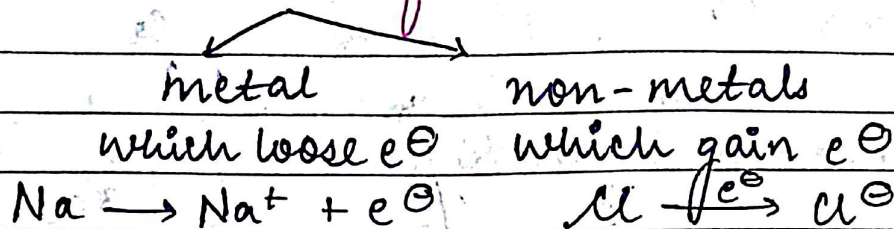


27/07/11

# Periodic Table

Page No. 75 Date

## Lavoisier Classification :-



cannot classify metalloids.

## Prout's Hypothesis

All elements are made up of hydrogen.

$$At. wt. = n \times (At. wt. of H atom)$$

$$n = 1, 2, 3, 4, \dots$$

Drawback :-  $Cl \rightarrow 35.5$  it is not whole no.

## Dobereiner law of triads :-

3 elements  $\rightarrow$  Triad

1, 2, 3

$$W_2 = \frac{W_1 + W_3}{2}$$

2

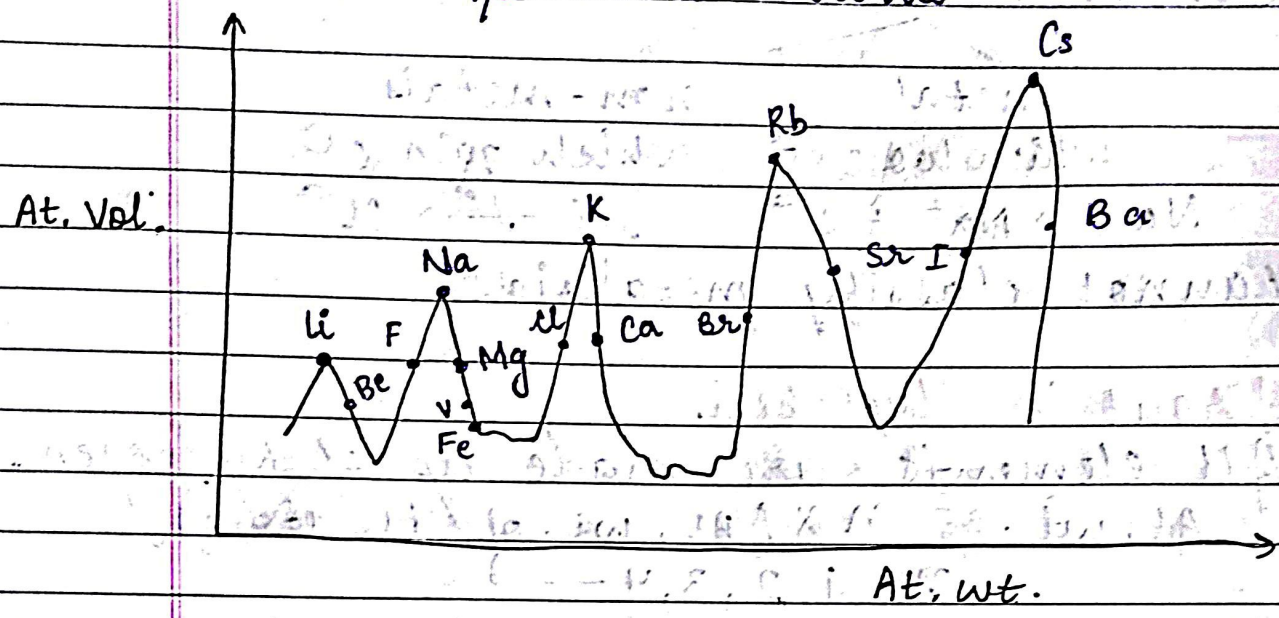
Drawback: A large no. of elements can't be classified in triads.

|    |    |      |                               |
|----|----|------|-------------------------------|
| eg | Li | 7    | $\frac{7 + 39}{2} = 23$       |
|    | Na | 23   |                               |
|    | K  | 39   |                               |
| eg | Cl | 35.5 | $\frac{35.5 + 127}{2} = 81.5$ |
|    | Br | 80   |                               |
|    | I  | 127  |                               |
|    | Fe | 55   |                               |
|    | Co | 58.9 |                               |
|    | Ni | 58.6 |                               |
|    | X  |      |                               |



## Lotharmeyer curve :-

At. vol. v/s At. wt. curve



Peak :- alkali metals (Li, Na, K ---)

descending part :- alkaline earth metals  
(Be, Mg, Ca ---)

Ascending part :- halogens

Metalloids & Transition elements - bottom

Note :- Elements with 11<sup>th</sup> property occupy 11<sup>th</sup> position in curve.

## Mendeleev Periodic Table :-

### Newland's Law of Octave :-

If elements are arranged in Pising order of atomic wt then every 8<sup>th</sup> element resembles with 1<sup>st</sup> element.

|    |    |    |    |     |     |    |    |
|----|----|----|----|-----|-----|----|----|
| 1  | 2  | 3  | 4  | 5   | 6   | 7  | 8  |
| Sa | Re | Ga | Ma | Paa | Dha | Ne | Sa |
| Li |    |    |    |     |     |    |    |
| Na |    |    |    |     |     |    |    |



valid upto Ca.

### Mendeleev Periodic Table :-

Physical and chemical properties of element are periodic function of their atomic wt.

- ① based on At. wt.
- ② 63 elements (not included inert gas)
- ③ 7 periods & 8 groups.

↓  
based on oxides of elements

| A                | B | A  | B | A                             | B | A               | B | A                             | B | A               | B | A                             | B | C               | 9 elements |
|------------------|---|----|---|-------------------------------|---|-----------------|---|-------------------------------|---|-----------------|---|-------------------------------|---|-----------------|------------|
| \                | / | \  | / | \                             | / | \               | / | \                             | / | \               | / | \                             | / | \               | /          |
| I                |   | II |   | III                           |   | IV              |   | V                             |   | VI              |   | VII                           |   | VIII            |            |
| E <sub>2</sub> O |   | EO |   | E <sub>2</sub> O <sub>3</sub> |   | EO <sub>2</sub> |   | E <sub>2</sub> O <sub>5</sub> |   | EO <sub>3</sub> |   | E <sub>2</sub> O <sub>7</sub> |   | EO <sub>4</sub> |            |

Merit :-

1. Classification in Tabular form
2. Prediction of future elements

Eka Aluminium → Gallium

Eka Silicon → Germanium

Eka Boron → Sc

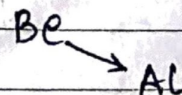
Eka Manganese → Tc

3. Correction in At. wt.

$$\text{At. wt.} = \text{Eq. wt.} \times \text{Valency}$$

$$\text{Be} = 4.5 \times 3$$

$$= 13.5 \times$$



Be → divalent

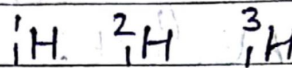
$$\text{Be} = 4.5 \times 2 = 9 \checkmark$$

(In)



Demerits :-

1. used A.E. wt. as base
2. Position of H  $\rightarrow$  alkali metals  
 $\rightarrow$  Halogens
3. Position of isotope



$\rightarrow$  same position

4. Anomalous Pair

आमिर खान Teri Ichha Thanda Pepsi Coke Ni

|      |      |       |     |     |     |      |      |
|------|------|-------|-----|-----|-----|------|------|
| Ar   | K    | Te    | I   | Tu  | Pa  | Co   | Ni   |
| 39.9 | 39.1 | 127.6 | 127 | 232 | 231 | 58.9 | 58.6 |

5. Elements with 11r property  $\rightarrow$  diff. gp.  
eg Pt & Au

6. Elements with diff. property  $\rightarrow$  same gp.  
K  
Rb  
Cs

7. Why Periodicity?

Modern Periodic Table :-

$$\sqrt{V} \propto Z$$

Law :- Physical and chemical properties of elements are periodic function of atomic number.

7 period

18 gp.



## S-Block Elements $ns^{1-2}$

- metals
- highly reactive (so not found in pure state)
- Low I.P.
- Except Li & Be all s-block elements form ionic compounds.

|          | $ns^1$  |                               | $ns^2$   |         |             |
|----------|---------|-------------------------------|----------|---------|-------------|
|          | I A / 1 |                               | II A / 2 |         |             |
| 2 $n=1$  | He      | 1 H                           |          |         |             |
| 2 $n=2$  | Li      | 3 Li [He] $2s^1$              | 4 Be     | Beta    | [He] $2s^2$ |
| 8 $n=3$  | Na      | 11 Na [Ne] $3s^1$             | 12 Mg    | Mange   | [Ne] $3s^2$ |
| 18 $n=4$ | Kare    | 19 <del>K</del> K [Ar] $4s^1$ | 20 Ca    | Car     | [Ar] $4s^2$ |
| 18 $n=5$ | Rab     | 37 Rb [Kr] $5s^1$             | 38 Sr    | Scooter | [Kr] $5s^2$ |
| 32 $n=6$ | Se      | 55 Cs [Xe] $6s^1$             | 56 Ba    | Baab    | [Xe] $6s^2$ |
| 32 $n=7$ | Fariyad | 87 Fr [Rn] $7s^1$             | 88 Ra    | Raji    | [Rn] $7s^2$ |



|             | III A<br>13                 | IV A<br>14                     | V A<br>15<br><i>pnictogens<br/>pnictogen</i> | VI A<br>16<br><i>chalcogens</i> | VII A<br>17<br><i>halogen</i> | zero<br>18<br><i>Noble gas</i>                |
|-------------|-----------------------------|--------------------------------|----------------------------------------------|---------------------------------|-------------------------------|-----------------------------------------------|
|             |                             |                                |                                              |                                 |                               | He $1s^2$                                     |
| n=2 Baingan | 5 B $[He]2s^22p^1$          | C $2s^22p^2$<br><i>Carne</i>   | N $2s^22p^3$<br><i>Nana</i>                  | O $2s^22p^4$<br><i>Old</i>      | F $2s^22p^5$<br><i>Fir</i>    | Ne $2s^22p^6$<br><i>Hema</i><br><i>Neelam</i> |
| n=3 Aalu    | 13 Al $[Ne]3s^23p^1$        | Si $3s^23p^2$<br><i>Sita</i>   | P $3s^23p^3$<br><i>Pateka</i>                | S $3s^23p^4$<br><i>style</i>    | Cl $3s^23p^5$<br><i>Kal</i>   | Ar $3s^23p^6$<br><i>Aur</i>                   |
| n=4 Gajar   | 31 Ga $[Ar]3d^{10}4s^24p^1$ | Ge $4s^24p^2$<br><i>Gee</i>    | As $4s^24p^3$<br><i>Aise</i>                 | Se $4s^24p^4$<br><i>Se</i>      | Br $4s^24p^5$<br><i>Bahar</i> | Kr $4s^24p^6$<br><i>Karishma</i>              |
| n=5 in      | 49 In $5s^25p^1$            | Sn $5s^25p^2$<br><i>Sune</i>   | Sb $5s^25p^3$<br><i>Sab</i>                  | Te $5s^25p^4$<br><i>Te</i>      | I $5s^25p^5$<br><i>ai</i>     | Xn $5s^25p^6$<br><i>Xe</i>                    |
| n=6 Thila   | 81 Tl $6s^26p^1$            | Pb $6s^26p^2$<br><i>Prabhu</i> | Bi $6s^26p^3$<br><i>Bikharu</i>              | Po $6s^26p^4$<br><i>Po</i>      | At $6s^26p^5$<br><i>aunty</i> | Rn $6s^26p^6$<br><i>Rani</i>                  |



### P-block Elements :-

$ns^2 np^{1-6} \rightarrow (13-18) \rightarrow 6 \text{ gp}$   
 $[s+p]$  representative elements

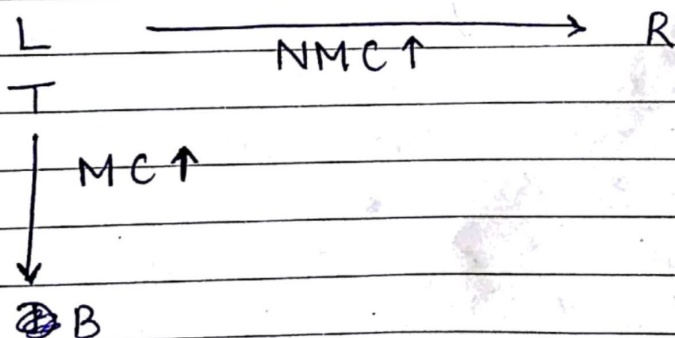
Typical elements  $\rightarrow 3^{\text{rd}}$  period

Na, Mg, Al, Si, P, S, Cl  
 $\rightarrow$  represent properties of their respective group.

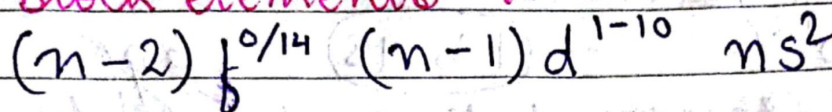
Total gaseous elements  $\rightarrow \text{H, N, O, F, Cl}$

He  
Ne  
Ar  
Kr  
Xe  
Rn

Total liquid elements  $\rightarrow \text{Cs, Fr, Hg, Ga, Br, Uub}$

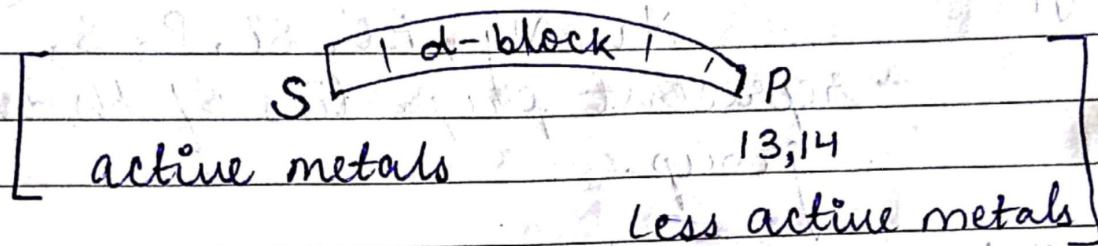


d-block elements :-



metals

transition elements



Show paramagnetism, coloured compd  
act as catalyst

Zn, Cd, Hg  $\xrightarrow{\text{full filled } nd^{10} ns^2}$  Volatile ~~element~~ metal

