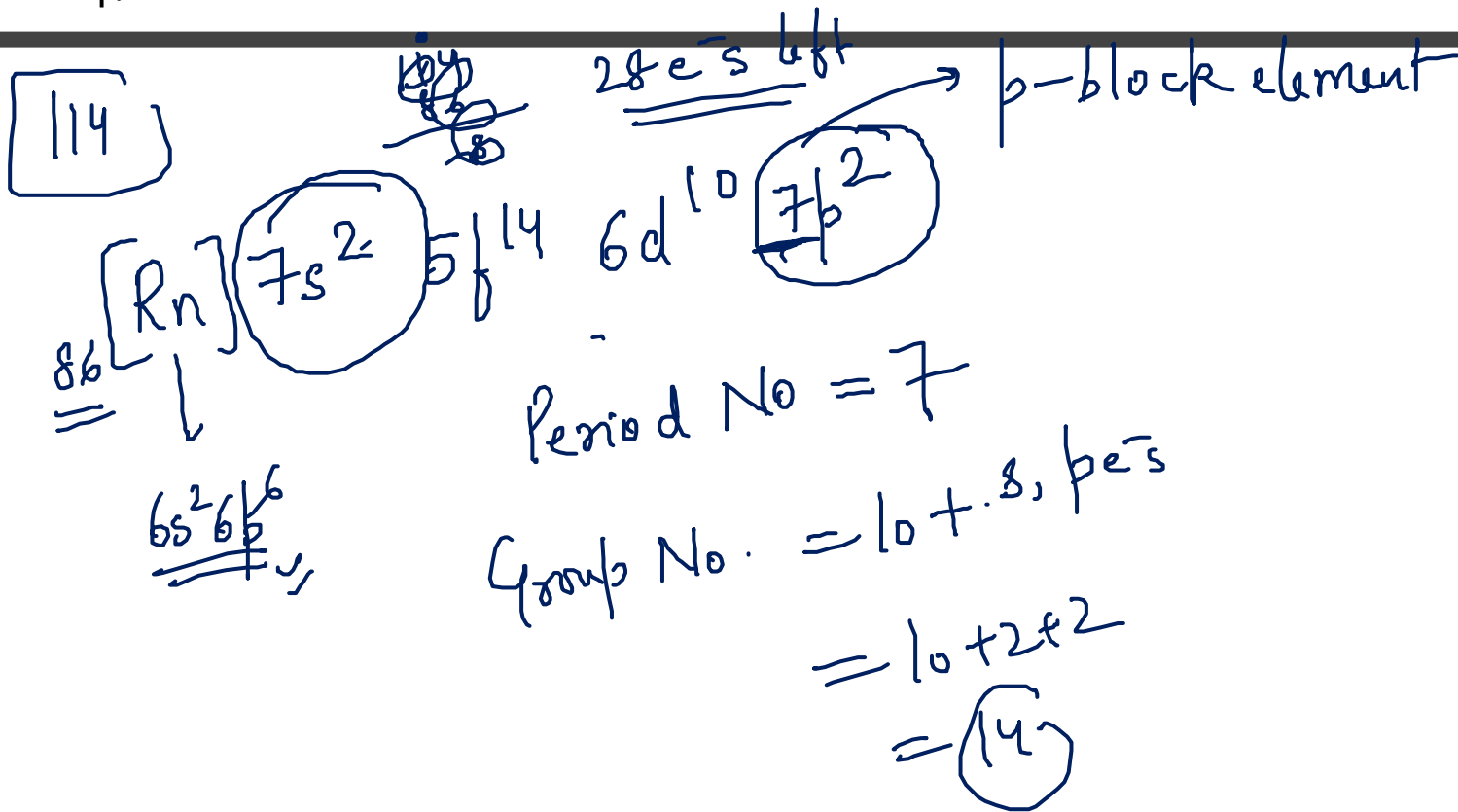
- Lanthanoids, Ce (Z = 58) – Lu (Z = 71)
- Actinoids, Th (Z = 90) – Lr (Z = 103)
- (n-2)f¹⁻¹⁴ (n-1)d⁰⁻¹ ns²
- Elements are radioactive
- Transuranium Elements. → Elements present after Uranium

Lanthanoids
 $4f$

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

Actinoids
 $5f$

Ques) In terms of period and group where would you locate the element with $Z = 114$?



ANSWER
Period 7
Group 14
Block p

Homework

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- Do all solved examples till 3.4
- Do exercise questions till 3.6

Question of the day

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Ques) Write the atomic number of the element present in the third period and seventeenth group of the periodic table.

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THANKYOU