Cu, Ag, Au  $\rightarrow$  Coinage metal

Ru, Os  $\rightarrow$  highest O.S. (+8)



|                  | Science Teacher   | Vinita            | Chamari           | Man               | Fe Co Ni          | Kyun              | Zaan Talati Ho    |                           |                      |                      |
|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|---------------------------|----------------------|----------------------|
| n=4<br>3d Series | Sc<br>$3d^1 4s^2$ | Ti<br>$3d^2 4s^2$ | V<br>$3d^3 4s^2$  | Cr<br>$3d^5 4s^1$ | Mn<br>$3d^5 4s^2$ | Fe<br>$3d^6 4s^2$ | Co<br>$3d^7 4s^2$ | Ni<br>$3d^8 4s^2$         | Cu<br>$3d^{10} 4s^1$ | Zn<br>$3d^{10} 4s^2$ |
| n=5<br>4d series | Y<br>$4d^1 5s^2$  | Zr<br>$4d^2 5s^2$ | Nb<br>$4d^4 5s^1$ | Mo<br>$4d^5 5s^1$ | Tc<br>$4d^5 5s^2$ | Ru<br>$4d^7 5s^1$ | Rh<br>$4d^8 5s^1$ | Pd<br>$[Kr] 4d^{10} 5s^0$ | Ag<br>$4d^{10} 5s^1$ | Cd<br>$4d^{10} 5s^2$ |
| n=6<br>5d series | La<br>$5d^1 6s^2$ | Hf<br>$5d^2 6s^2$ | Ta<br>$5d^3 6s^2$ | W<br>$5d^4 6s^2$  | Re<br>$5d^5 6s^2$ | Os<br>$5d^6 6s^2$ | Ir<br>$5d^7 6s^2$ | Pt<br>$5d^9 6s^1$         | Au<br>$5d^{10} 6s^1$ | Hg<br>$5d^{10} 6s^2$ |
| n=7<br>6d series | Ac<br>$6d^1 7s^2$ | 104               |                   |                   |                   |                   |                   |                           |                      |                      |

Page No. 83  
 Date:

Lanthanoids [Ce (Z=58) - Lu (Z=71)] F-block Elements  $(n-2)f^{1-14} (n-1)d^{0-1} ns^2$

|         | La | [Xe] | 4f <sup>0</sup> | 5d <sup>1</sup> | 6s <sup>2</sup> |
|---------|----|------|-----------------|-----------------|-----------------|
| Ceene   | Ce |      | 2               | 0               | 2               |
| Par     | Pr |      | 3               | 0               | 2               |
| Nadia   | Nd |      | 4               | 0               | 2               |
| Prem ki | Pm |      | 5               | 0               | 2               |
| Samai   | Sm |      | 6               | 0               | 2               |
| Eu Yi   | Eu |      | 7               | 0               | 2               |
| Gradgad | Gd |      | 7               | 1               | 2               |
| Tab     | Tb |      | 9               | 0               | 2               |
| Die     | Dy |      | 10              | 0               | 2               |
| Hua     | Ho |      | 11              | 0               | 2               |
| Eur     | Er |      | 12              | 0               | 2               |
| Tum     | Tm |      | 13              | 0               | 2               |
| La. Yab | Yb |      | 14              | 0               | 2               |
| Legt Ho | Lu |      | 14              | 1               | 2               |

•  $f^0, f^2, f^8$  X

• half filled/full filled repeats once  
 $f^7, f^{14}$

(Pm) first man made lanthanoid

Tc first man made element

${}_{64}\text{Gd} [\text{Xe}] 4f^7 5d^1 6s^2$

$\text{Gd}^{2+} [\text{Xe}] 4f^7 5d^1 6s^0$

$\text{Gd}^{3+} [\text{Xe}] 4f^7 5d^0 6s^0$

$\text{Gd}^{4+} [\text{Xe}] 4f^6 5d^0 6s^0$



# Actinoids

[ ${}_{90}\text{Th}$  -  $\text{Lr}$ ]

|         | Ac                 | [Rn] | $5f^0$ | $6d^1$ | $7s^2$ |
|---------|--------------------|------|--------|--------|--------|
| Thore   | ${}_{90}\text{Th}$ |      | 0      | 2      | 2      |
| Papad   | Pa                 |      | 2      | 1      | 2      |
| U       | U                  |      | 3      | 1      | 2      |
| Napo    | Np                 |      | 4      | 1      | 2      |
| Purane  | Pu                 |      |        |        |        |
| Aam     | Am                 |      |        |        |        |
| Cun     | Cm                 |      |        |        |        |
| Bikenge | Bk                 |      |        |        |        |
| Cafe    | Cf                 |      |        |        |        |
| Eise    | Es                 |      |        |        |        |
| Farmas  | Fm                 |      |        |        |        |
| Madam   | Md                 |      |        |        |        |
| Naster  | No                 |      |        |        |        |
| Lao     | Lr                 |      |        |        |        |

• Last  $e^- \rightarrow 5f$

$f^1, f^5, f^8$  X

half filled / fully filled  
 $f^7$   $f^{14}$

repeat once

Note :  
• elements after uranium are called Transuranium elements

NCERT :  ${}_{91}\text{Pa}, {}_{93}\text{Np}, {}_{94}\text{Pu}$  are obtained from Pitch blend  
which is an ore of U

6<sup>th</sup> ← 71  
7<sup>th</sup> ← 103  
f-block  
3<sup>rd</sup> gp

3/07/

Page No. 86 Date

## Determination of Period, block and groups :-

If Atomic no. is given

- ① Period : 'n' (outermost shell)
- ② Block : It is decided by the fact that in which subshell ~~the~~ last  $e^-$  entered.
- ③ Group :
  - s-block = no. of valence  $e^-$
  - p-block = 10 + no. of valence shell  $e^-$
  - d-block = no. of  $e^-$  in  $(n-1)d$  subshell + no. of  $e^-$  in  $ns$  subshell
  - f-block = 3<sup>rd</sup> group or III B gp.

Note :- write electronic configuration without acc<sup>n</sup> to  $(n+1)$  rule without any exception.

Ques Find period, block and gp for following atomic number :-

1. 17  $3s^2 3p^5$   
 P  $\rightarrow$  3 B  $\rightarrow$  P-block gp  $\rightarrow$  10 + 5 = 15  
 VII A = 17<sup>th</sup> gp

2. 24  $4s^2 3d^4$   
 period  $\rightarrow$  4, B  $\rightarrow$  d-block, gp = 4 + 2 = 6

3. 46  $36[Kr] 5s^2 4d^8$   
 period  $\rightarrow$  5 B  $\rightarrow$  d-block gp  $\rightarrow$  2 + 8 = 10 gp



4. 47  $_{36}[\text{Kr}] 5s^2 4d^9$   
Period  $\rightarrow 5$  B  $\rightarrow$  d-block gp  $\rightarrow 9 + 2 = 11$

5. 82  $_{54}[\text{Xe}] 6s^2 4f^{14} 5d^{10} 6p^2$   
Per  $\rightarrow 6$  B  $\rightarrow$  p gp  $\rightarrow 10 + 4 = 14$

6. 93  $\rightarrow$   $_{86}[\text{Rn}] 7s^2 5f^5$   
Period  $\rightarrow 7$  B  $\rightarrow$  f gp  $\rightarrow$  3<sup>rd</sup> gp.

7. 102  $_{86}[\text{Rn}] 7s^2 5f^{14}$   
Period  $\rightarrow 7$  B  $\rightarrow$  f gp  $\rightarrow$  3<sup>rd</sup> gp.

| Period | n   | no. of element | Z                      |
|--------|-----|----------------|------------------------|
| 1      | n=1 | 2              | 1-2 $_{2}\text{He}$    |
| 2      | n=2 | 8              | 3-10 $_{10}\text{Ne}$  |
| 3      | n=3 | 8              | 11-18 $_{18}\text{Ar}$ |
| 4      | n=4 | 18             | 19-36 $_{36}\text{Kr}$ |
| 5      | n=5 | 18             | 37-54 $_{54}\text{Xe}$ |
| 6      | n=6 | 32             | 55-86 $_{86}\text{Rn}$ |
| 7      | n=7 | 32             | 87-118 -               |

H.W

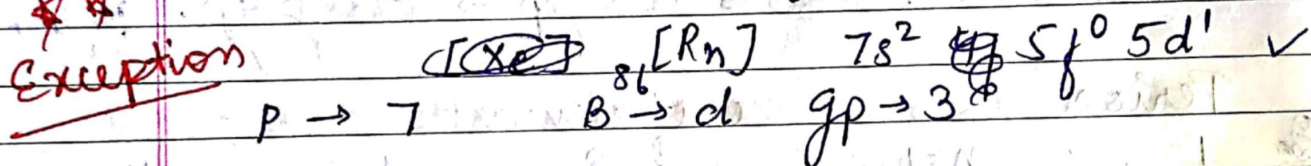
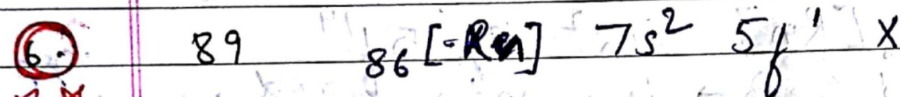
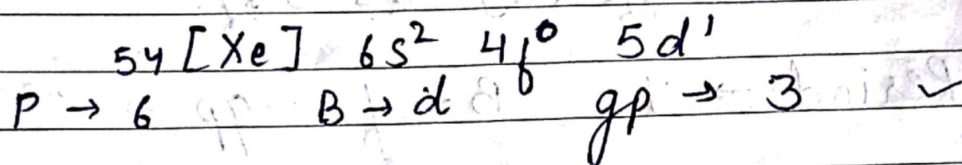
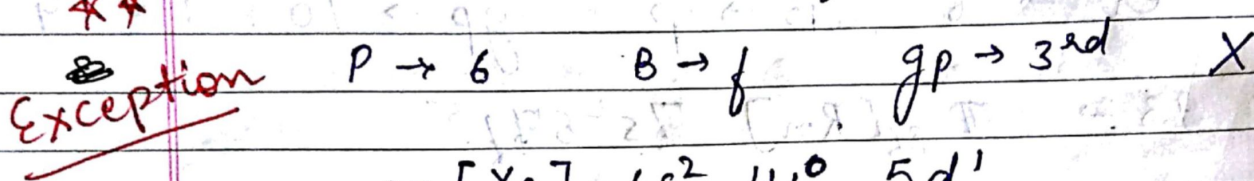
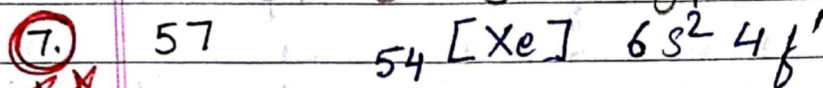
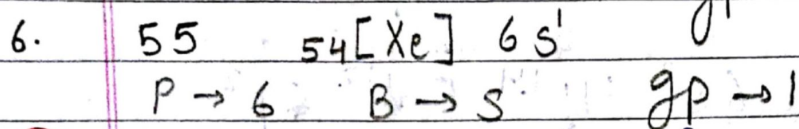
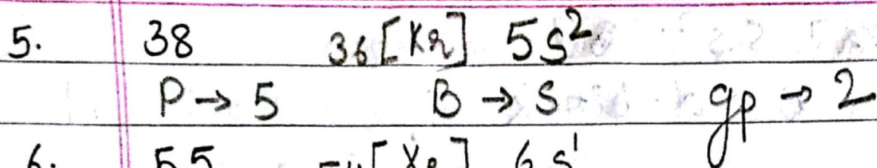
1. 53  $_{36}[\text{Kr}] 5s^2 4d^{10} 5p^5$   
P  $\rightarrow 5$  B  $\rightarrow$  p gp  $\rightarrow 10 + 2 + 5 = 17$  gp.

2. 114  $_{86}[\text{Rn}] 7s^2 5f^{14} 6d^{10} 7p^2$   
P  $\rightarrow 7$  B  $\rightarrow$  p gp  $\rightarrow 10 + 2 + 2 = 14$  gp

3. 98  $_{86}[\text{Rn}] 7s^2 5f^{14}$   
P  $\rightarrow 7$  B  $\rightarrow$  f gp  $\rightarrow$  III gp

4. 75  $_{54}[\text{Xe}] 6s^2 4f^{14} 5d^5$   
P  $\rightarrow 6$  B  $\rightarrow$  d gp  $\rightarrow 7$  gp





If electronic configuration is given :-  
s-block :-  $(n-2)f^0 (n-1)d^0 ns^{1-2}$   
n<sup>th</sup> period

$ns^1$  → 1<sup>st</sup> gp.

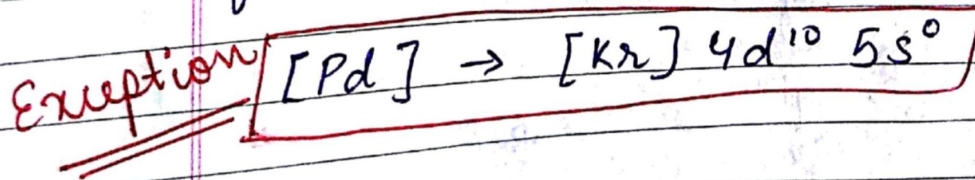
$ns^2$  → 2<sup>nd</sup> gp

p-block :-  $(n-2)f^{14} (n-1)d^{10} ns^2 np^{1-6}$   
n<sup>th</sup> period

gp = 10 + valence e<sup>-</sup>

d-block →  $(n-2)f^{0/14} (n-1)d^{1-10} ns^{0-2}$

f-block →  $(n-2)f^{1-14} (n-1)d^{0-1} ns^2$





## ↑ IUPAC Name of $Z > 100$

0 → nil

1 → un

2 → bi

3 → tri

4 → quad

5 → pent

6 → hex

7 → sept

8 → oct

9 → enn

101 - Unnilunium ~~Unu~~ Unv

102 - unnilbium Unb

103 - unniltrium Unt

110 - ununnilium

119 → ununennium

113 → ununtrium

118 → ununoctium

Suffix → ium

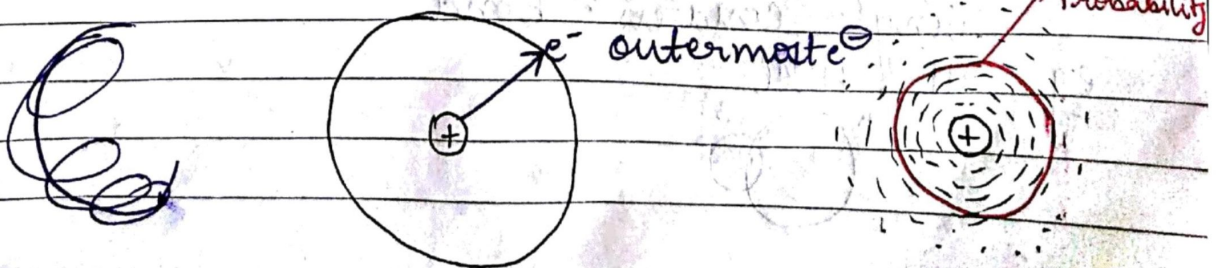
Ques Name of element which has  $Z = 100$  ?

- ① Unnilunium
- ② Unnilnilium
- ✓ ③ Fermium
- ④ Both 2 & 3

Periodicity

↙  $\lambda$   
↘ I.P.  
↘ Eg  
↘ E.N.

Atomic Radii It is distance b/w nucleus and outermost  $e^-$ .

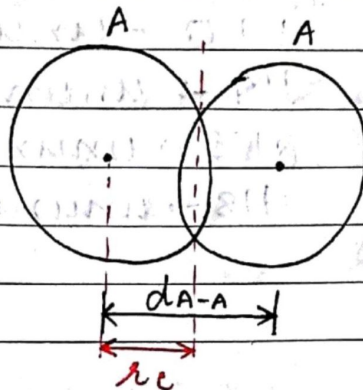


→ It depends upon type of bond.

### 1. Covalent Radii :-

eg:  $H_2, Cl_2$

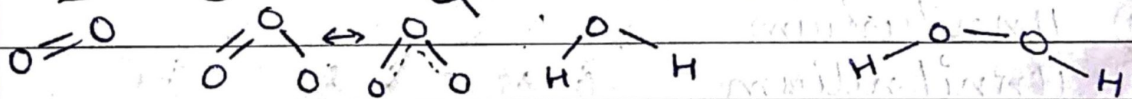
Case-I :- same covalent bond atom by a single bond.



$$r_c = \frac{d_{A-A}}{2}$$

Ques Covalent radii of oxygen can be calculated in

- (i)  $O_2$  (2)  $O_3$  (3)  $H_2O$  (4)  $H_2O_2$

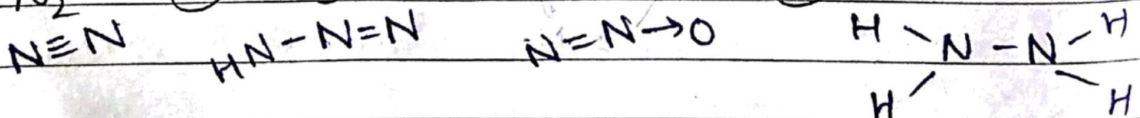


Ques Covalent radii of C can be calculated in

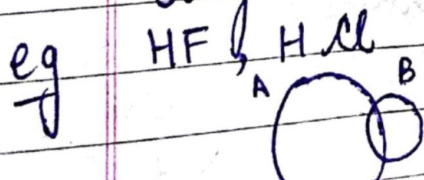
- (1)  $C_6H_6$  (2)  $C_2H_4$  (3)  $C_2H_6$  (4)  $C_2H_2$

Ques Covalent radii of Nitrogen can be calculated in

- (1)  $N_2$  (2)  $N_3H$  (3)  $N_2O$  (4)  $N_2H_4$



Case-II when 2 different atoms are bonded by a single covalent bond.





$$r_{A-B} = r_A + r_B - 0.09(\Delta E.N.) \text{ \AA}$$

Schomaker & Stevenson Formula

$$r_{A-B} = r_A + r_B - 9(\Delta E.N.) \text{ pm}$$

$r_A \rightarrow$  radii of A atom

$r_B \rightarrow$  radii of B atom

$\Delta E.N \rightarrow$  E.N. diff. b/w A & B

Ques

Find covalent radii of H-F molecule

B.L. of  $F_2 = 1.44 \text{ \AA}$   $r = \frac{1.44}{2}$

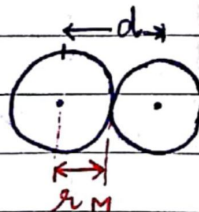
B.L. of  $H_2 = 0.74 \text{ \AA}$   $r = \frac{0.74}{2} = 0.37 = 0.72$

E.N. of F = 4

E.N. of H = 2.1

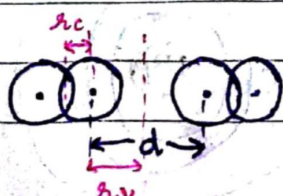
$$\begin{aligned} r_{H-F} &= 0.72 + 0.37 - 0.09(1.9) \\ &= 1.09 - 0.171 \\ &= 0.919 \end{aligned}$$

2. Metallic Radii :-

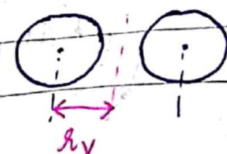


3. Vander wall radii

Non Metal



Inert gas





→ In non metals, Vanderwaal radii coexist ~~and~~ with covalent radii.

IIT/NEET/AIIMS

$$r_v > r_m > r_c$$

$$(r_v)_{\text{inert gas}} > (r_v)_{\text{N.M.}}$$

Ques Three student A, B & C find different radii of carbon  $2.44 \text{ \AA}$ ,  $2.20 \text{ \AA}$ ,  $2.06 \text{ \AA}$  resp. their result may be.

- ①  $r_m, r_c, r_v$
- ②  $r_v, r_c, r_m$
- ③  $r_v, r_m, r_c$
- ④  $r_c, r_m, r_v$

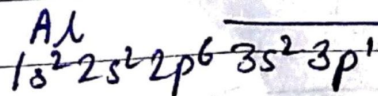
Ques Covalent radii & Vanderwall radii for oxygen may be

- ①  $1.70 \text{ \AA}$  &  $0.66 \text{ \AA}$
- ②  $1.70 \text{ \AA}$  &  $1.70 \text{ \AA}$
- ③  $0.66 \text{ \AA}$  &  $1.70 \text{ \AA}$
- ④  $0.66 \text{ \AA}$  &  $0.66 \text{ \AA}$

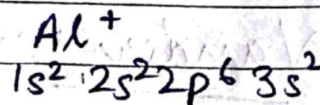
### Ionic Radii :-

1. Cationic Radii
2. Anionic Radii

#### 1. Cationic Radii

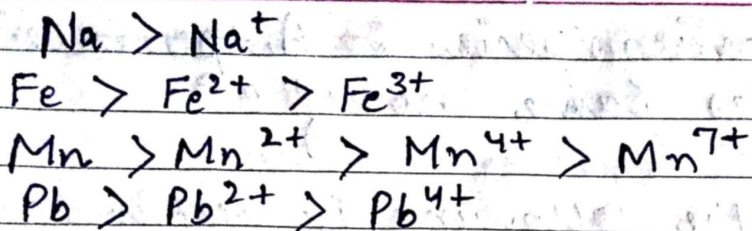


$-e^-$

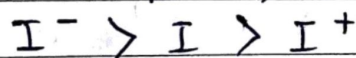
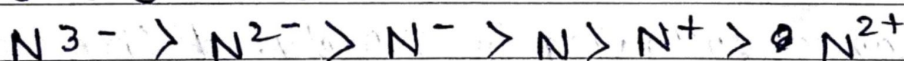
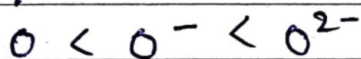
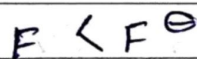
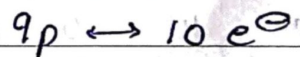
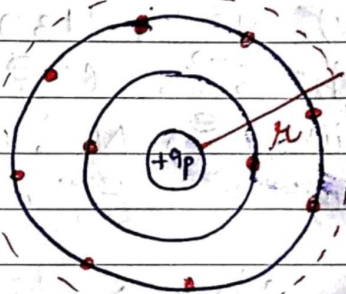
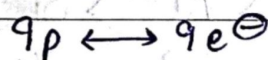
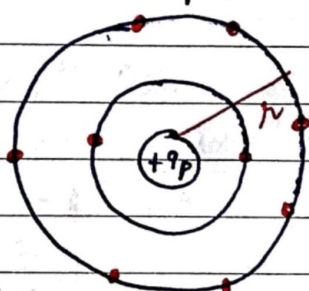
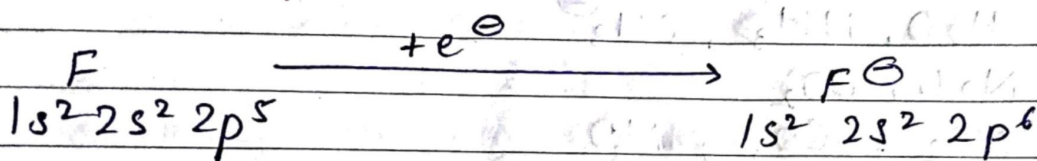




93



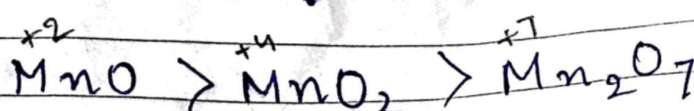
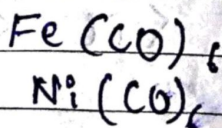
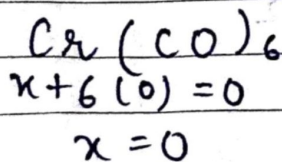
## 2. Anionic Radii :-



Ques Which of the following has largest radii  
(i)  $\text{CrCl}_2$  (ii)  $\text{Cr}_2\text{O}_3$  (iii)  $\text{Cr}_2\text{O}_7$  (iv)  $\text{Cr}(\text{CO})_6$   
+2 +3 +7 0



Metal Carbonyl :-  $\text{M}(\text{CO})_x$   
O.S. = 0





Isoelectronic species :- A series of species same no. of  $e^-$

Ques which of the following is ~~elect~~ isoelectronic species?

- (i)  $CO$ ,  $N^+O$ ,  $N_2$   
 (ii)  $H_2O$ ,  $NH_3$ ,  $CH_3^-$   
 (iii)  $N_2O$ ,  $CO_2$   
 (iv)  $NO_2$ ,  $CO_2$ ,  $N_2O$   
 (v)  $N^{3-}$ ,  $H_3O^+$ ,  $NH_4^+$   
 (vi)  $S^{2-}$ ,  $Cl^-$ ,  $K^+$ ,  $Ca^{2+}$   
 (vii)  $F^-$ ,  $Ne$ ,  $Na^+$   
 (viii)  $O^{2-}$ ,  $F^-$ ,  $Mg^{2+}$ ,  $Na^+$

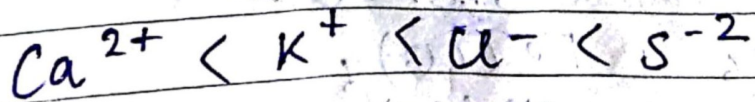
|   |          |          |          |       |      |        |           |           |           |
|---|----------|----------|----------|-------|------|--------|-----------|-----------|-----------|
|   | $C^{4-}$ | $N^{3-}$ | $O^{2-}$ | $F^-$ | $Ne$ | $Na^+$ | $Mg^{2+}$ | $Al^{3+}$ | $Si^{4+}$ |
| e | 10       | 10       | 10       | 10    | 10   | 10     | 10        | 10        | 10        |
| p | 6        | 7        | 8        | 9     | 10   | 11     | 12        | 13        | 14        |

Ques. Arrange following in  $\uparrow$  order of size

TEEE mains  
2017  
p  
NEERT

- ①  $O^{2-}$ ,  $F^-$ ,  $Na^+$ ,  $Mg^{2+}$
- |   |    |    |    |    |
|---|----|----|----|----|
| e | 10 | 10 | 10 | 10 |
| p | 8  | 9  | 11 | 12 |

- ②  $S^{2-}$ ,  $K^+$ ,  $Ca^{2+}$ ,  $Cl^-$
- |   |    |    |    |    |
|---|----|----|----|----|
| e | 18 | 18 | 18 | 18 |
| p | 16 | 19 | 20 | 17 |





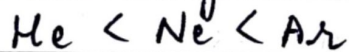
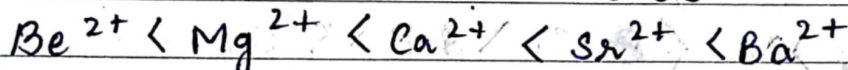
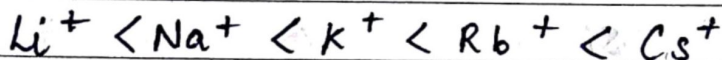
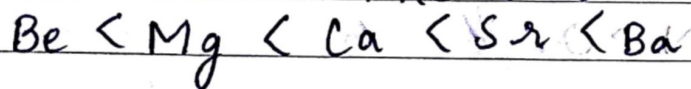
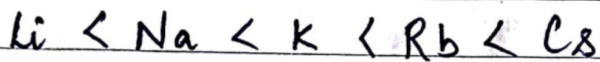
## Factors affecting atomic size :-

1. No. of shells

no. of shell  $\uparrow$  Atomic size  $\uparrow$   
in a gp  $\downarrow$  A.S.  $\uparrow$  becoz no. of shell  $\uparrow$

$$r = 0.529 \frac{n^2}{Z}$$

$$r \propto n$$

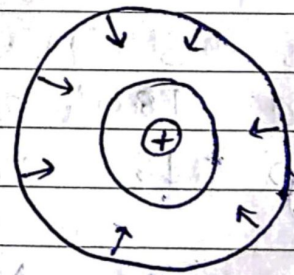


In a period

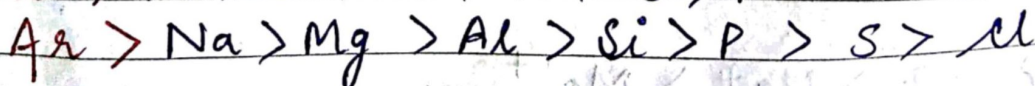
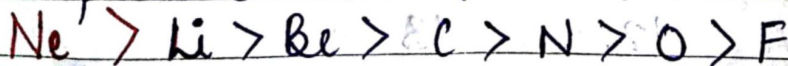
L  $\xrightarrow{\text{ENC} \uparrow \text{ size} \downarrow}$  R

Shell remaining same  
but no. of p  $\uparrow$   
ENC  $\uparrow$

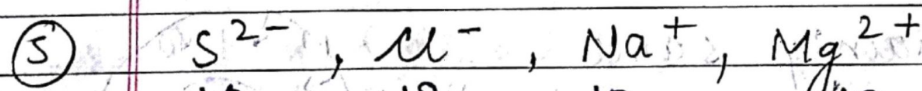
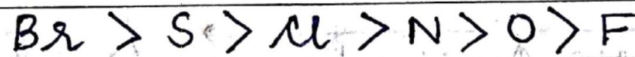
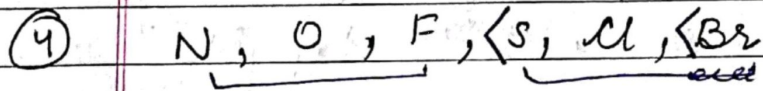
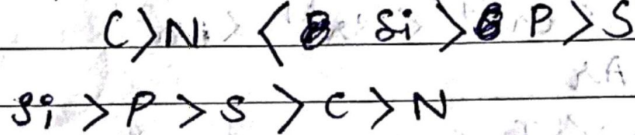
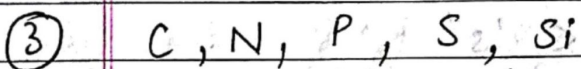
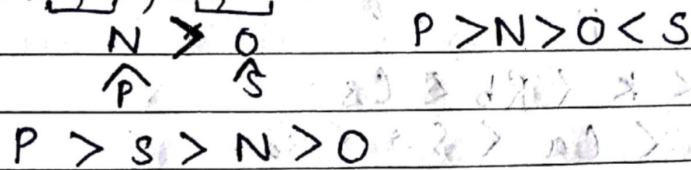
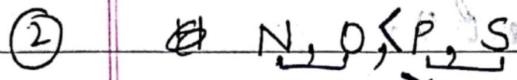
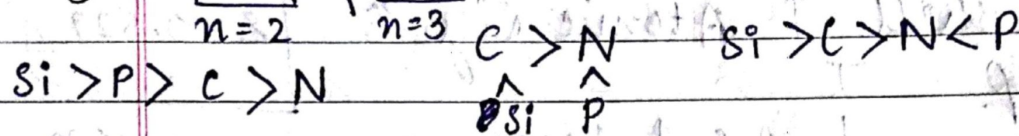
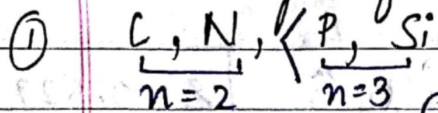
$e^-$  cloud shrink  
Size  $\downarrow$



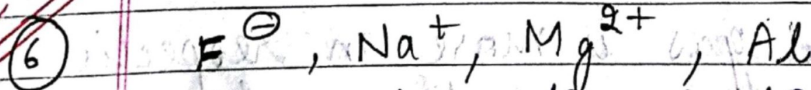
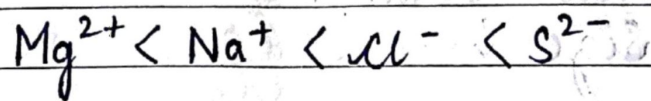
Note : Size of inert gas is more in respective period due to vanderwaal radii.



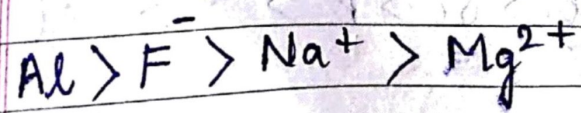
Ques Arrange following in  $\downarrow$  sing order of size



|   |    |    |    |    |
|---|----|----|----|----|
| e | 18 | 18 | 10 | 10 |
| p | 16 | 17 | 11 | 12 |



|   |    |    |    |    |
|---|----|----|----|----|
| e | 10 | 10 | 10 | 13 |
| p | 9  | 11 | 12 | 13 |





जिसका  $\frac{e}{p}$  ratio छोटा size छोटा

Page No. 97 Date \_\_\_\_\_

Ques which of the following has smallest size?

- (1) (A)  $1s^2 2s^1$  (B)  $1s^2 2s^2 2p^1$  (C)  $1s^2 2s^2 2p^4$   
(D)  $1s^2 1s^2 2p^5$

$A > B > C > D$

- (2) (A)  $1s^2 2s^2$  (B)  $1s^2 2s^2 2p^6 3s^1$  (C)  $1s^2 2s^2 2p^6 3s^2 3p^4$   
(D)  $1s^2 2s^2 2p^1$

$C > B > D > A$

उत्तर:

Ques which of the following has largest size

- (1) (A)  $1s^2 2s^1$  (B)  $1s^2 2s^2 2p^3$  (C)  $1s^2 2s^2 2p^5$  (D)  $1s^2 2s^2 2p^6$   
Ne  $> \text{Cl} > \text{N} > \text{F}$

- (2) (A)  $1s^2 2s^2 2p^1$  (B)  $1s^2 2s^2 2p^6$  (C)  $1s^2 2s^2 2p^5$  (D)  $1s^2 2s^2 2p^6$

- (C)  $1s^2 2s^2 2p^6 3s^1$  (D)  $1s^2 2s^2 2p^6 3s^2 3p^4$

$C > D > B > A$

2/8/17

Ques

$\underline{\text{K}}, \text{Na}, \text{Ar}, \text{Cl}, \text{F}, \text{Ne}$   
 $n=4 \quad n=3 \quad \text{F} \quad \text{Ne}^{n=2}$

$\text{Na} > \text{Cl} > \text{Ar}$

$\text{K} > \text{Ar} > \text{Na} > \text{Cl} > \text{Ne} > \text{F}$

$\text{Ne} > \text{F}$

$\text{Ar} > \text{Na} > \text{Cl}$

$\text{K}$

$\text{K} > \text{Ar} > \text{Na} > \text{Cl} > \text{Ne} > \text{F}$





Screening / shielding effect  $\rightarrow$  group

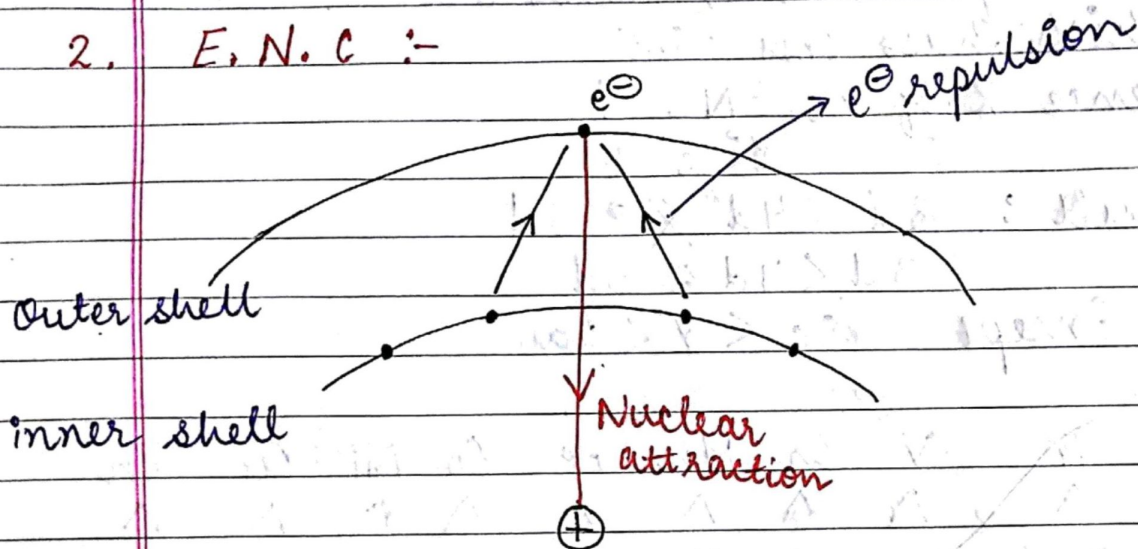
Screening / shielding effect  $\rightarrow$  group

Page No. 11 Date 11/11/2022

$I < Xe$   
BHV  $I > Xe$

Vanderwaal  
Covalent

2. E.N.C :-



Size  $\propto \frac{1}{ENC}$

Size  $\propto$  Shielding Effect

Shielding Power :  $s > p > d > f$

↓  
due to symmetry

Exception in atomic size of d-block elements.

164  
~~148~~ 148 135 129 137 126 125 125 128 137

$\text{Sc} > \text{Ti} > \text{V} > \text{Cr} > \text{Mn} > \text{Fe} \approx \text{Co} \approx \text{Ni} < \text{Cu} < \text{Zn}$

$Z_{\text{eff}} > \text{S.E.}$   $Z_{\text{eff}} \approx \text{S.E.}$   $Z_{\text{eff}} < \text{S.E.}$

ENC

$s > p > d > f$

## Lanthanoid Contraction :

f-block  $(n-2)f^{1-14} (n-1)d^{0-1} ns^2$   
 $e^-$  are filled in f subshell  
 which has less S.E.

hence  $Z_{eff}$  or ENC  $\uparrow$

Size  $\downarrow$

result :  $3d < 4d \times 5d$   
 $3d < 4d \approx 5d$

Except  $Sc < Y < La$

|          |          |          |          |          |          |          |          |          |          |          |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3d       | Sc       | Ti       | V        | Cr       | Mn       | Fe       | Co       | Ni       | Cu       | Zn       |
| $\wedge$ | $\wedge$ | $\wedge$ | $\wedge$ | $\wedge$ | $\wedge$ | $\wedge$ | $\wedge$ | $\wedge$ | $\wedge$ | $\wedge$ |
| 4d       | Y        | Zr       | Nb       | Mo       | Tc       | Ru       | Rh       | Pd       | Ag       | Cd       |
| SS       | $\wedge$ | SS       | SS       | SS       | SS       | SS       | SS       | SS       | SS       | SS       |
| 5d       | La       | Hf       | Ta       | W        | Re       | Os       | Ir       | Pt       | Au       | Hg       |

[Xe]  $4f^{14} 5d^1 6s^2$

14  $e^-$  in f

(114P)  $\uparrow$

SE  $\downarrow$

ENC  $\uparrow$

Size  $\downarrow$

## d-Block Contraction / Transition Contraction

Size of Al  $>$  Size of Ga due to less shielding of 3d  $e^-$

ENC  $\uparrow$

Size  $\downarrow$

|              |          |
|--------------|----------|
| B            | C        |
| $\wedge$     | $\wedge$ |
| Al           | Si       |
| $\checkmark$ | $\wedge$ |
| Ga           | Ge       |
| $\wedge$     | $\wedge$ |
| In           | Sn       |
| SS           | SS       |
| Tl           | Pb       |

$B^{3+} < Al^{3+} < Ga^{3+} < In^{3+} < Tl^{3+}$

For ionic and metallic radii

21  $3d^{1-10}$   
 less shielding of 10  $d e^-$   
 Size  $\downarrow$

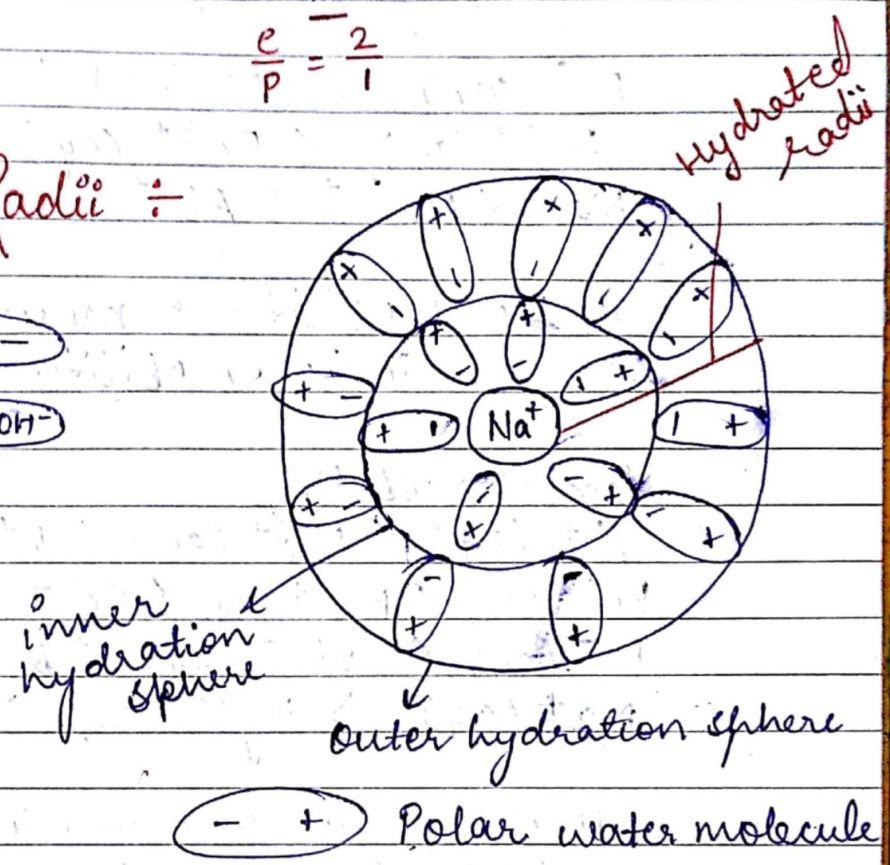
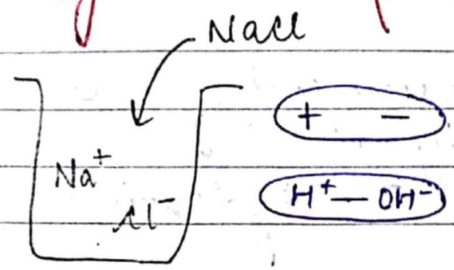
Lanthanoid



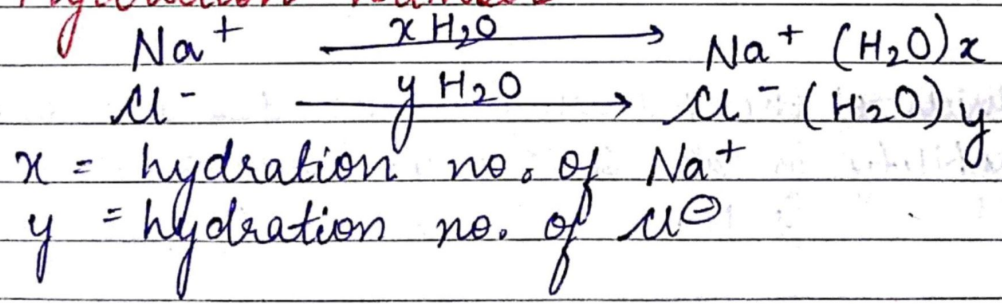
Note :-  $F^- < H^-$

$F^- < Cl^- < Br^- < H^- < I^-$   
 $\frac{e}{p} = \frac{2}{1}$

Hydrated Radii :-



Hydration Number

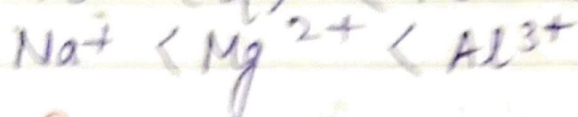
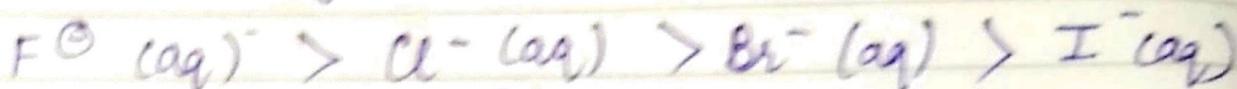
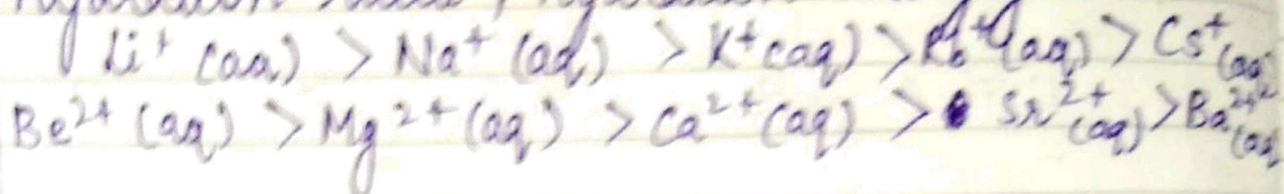


Hydration Energy :- The amount of energy released during hydration of ions.

Hydrated Radii  
Hydration Number  
H.F.] all depend upon charge density (i.e. charge per unit area)  
Charge  
area

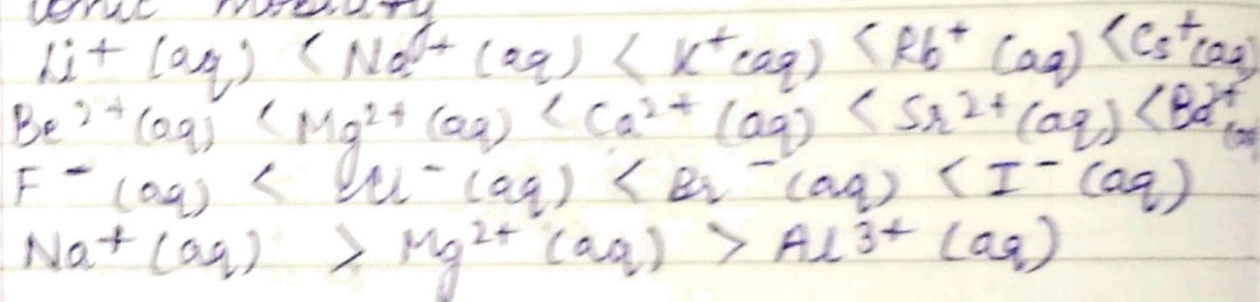


## Hydration radii, Hydration Energy

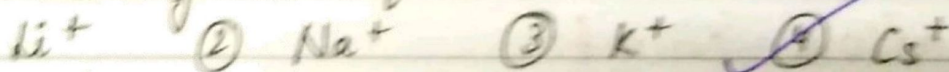


**Ionic Mobility** : movement of ions  
ionic mobility  $\propto \frac{1}{\text{hydration}}$

ionic mobility

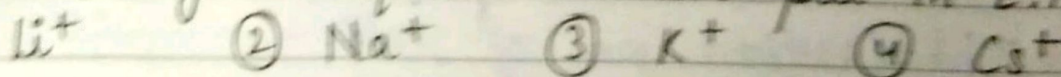


Ques Which of the following ion has highest ionic mobility in aq. sol<sup>n</sup>?

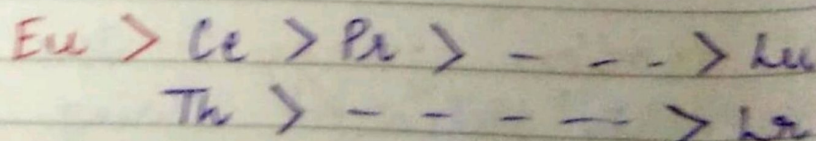


NEET-2017

Ques Which of the following ion has highest ionic mobility in aq. sol<sup>n</sup> when put in E.F.?



f-block



**Density (d) :**

$$d = \frac{m}{V}$$



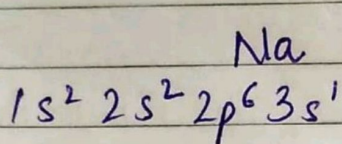
Unit :-  $g/ml$ ,  $g/cc$ ,  $kg/m^3$

In a group :-

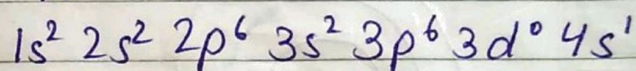
T  
↓  
B

$d \uparrow$  becoz  $\uparrow$  in  $m$  is much more  
than  $\uparrow$  in  $V$

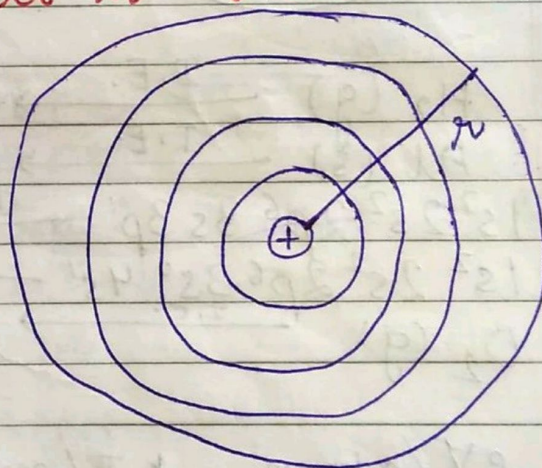
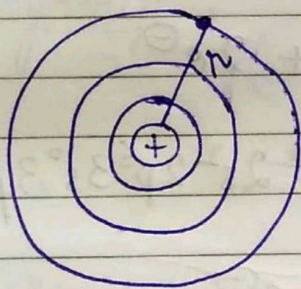
Exception :  $Li < K < Na < Rb < Cs$



$>$  K



due to vacant  $3d$  orbital there  
is abrupt  $\uparrow$  in Vol. which  
result in  $\downarrow d$ .



$Ca < Mg < Be < Sr < Ba$

Period :-

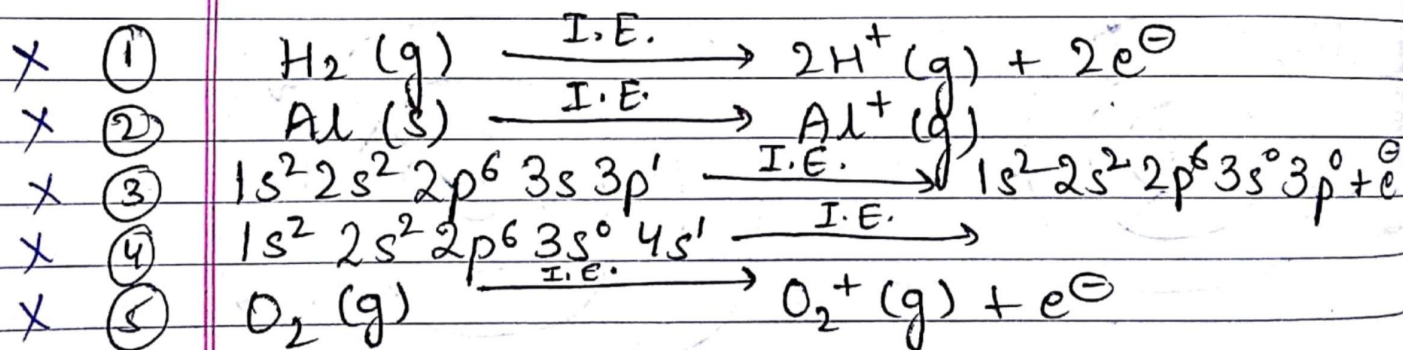
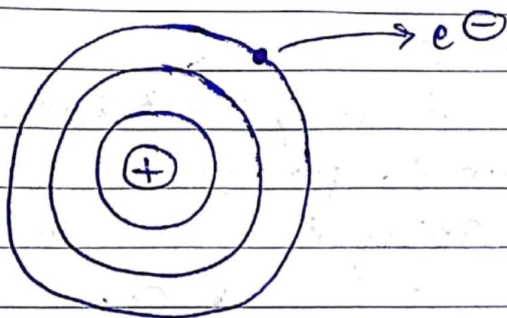
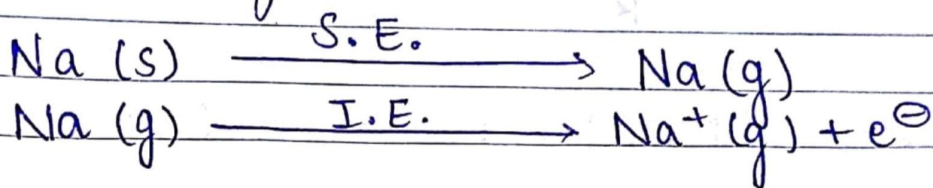
$d > p > s$



# 104

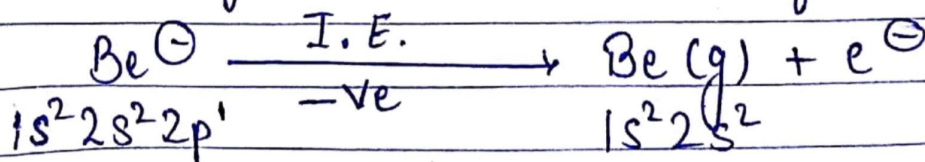
## Ionisation Potential / Energy / Enthalpy (I.P. / I.E.) :

The amount of energy required to remove an  $e^-$  from outermost shell or most loosely bound  $e^-$  in ground state of isolated gaseous atom.



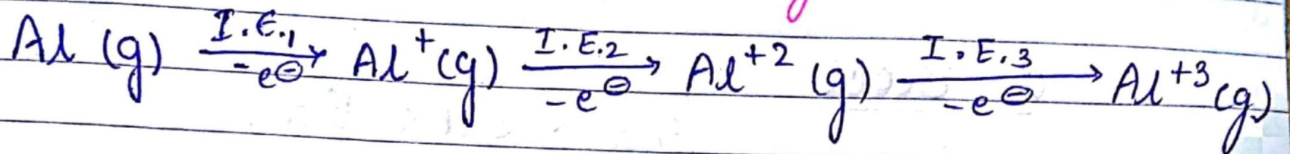
Unit : eV/atom, KJ/mol or Kcal/mol

It is an endothermic process i.e.  $\Delta H$  is +ve but it may be -ve in case of anion





## Successive Ionisation Energies :-



$$\text{I.E.}_1 < \text{I.E.}_2 < \text{I.E.}_3 \dots$$

Note : here  $\text{I.E.}_2$  is 1<sup>st</sup> I.E. for  $\text{Al}^+$   
 $\text{I.E.}_3$  is 1<sup>st</sup> I.E. for  $\text{Al}^{2+}$

## Factors affecting Ionisation Energy :-

### 1. Atomic Size :-

$$\text{I.E.} \propto \frac{1}{\text{A.S.}}$$

In a group :

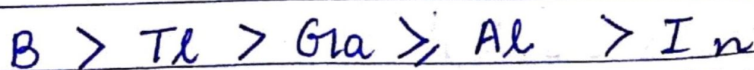
|    |    |    |    |    |  |
|----|----|----|----|----|--|
|    |    |    | T  |    |  |
|    |    |    | ↓  |    |  |
|    |    |    | B  |    |  |
|    |    |    |    |    |  |
| Li | Be | N  | F  | He |  |
| Na | Mg | P  | Cl | Ne |  |
| K  | Ca | As | Br | Ar |  |
| Rb | Sr | Sb | I  | Kr |  |
| Cs | Ba | Bi |    |    |  |

n ↑  
S.E. ↑  
Size ↑  
I.E. ↓  
shielding effect

### Exception

I.E. of Al < I.E. of Ga ] due to d-block contraction

In < Tl due to lanthanoid contraction



I.E. KJ/mol    801   589   579   577   558

C → C > Si > Ge > Pb > Sn Ln contraction

d - Block

4d < 3d < 5d

Sc > Y > La Exception

Zr < Ti < Hf  
Mo < Cr < W

Period ∴ L → R  
ENC ↑  
Size ↓  
I.E. ↑

2. E.N.C.

I.E. ∝ E.N.C.

Pb < Pb<sup>2+</sup> < Pb<sup>4+</sup>

Mn < Mn<sup>2+</sup> < Mn<sup>4+</sup> < Mn<sup>7+</sup>

3. Shielding Effect (SE) :-

I.E. ∝  $\frac{1}{S.E.}$

4. Penetration Powers of Orbitals :-

s > p > d > f

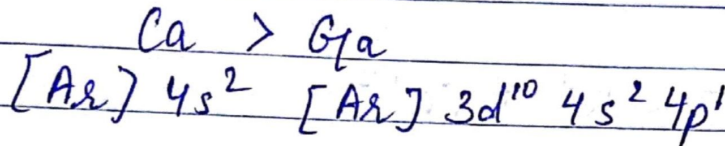
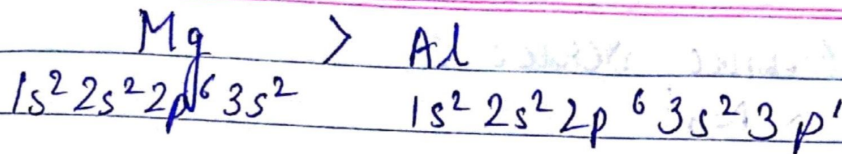
it means nuclear attraction is max<sup>m</sup> for s subshell & then for p > d > f

Be > B

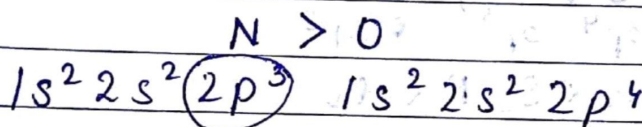
1s<sup>2</sup> 2s<sup>2</sup>

1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>1</sup>





5. **Electronic Configuration :-**  
full filled & half filled E.C. are more stable so IE



half filled



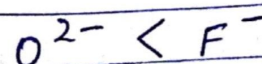
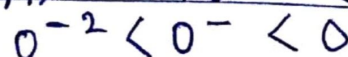
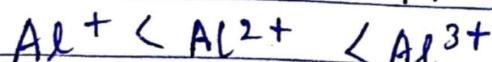
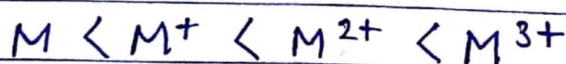
$Z_{\text{eff}}$  is more effective.

2<sup>nd</sup> & 3<sup>rd</sup> period  $\rightarrow$  I.E. 1 & I.E. 2

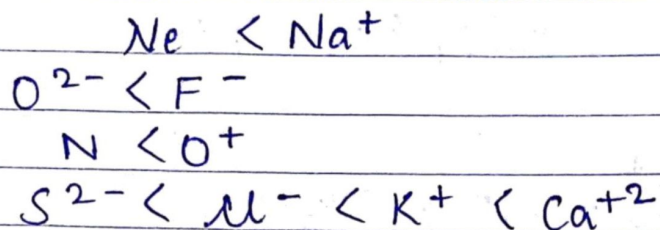


Note: He has highest I.E. in a periodic table

Note: Cs has lowest I.E.



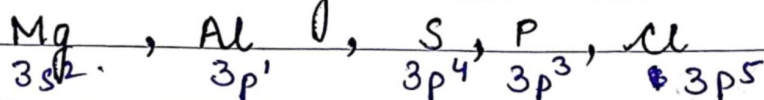
Isoelectronic Series :-



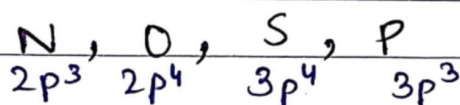
Ques

(i)

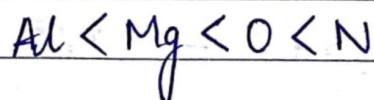
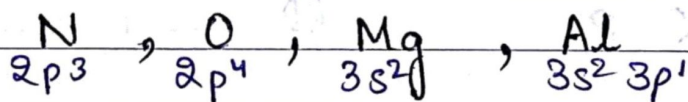
Write ↑ sing order I.E.



(ii)



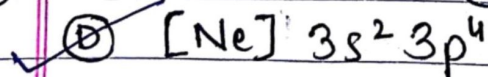
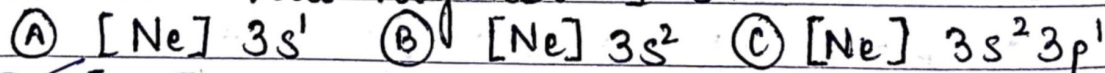
(iii)



Ques

which has highest I.E.?

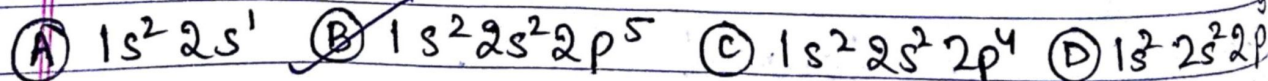
(1)



(2)



(3)

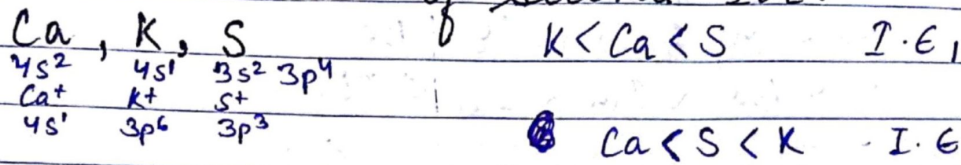




जितना ज्यादा +ve charge उतना ज्यादा I.E.

Page No. 109 Date

Ques Write ↑ order of second I.E.

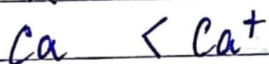


Ques Which of the following has largest jump b/w I.E.<sub>1</sub> & I.E.<sub>2</sub>?

- (1) (A) Li (B) O (C) Ne (D) Be  
 $\begin{matrix} 2s^1 \\ Li \\ 1s^2 \end{matrix} \quad \begin{matrix} 2s^2 2p^4 \\ O \\ 2s^2 2p^3 \end{matrix} \quad \begin{matrix} 2p^6 \\ Ne \\ 2p^5 \end{matrix} \quad \begin{matrix} 2s^2 \\ Be \\ 2s^1 \end{matrix}$   $Li < Be < O < Ne$   
 $Be < O < Ne < Li$   
 (2) (A)  $1s^2 2s^2 2p^1$  (B)  $1s^2 2s^2 2p^4$  (C)  $1s^2 2s^2 2p^3$   
 (D)  $1s^2 2s^2 2p^6 3s^1$   $\begin{matrix} 2p^3 \\ \\ 2p^2 \end{matrix}$   $\begin{matrix} 2p^2 \\ \\ 2p^1 \end{matrix}$   $D < A < C < B$   
 $A < C < B < D$

Ques which has largest jump b/w I.E.<sub>2</sub> & I.E.<sub>3</sub>?

- (1) (A) Mg (B) Al (C) Cl (D) P  
 $\begin{matrix} 3s^2 \\ Mg \\ 3s^1 \end{matrix} \quad \begin{matrix} 3p^1 \\ Al \\ 3s^2 \end{matrix} \quad \begin{matrix} 3p^5 \\ Cl \\ 3p^4 \end{matrix} \quad \begin{matrix} 3p^3 \\ P \\ 3p^2 \end{matrix}$   $Al < Mg < P < Cl$   
 $Mg < Al < P < Cl$   
 $Al < P < Cl < Mg$

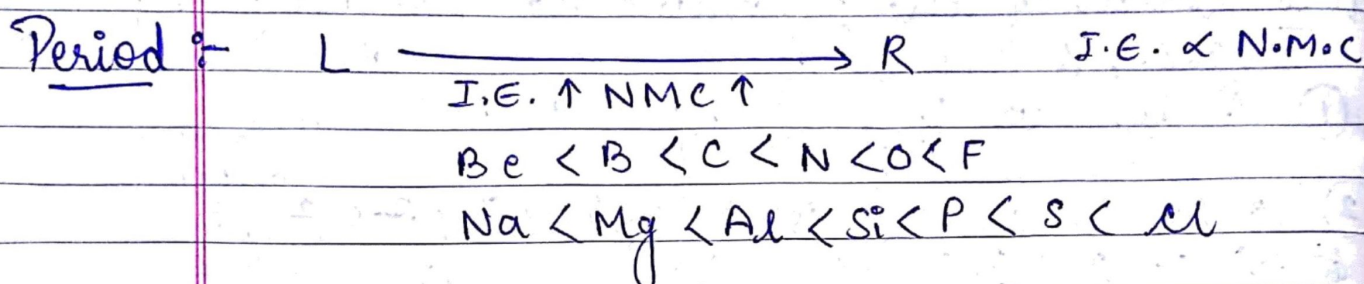
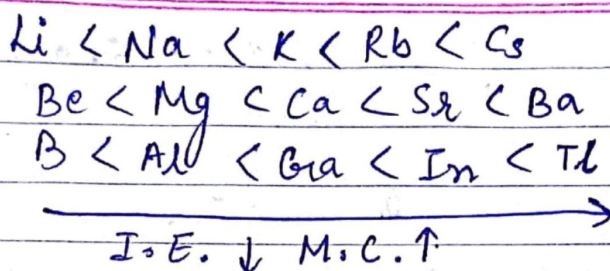


Determination of Application of I.E. :-

1. Determination of metallic and non-metallic character :-

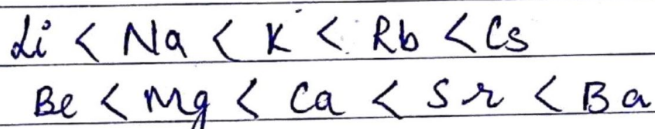
$$M.C. \propto \frac{1}{I.E.}$$

in a group :-  
 $\begin{matrix} T \\ \downarrow \\ B \end{matrix}$  I.E. ↓ MC ↑



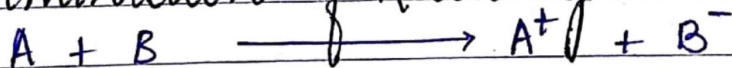
2. Reactivity :- Reactivity is a term used in group becoz no. of valence shell remains same

$$\text{reactivity} \propto \frac{1}{\text{I.E.}}$$



Note :- Reactivity halogens  $\propto$  E.No  
 $\text{F} > \text{Cl} > \text{Br} > \text{I}$

3. Determination of Reducing  $\text{Ch}^r$  & Oxidising  $\text{Ch}^r$



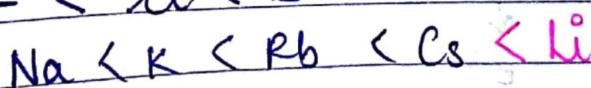
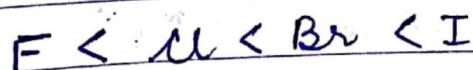
A  $\rightarrow$  reducing agent (which give  $e^-$ )

B  $\rightarrow$  oxidising agent (which gain  $e^-$ )

in a group :-

T  
↓  
B

I.E. ↓  
 $e^-$  donating tendency ↑  
Reducing  $\text{Ch}^r$  ↑



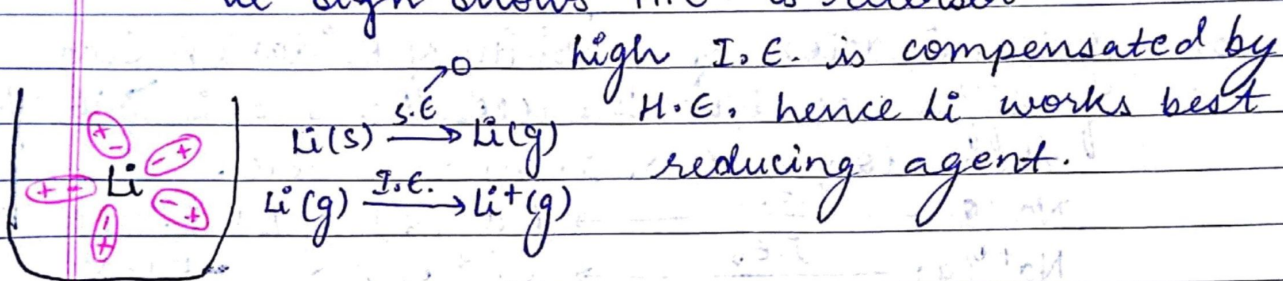


Ques  $\text{Li}^0$  has highest I.E. in alkali metals. Yet it act as best Reducing agent. Explain why?  
Reducing Ch. is calculated in aq. medium it is sum of 3 energies.

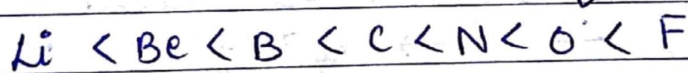
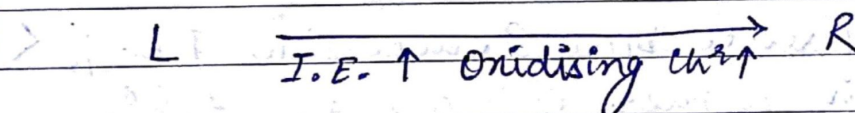
$$\text{Reducing Ch.} = \text{S.E.} + \text{I.E.} + (-\text{H.E.})$$

$$\text{S.E.} \ll \ll \text{I.E.} \quad (\text{neglect})$$

-ve sign shows H.E. is released.



In a period :-



1 / IA  $\rightarrow$  electropositive elements

17 / VIIA  $\rightarrow$  electronegative elements

most electropositive element  $\rightarrow$  Cs

most electronegative element  $\rightarrow$  F

Best reducing agent = Li

Best oxidising agent = F

Ques which is best oxidising agent?

- ① Mg    ② Si    ③ S    ④ Cl

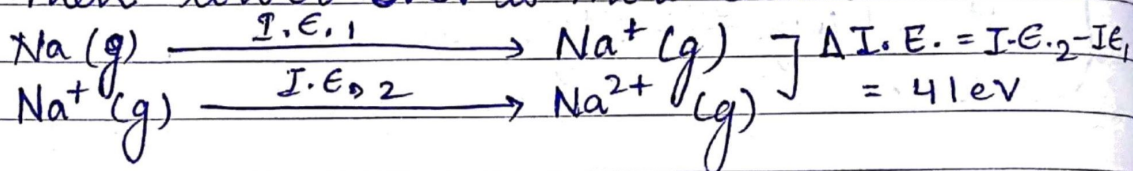


#### 4. Determination of valence shell $e^-$ :

Ques An element 'X' has successive I.E. (eV/atom) 12.82, 26.8, 44.3, 80.5, 230.7, 300.8. X is  
 (1) Na (2) Mg (3) Al (4) Si

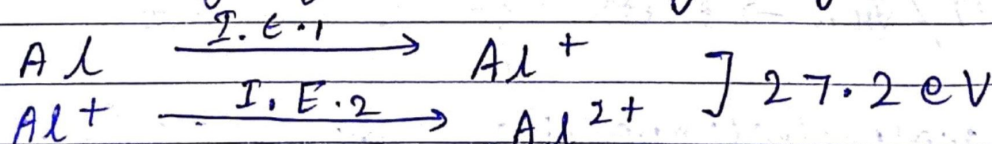
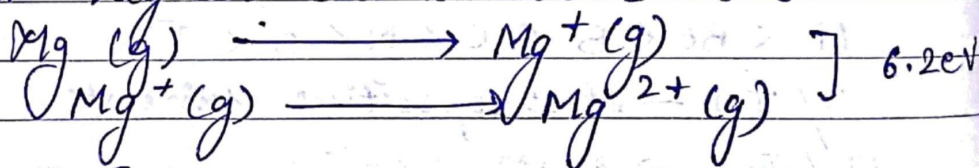
Largest jump  $\rightarrow$  inert gas configuration

5. Determination of stability of oxidation state:-  
 $\rightarrow$  If difference b/w 2 successive I.E. is  $\geq 16$  eV/atom then lower O.S. is more stable.

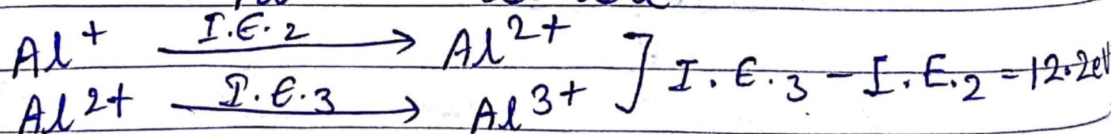


$\text{Na}^+$  is more stable.

$\rightarrow$  If difference b/w 2 successive I.E. is  $< 11$  eV then higher O.S. is more stable

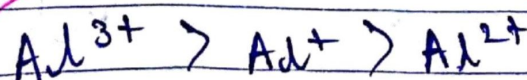


$\text{Al}^+ \rightarrow$  stable



$\text{Al}^{3+}$  is more stable

Room Temp.





Ques Which correct order of stability of Al in gaseous state? (High Temp)

- (1)  $Al^+ > Al^{2+} > Al^{3+}$
- (2)  $Al^{3+} > Al^+ > Al^{2+}$
- (3)  $Al^+ > Al^{3+} > Al^{2+}$
- (4)  $Al^{3+} > Al^{2+} > Al^+$

AIIMS 2013

Ques Value of <sup>1st</sup> I.E. of Na, Mg & Si in KJ/mol are 496, 737 & 786 resp. then correct ~~cor~~ order value of 1<sup>st</sup> I.E. of Al is -

- (1)  $> 786$  KJ/mol
- (2)  $> 496$  &  $< 786$  KJ/mol ✓
- (3)  $> 496$  &  $< 737$  KJ/mol
- (4)  $< 496$  KJ/mol

Na, Mg, Al, Si  
 $Na < Al < Mg < Si$   
 496                  737                  786

AIIMS 2018 NCERT eg 3.5

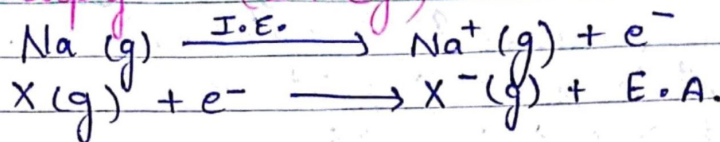
Ques Arrange following in ↑ order of size -

Mg,  $Mg^{2+}$ , Al,  $Al^{3+}$   
 12e    10e    13e<sup>-</sup>    10e<sup>-</sup>  
 12p    12p    13p    13p

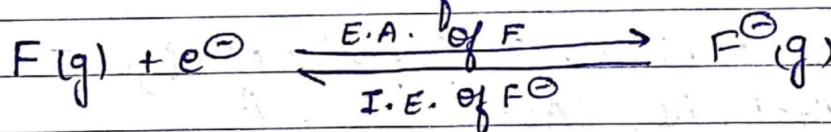
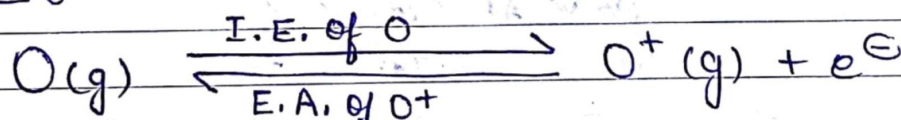
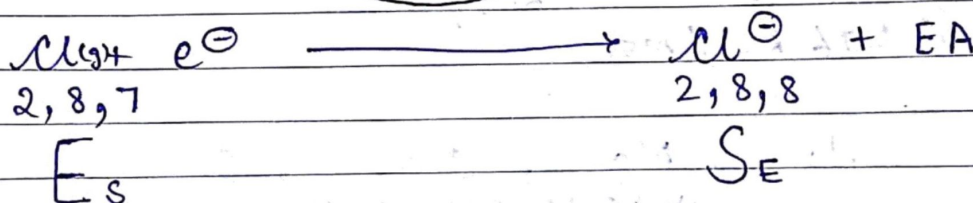
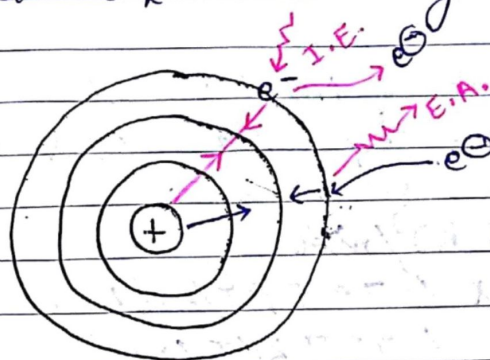
~~$Al^{3+} < Al < Mg^{2+} < Mg$~~      $Al^{3+} < Mg^{2+} < Al < Mg$

## 114

# Electron Affinity (E.A.) or Electron Gain Enthalpy ( $\Delta H_{eg}$ )



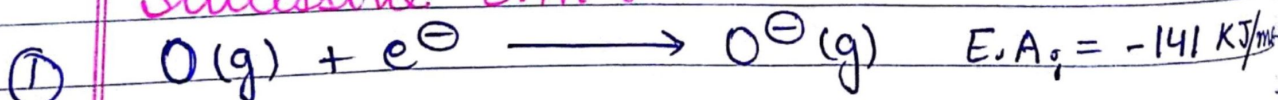
It is the amt. of energy released when an  $e^-$  is added to an isolated gaseous atom in G.S.



E.A. is calculated at absolute zero temp. (OK)  
Temp T.

$$\Delta H_{eg} = -\text{E.A.} - \frac{5}{2} RT$$

Successive E.A. :-





$E.A.1 > E.A.2$  always

- ① energy is released due to att<sup>n</sup> b/w nucleus of  $O$  &  $e^-$
- ② energy is absorbed to overcome repulsion force b/w  $O^-$  &  $e^-$ .

Ques Energy is absorbed in which of the process?

- ①  $O(g) \longrightarrow O^-(g)$
- ②  $F(g) \longrightarrow F^-(g)$
- ③  $S(g) \longrightarrow S^{2-}(g)$
- ④  $Cl(g) \longrightarrow Cl^-(g)$

- ①  $Na(g) \xrightarrow[S.E.]{Ab} Na(g)$
- ②  $Na(g) \xrightarrow[I.E.]{Ab} Na^+(g)$
- ③  $Cl(g) \xrightarrow[E.A]{Re} Cl^-(g)$
- ④  $O(g) \xrightarrow{Ab} O^{2-}(g)$

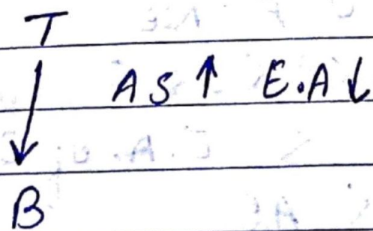
Factors affecting E.A. :-

1. Atomic Size

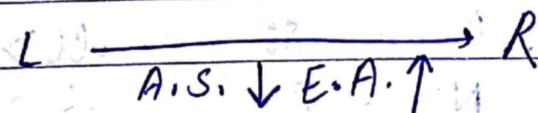
$$E.A \propto \frac{1}{A.S.}$$

A.S. ↑ distance b/w ↑ att<sup>n</sup> ↓ E.A.  
nucleus & outermost shell

In a group

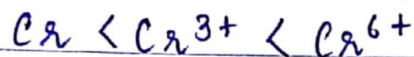


In Period



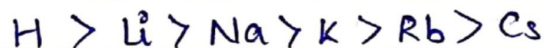
2. E.N.C.

$$E.N.C. \propto E.A.$$



3. Shielding Effect :

$$E.A. \propto \frac{1}{S.E.}$$



4. Electronic Configuration :-

Half filled & Fully filled  $e^-$  conf. are more stable  
 $e^-$  gain tendency ↓  
E.A. ↓

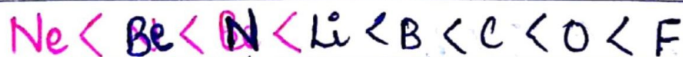
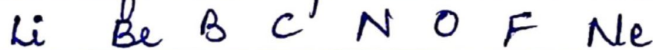
⊕ve E.A. → zero

E.A. for noble gas is zero due to full filled stable conf.

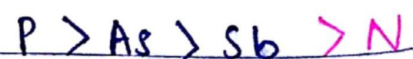
E.A. for N family is <sup>very less</sup> almost zero due to H.F. conf.

E.A. for alkaline earth metals is <sup>almost zero</sup> very less  
(Be, Mg, Ca, Sr, Ba)  
 $1s^2 2s^2$

E.A. for 2nd period



Note:- E.A. of 2nd pd < E.A. of 3rd pd.

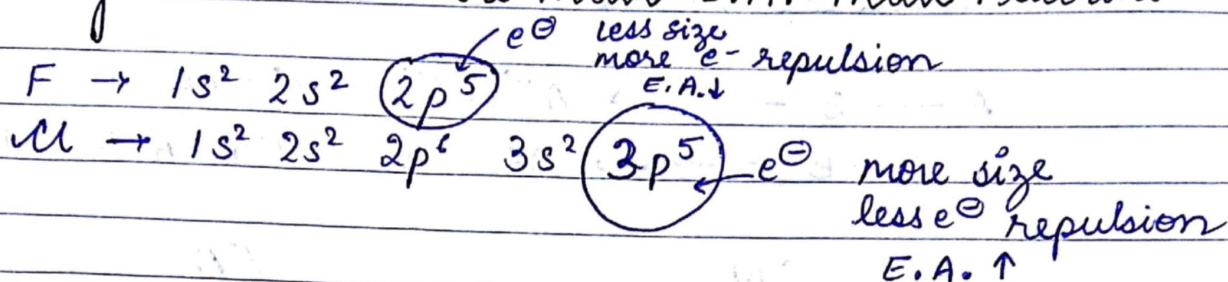




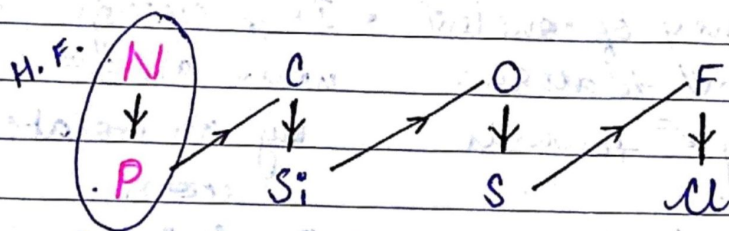
1/7

Note Al has highest E.A in P.T.

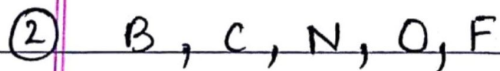
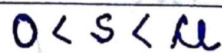
Ques why Al has more ~~than~~ E.A. than Fluorine



2<sup>nd</sup> reason: Al has vacant 3d orbital which attract  $e^-$ .

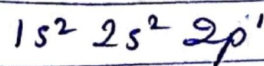
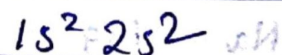


Ques Write ↑ E.A. order



IIT

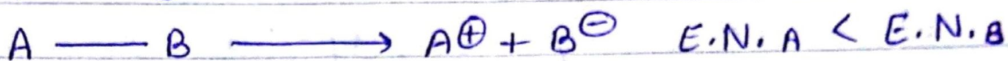
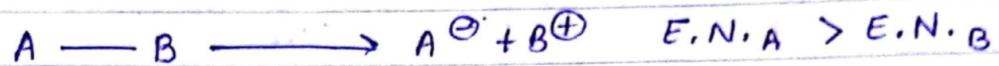
Ques Which of the following is least stable anion?



## Electronegativity :- (E.N.)

118

It is tendency of a covalent bonded atom to attract shared pair of  $e^-$  towards itself.

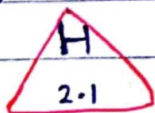


EN

EA

- It is property of bonded atom.
- It is tendency of covalent bonded atom to attract shared pair of  $e^-$  towards itself.
- It is ↑ses regularly
- unit less
- Interelectronic repulsion are not considered
- It is property of an isolated gaseous atom.
- It is energy released when an  $e^-$  is gained by an isolated gaseous atom.
- It ↑ in period but not regularly.
- eV/atom, kJ/mole, kcal/mol.
- Intere- repulsion are considered.

NEET  
1 min Ques



|        |     |     |     |     |     |     |
|--------|-----|-----|-----|-----|-----|-----|
| Li     | Be  | B   | C   | N   | O   | F   |
| 1.0    | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 |
| Na     | Mg  | Al  | Si  | P   | S   | Cl  |
| 0.9    | 1.2 | 1.5 | 1.8 | 2.1 | 2.5 | 3.0 |
| K      |     |     |     |     |     | Br  |
| 0.8    |     |     |     |     |     | 2.8 |
| Rb     |     |     |     |     |     | I   |
| 0.8    |     |     |     |     |     | 2.5 |
| Cs 0.7 |     |     |     |     |     | At  |
| Fr 0.7 |     |     |     |     |     | 2.2 |



H, P : - 2.1

Be, Al  $\rightarrow$  1.5

C, S, I  $\rightarrow$  2.5

N, Cl  $\rightarrow$  3.0

Ques

write  $\uparrow$  order of E.N.

C, Si, P, N

C N  
Si P

Si < P < C < N

Factors affecting E.A.

1. A.S.

E.N  $\propto \frac{1}{A.S.}$

A.S.  $\rightarrow$  Atomic size

In a group :-

T

A.S.  $\uparrow$  E.N.  $\downarrow$

B

Li  $\rightarrow$  ---  $\rightarrow$  Cs

F  $\rightarrow$  ---  $\rightarrow$  I

In a period

L  $\rightarrow$  ---  $\rightarrow$  R

A.S.  $\downarrow$  E.N.  $\uparrow$

C < N < O < F

2. E.N.C

ENC  $\propto$  E.N

Pb < Pb<sup>2+</sup> < Pb<sup>4+</sup>

Cu < Cu<sup>3+</sup> < Cu<sup>6+</sup>

3. S.E.

E.N.  $\propto \frac{1}{S.E.}$

4. % s character :-

% s ch<sup>r</sup>  $\propto$  E.N.

sp

sp<sup>2</sup>

sp<sup>3</sup>

% s ch<sup>r</sup>

$\frac{1}{2} \times 100$

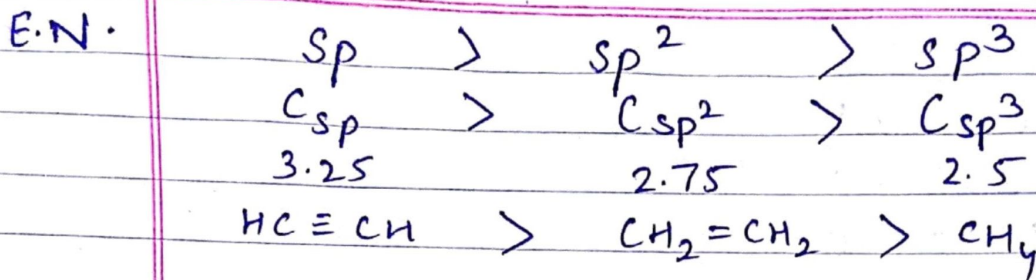
$\frac{1}{3} \times 100$

$\frac{1}{4} \times 100$

= 50 %

= 33.33 %

= 25 %



Application of E.A. :-

1. Nature of Bond :-

If E.N. of both bonded atom is same then bond is non-polar covalent bond.

eg :-  $H_2$ ,  $Cl_2$

If  $\Delta E.N. \uparrow \propto$  ionic ch<sup>r</sup>  $\uparrow \propto$  polarity of bond  $\uparrow$   
 $\Delta E.N. \propto$  ionic ch<sup>r</sup>  $\propto$  Polarity of bond  $\propto$  1  
covalent ch<sup>r</sup>

|               |         |   |         |   |         |   |         |
|---------------|---------|---|---------|---|---------|---|---------|
|               | H-I     | < | H-Br    | < | H-Cl    | < | H-F     |
|               | 2.1 2.5 |   | 2.1 2.8 |   | 2.1 3.0 |   | 2.1 4.0 |
| $\Delta E.N.$ | 0.4     |   | 0.7     |   | 0.9     |   | 1.9     |

$\Delta E.N. \uparrow \quad \% \text{ ionic ch}^r \rightarrow$

Ques which of the following is least polar bond ?

|   |      |         |       |
|---|------|---------|-------|
| ① | H-Cl | 2.1 3   | = 0.9 |
| ② | C-Cl | 2.5 3   | = 0.5 |
| ③ | C-Br | 2.5 2.8 | = 0.3 |
| ④ | P-H  | 2.1 2.1 | = 0   |

Henry & Smith Formula :-

to calculate % ionic ch<sup>r</sup>

$$\% \text{ ionic character} = 16 | (X_A - X_B) | + 3.5 | (X_A - X_B)^2 |$$

$X_A = \text{E.N. of A}$

$X_B = \text{E.N. of B}$



Ques Calculate % ionic character in H-F bond?

$$\begin{aligned}\% \text{ ionic} &= 16 (4 - 2.1) + 3.5 (4 - 2.1)^2 \\ &= 16 (1.9) + 3.5 (1.9)^2 \\ &= 43\%\end{aligned}$$

|                   |   |                   |
|-------------------|---|-------------------|
| 100% ionic X      | } | 99.99% ionic ✓    |
| 100% covalent X   |   | or                |
| <u>Fajan Rule</u> |   | 99.99% covalent ✓ |

2. Bond Strength :-

$$\text{B.S.} \propto \Delta \text{E.N.}$$

$$\text{H-I} < \text{H-Br} < \text{H-Cl} < \text{H-F}$$

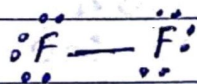
3. Bond Length :-

$$\text{B.L.} \propto \frac{1}{\Delta \text{E.N.}} \quad \text{B.L.} \propto \frac{1}{\text{B.S.}}$$

$$\text{H-I} > \text{H-Br} > \text{H-Cl} > \text{H-F}$$

Ques  $\text{F}_2$   $\text{Cl}_2$   $\text{Br}_2$   $\text{I}_2$  ~~BB~~ Highest Bond <sup>strength</sup> length

$$\text{Cl}_2 > \text{Br}_2 > \text{F}_2 > \text{I}_2$$

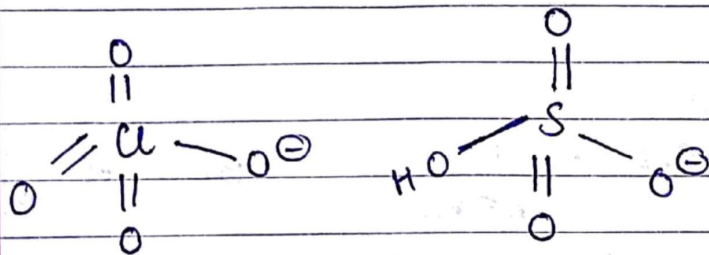
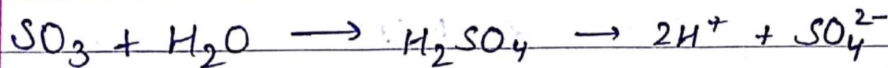
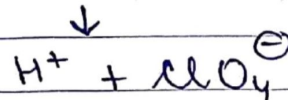


↔ more Repulsive force

|                                  |   |           |
|----------------------------------|---|-----------|
| Acid :- which give $\text{H}^+$  | } | Arrhenius |
| Base :- which give $\text{OH}^-$ |   |           |
| Acid :- which accept lp          | } | Lewis     |
| Base :- which donate lp          |   |           |

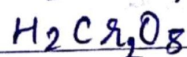
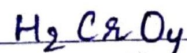
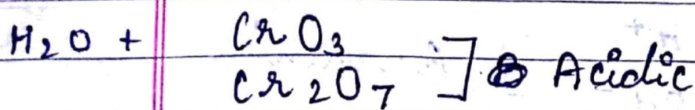
### Nature of Oxide :-

$\text{Na}_2\text{O} < \text{MgO} < \text{Al}_2\text{O}_3 < \text{SiO}_2 < \text{P}_4\text{O}_{10} < \text{SO}_3 < \text{Cl}_2\text{O}_7$   
 most basic      Basic      Amphoteric      WA      acidic      Most Acidic  
 least acidic                               least basic



Oxides of metals like

| Oxides of metals like |     |                                  |                  |                                 |                                |                                |                  |
|-----------------------|-----|----------------------------------|------------------|---------------------------------|--------------------------------|--------------------------------|------------------|
| 1912-1901             | Qhi | karbaini                         | Party            | Jao                             | Sab                            | Australia                      | Sydney           |
| Zn                    | Be  | Cr                               | Pb               | Gra                             | Sb                             | Al                             | Sn               |
| ZnO                   | BeO | Cr <sub>2</sub> O <sub>3</sub> * | PbO              | Gra <sub>2</sub> O <sub>3</sub> | Sb <sub>2</sub> O <sub>3</sub> | Al <sub>2</sub> O <sub>3</sub> | SnO              |
|                       |     |                                  | PbO <sub>2</sub> |                                 | Sb <sub>2</sub> O <sub>5</sub> |                                | SnO <sub>2</sub> |





EN ↑ lp accept ↑  
charge ↑ EN ↑

Page No. 123 Date

### Neutral Oxide :-

NO, N<sub>2</sub>O, CO, H<sub>2</sub>O

Ques  
Alecce

↑ order of A.S. <sup>Acidic</sup>

MgO, Al<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, P<sub>4</sub>O<sub>10</sub>  
MgO < Al<sub>2</sub>O<sub>3</sub> < SiO<sub>2</sub> < P<sub>4</sub>O<sub>10</sub>

2st

P<sub>4</sub>O<sub>10</sub>, SO<sub>3</sub>, N<sub>2</sub>O<sub>7</sub>  
P<sub>4</sub>O<sub>10</sub> < SO<sub>3</sub> < N<sub>2</sub>O<sub>7</sub>

1st

CuO, CaO, H<sub>2</sub>O, CO<sub>2</sub>  
CaO < CuO < H<sub>2</sub>O < CO<sub>2</sub>

### Ques Least Basic Oxide

(1) BaO (2) MgO (3) Fe<sub>2</sub>O<sub>3</sub> (4) FeO  
Ba Mg Fe

### Ques Least basic & least acidic oxides

(1) MgO (2) BaO (3) CO<sub>2</sub> (4) SO<sub>3</sub> → most acidic least Basic  
MgO BaO CO<sub>2</sub> SO<sub>3</sub>

09/08/17

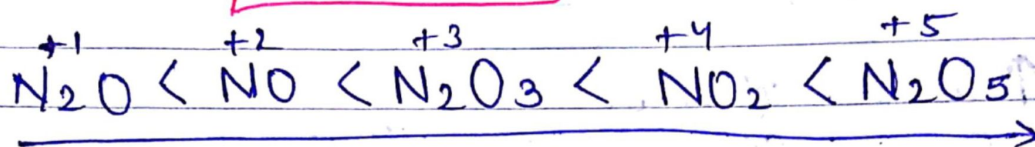
In a group :-

T  
↓  
B  
E.N. ↓ so lp accepting tendency ↓  
A.S. ↓

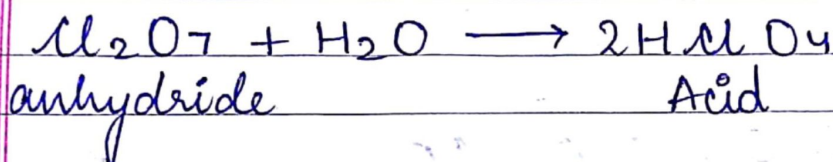
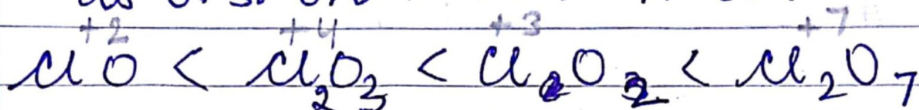
N<sub>2</sub>O<sub>3</sub> > P<sub>2</sub>O<sub>3</sub> > As<sub>2</sub>O<sub>3</sub> > Sb<sub>2</sub>O<sub>3</sub> > Bi<sub>2</sub>O<sub>3</sub>  
SO<sub>2</sub> > SeO<sub>2</sub> > TeO<sub>2</sub> > PoO<sub>2</sub>

E.N. ↓ A.S. ↓

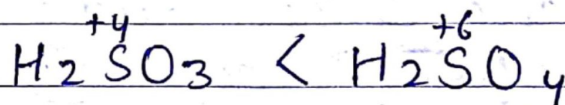
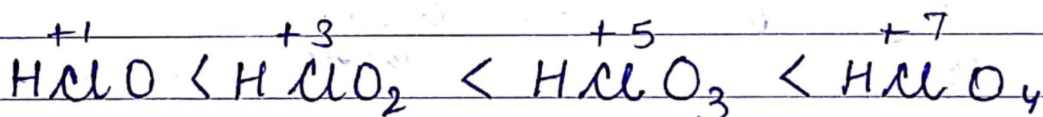
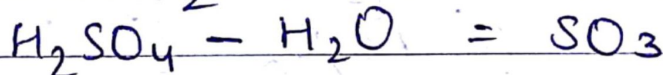
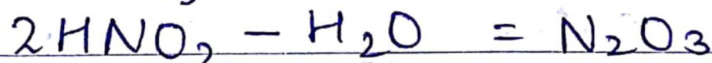
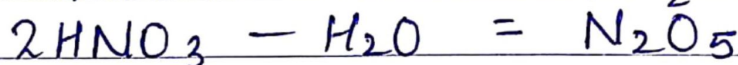
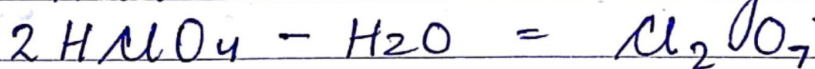
Note: If oxides of same element are given then  
A.S.  $\propto$  O.S.



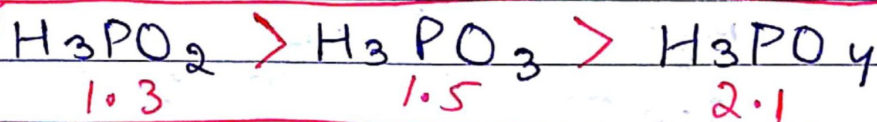
as O.S. on C.A.  $\uparrow$  A.S.  $\uparrow$



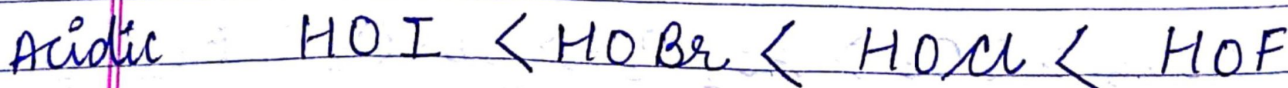
Acid  $- \text{H}_2\text{O} = \text{Anhydride}$



Exception  
pKa

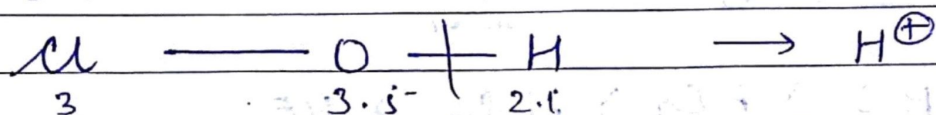
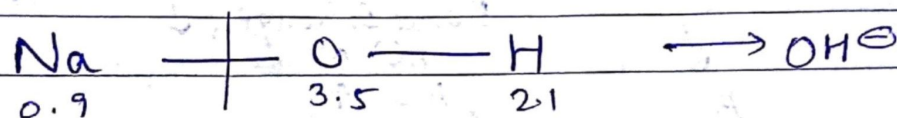
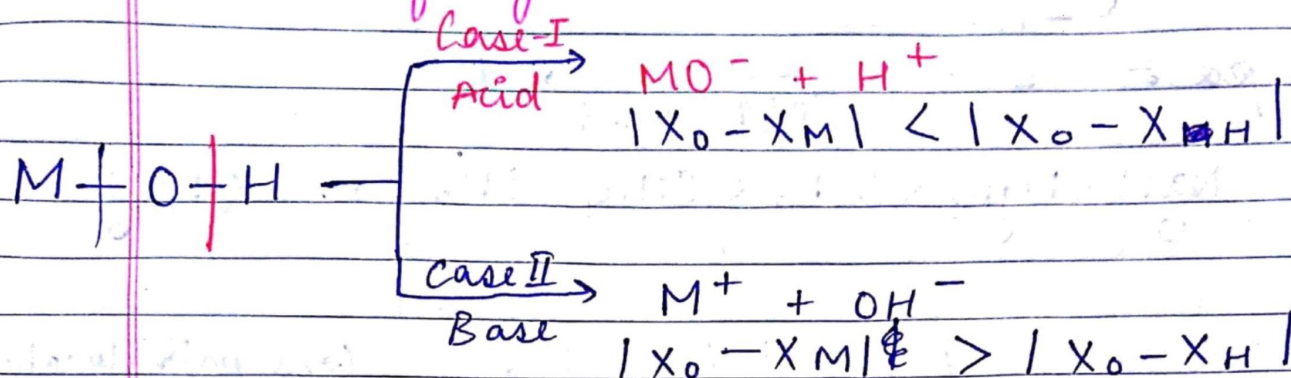


$$\text{A.S.} \propto K_a \propto \frac{1}{\text{pKa}}$$

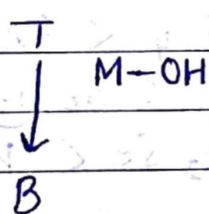




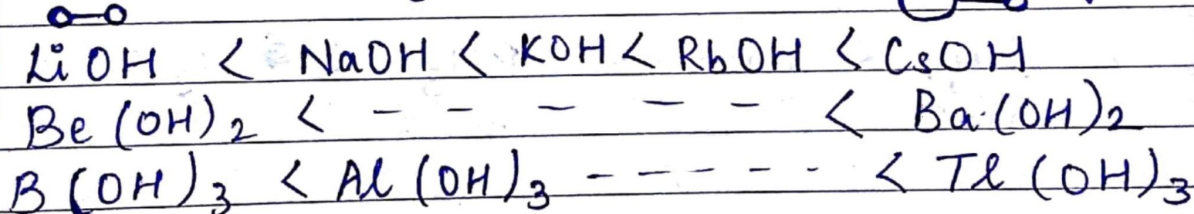
## Nature of hydroxides :-



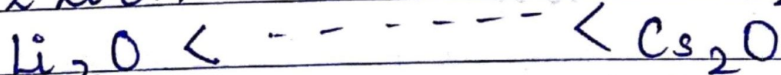
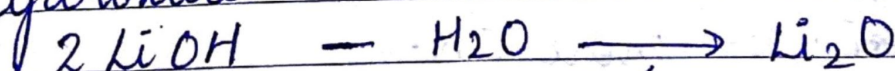
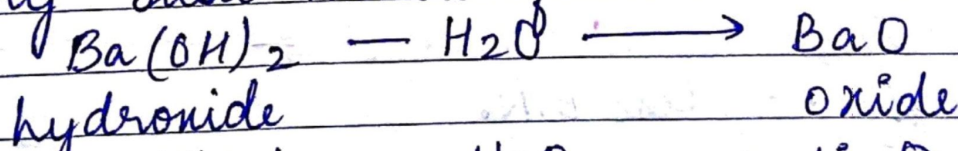
In a group :-



BL ↑  
 Bond strength ↓  
 $OH^-$  ↑  
 Bond basic strength ↑



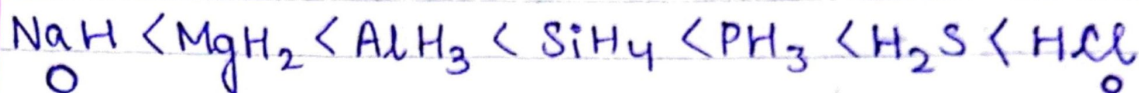
IIry basic nature of oxides ↑ down the gp



## Nature of Hydrides :-



In a pd :-  $L \xrightarrow{EN \uparrow \text{ A.S. } \uparrow} R$

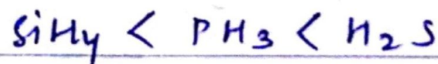
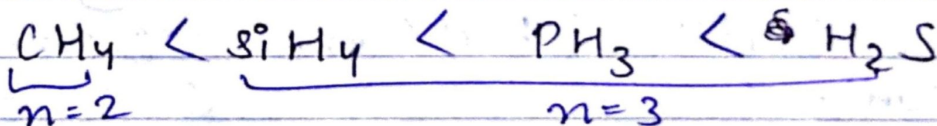
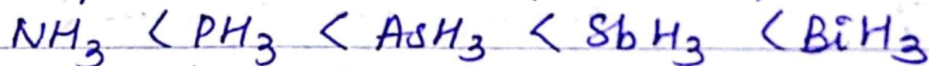
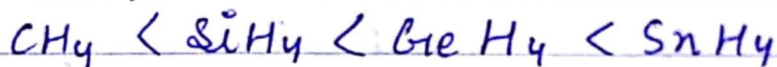


In a gp :-



M-H  
Bond length  $\uparrow$   
Bond strength  $\downarrow$   
 $H^+ \uparrow$   
A.S.  $\uparrow$   
Acidic

lone pair donating tendency  $\downarrow$



## Naming of compound :-

Prefix :- Less E.N.

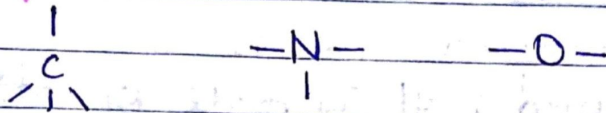
Suffix :- more E.N.

$OF_2 \rightarrow$  Oxygen diFluoride

$I_2Cl \rightarrow$  Iodine Chloride



**Valency :-** It is combining capacity of element



**Old concept :-**

Valency w.r.t. H :- Valency of H = 1  
Valency of an element = 1 x no. of H-atom attached

|              |                  |                  |                  |                 |                  |     |
|--------------|------------------|------------------|------------------|-----------------|------------------|-----|
| NaH          | MgH <sub>2</sub> | AlH <sub>3</sub> | SiH <sub>4</sub> | PH <sub>3</sub> | H <sub>2</sub> S | HCl |
| Valency :- 1 | 2                | 3                | 4                | 3               | 2                | 1   |

Valency w.r.t. O = 2

Valency of an element = 2 x no. of O atom attached to an element

|                        |     |                                |                  |                                |                 |                                |
|------------------------|-----|--------------------------------|------------------|--------------------------------|-----------------|--------------------------------|
| Na <sub>2</sub> O      | MgO | Al <sub>2</sub> O <sub>3</sub> | SiO <sub>2</sub> | P <sub>4</sub> O <sub>10</sub> | SO <sub>3</sub> | Cl <sub>2</sub> O <sub>7</sub> |
| $\frac{2 \times 1}{2}$ |     |                                |                  |                                |                 |                                |
| = 1                    |     |                                |                  |                                |                 |                                |

**New concept :-**

|                        | IA              | IIA             | IIIA                            | IVA                             | VA                              | VIA                             | VIIA                            | zero                            |
|------------------------|-----------------|-----------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|                        | ns <sup>1</sup> | ns <sup>2</sup> | ns <sup>2</sup> np <sup>1</sup> | ns <sup>2</sup> np <sup>2</sup> | ns <sup>2</sup> np <sup>3</sup> | ns <sup>2</sup> np <sup>4</sup> | ns <sup>2</sup> np <sup>5</sup> | ns <sup>2</sup> np <sup>6</sup> |
| Valence e <sup>-</sup> | 1               | 2               | 3                               | 4                               | 5                               | 6                               | 7                               | 8                               |
| Valency                | 1               | 2               | 3                               | 4                               | 8-5<br>= 3                      | 8-6<br>= 2                      | 8-7<br>= 1                      | 8-8<br>= 0                      |
|                        |                 |                 |                                 |                                 | (3, 5)                          | (2, 6)                          | (1, 7)                          | (0, 8)                          |

For more free Study material  
visit : [www.sbgstudy.com](http://www.sbgstudy.com)