# Classification of Elements and Periodicity in Properties

## Question1

**Inert gases have positive electron gain enthalpy. Its correct order is [25-Jan-2023 Shift 1]**

**Options:**

A. Xe < Kr < Ne < He

B. He < Ne < Kr < Xe

C. He < Xe < Kr < Ne

D. He < Kr < Xe < Ne

**Answer: C**

### Solution:

| Element | $\Delta_{eg}H$[KJ/mol] |
|---|---|
| He | +48 |
| Ne | +116 |
| Kr | +96 |
| Xe | +77 |

From NCERT
So, order is Ne > Kr > Xe > He

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## Question2

**Which of the following represents the correct order of metallic character of the given elements?
[25-Jan-2023 Shift 2]**

**Options:**

A. Si < Be < Mg < K

B. Be < Si < Mg < K

C. K < Mg < Be < Si

D. Be< Si <K < Mg

**Answer: A**

## Solution:

**Solution:**
Metallic character increases down the group and decreases along the period.

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# Question3

## The bond dissociation energy is highest for [29-Jan-2023 Shift 1]

**Options:**

A. $Cl_2$

B. $I_2$

C. $Br_2$

D. $F_2$

**Answer: A**

## Solution:

**Solution:**
Bond energy of $F_2$ less than $Cl_2$ due to lone pair lone pair repulsions.
Bond energy order $Cl_2 > Br_2 > F_2 > I_2$

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# Question4

## Match List - I with List - II

| LIST-I (Atomic number) | LIST-II (Block of periodictable) |
|---|---|
| (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: [30-Jan-2023 Shift 1]

**Options:**

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

**Answer: D**

## Solution:

**Solution:**

| Atomic number | Block |
|---|---|
| 37(K) | s-block |
| 78(Pt) | d-block |
| 52(Te) | p-block |
| 65(Tb) | f-block |

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# Question5

## The correct increasing order of the ionic radii is [31-Jan-2023 Shift 1]

**Options:**

A. $Cl^- < Ca^{2+} < K^+ < S^{2-}$

B. $K^+ < S^{2-} < Ca^{2+} < Cl^-$

C. $S^{2-} < Cl^- < Ca^{2+} < K^+$

D. $Ca^{2+} < K^+ < Cl^- < S^{2-}$

**Answer: D**

## Solution:

**Solution:**

In isoelectronic species size $\propto \frac{1}{Z}$

$Ca^{2+} < K^+ < Cl^- < S^{2-}$ : Size

Z: 20 19 17 18

Z : 20 19 17 18

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# Question6

**$Nd^{2+}$ = _____**
**[31-Jan-2023 Shift 1]**

**Options:**

A. $4f^2 6\ s^2$

B. $4f^4$

C. $4f^3$

D. $4f^4 6s^2$

**Answer: B**

## Solution:

$Nd(60) = [Xe]4f^4 5d^0 6\ s^2$
$Nd^{2+} = [Xe]4f^4 5d^0 5\ s^0$

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# Question7

**Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R)**
**Assertion (A) : The first ionization enthalpy of 3d series elements is more than that of group 2 metals**
**Reason (R): In 3d series of elements successive filling of d-orbitals takes place.**
**In the light of the above statements, choose the correct answer from the options given below :**
**[31-Jan-2023 Shift 2]**

**Options:**

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

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

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

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

**Answer: C**

## Solution:

**Solution:**
From Sc to Mn ionization energy is less than that of Mg
For 3 d series:

| | Sc | Ti | V | Cr | Mn |
|---|---|---|---|---|---|
| IE(KJ/mol) | 631 | 656 | 650 | 653 | 717 |
| | Fe | Co | Ni | Cu | Zn |
| IE(KJ/mol) | 762 | 758 | 736 | 745 | 906 |

For 2 ad Group

| | Be | Mg | Ca | Sr | Ba | Ra |
|---|---|---|---|---|---|---|
| IE(KJ/mol) | 631 | 656 | 650 | 653 | 717 | 762 |

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# Question8

**Which of the following elements have half-filled f-orbitals in their ground state?**
**(Given : atomic number**
**Sm = 62; Eu = 63; Tb = 65; Gd = 64, Pm = 61 )**
**A. Sm**
**B. Eu**
**C. Tb**
**D. Gd**
**E. Pm**
**Choose the correct answer from the options given below:**
**[31-Jan-2023 Shift 2]**

**Options:**

A. B and D only

B. A and E only

C. A and B only

D. C and D only

**Answer: A**

## Solution:

1. 62 Sm : $4f^6 6s^2$
2. $_{64}$ Gd : $4f^7 5d^1 6s^2$
3. $_{63}$ Eu : $4f^7 6s^2$
4. $_{65}$ Tb : $4f^9 6s^2$
5. $_{61}$ Pm : $4f^5 6s^2$

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# Question9

## For electron gain enthalpies of the elements denoted as $\Delta_{eg}H$, the incorrect option is : [1-Feb-2023 Shift 2]

**Options:**

A. $\Delta_{eg}H(Cl) < \Delta_{eg}H$ (F)

B. $\Delta_{eg}H(Se) < \Delta_{eg}H(S)$

C. $\Delta_{eg}H$ (I) $<\Delta_{eg}H$ (At)

D. $\Delta_{eg}H(Te) < \Delta_{eg}H(Po)$

**Answer: B**

## Solution:

(1) $\Delta_{eg}H(Cl) < \Delta_{eg}H(F)$
$(-345)(-328)$ Correct
(2) $\Delta_{eg}H(Se) < \Delta_{eg}H(S)$
$(-195)$ $(-200)$ Incorrect
(3) $\Delta_{eg}H$ (I) $<\Delta_{eg}H$ (At)
(-295) (-270) Correct
(4) $\Delta_{eg}H(Te) < \Delta_{eg}H(Po)$
$(-190)$ $(-183)$ Correct

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# Question10

## Which one of the following elements will remain as liquid inside pure boiling water ? [6-Apr-2023 shift 2]

**Options:**

A. Cs

B. Ga

C. Li

D. Br

**Answer: B**

## Solution:

**Solution:**
Li, Cs reacts vigorously with water.
$Br_2$ changes in vapour state in boiling water (BP = 58˚C)
Ga reacts with water above 100˚C( MP = 29˚C, BP. = 2400˚C )

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# Question11

## Group-13 elements react with $O_2$ in amorphous form to form oxides of type $M_2O_3$ ( M = element). Which among the following is the most basic oxide?
## [6-Apr-2023 shift 2]

**Options:**

A. $Al_2O_3$

B. $Ga_2O_3$

C. $Tl_2O_3$

D. $B_2O_3$

**Answer: C**

## Solution:

**Solution:**
As electropositive character increases basic character of oxide increases.
$\underset{\text{acidic}}{B_2O_3} < \underset{\text{amphoteric}}{Al_2O_3} < Ga_2O_3 < In_2O_3 < \underset{\text{basic}}{Tl_2O_3}$

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# Question12

## The correct order of electronegativity for given elements is:
## [8-Apr-2023 shift 1]

**Options:**

A. P > Br > C > At

B. C > P > At > Br

C. Br > P > At > C

D. Br > C > At > P

**Answer: D**

## Solution:

C(2.5)
P(2.1) ⇒ Br > C > At > P
Br(2.8)
At (2.2)

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# Question13

**Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R**
**Assertion A : The energy required to form $Mg^{2+}$ from Mg is much higher than that required to produce $Mg^{+}$**
**Reason R: $Mg^{2+}$ is small ion and carry more charge than $Mg^{+}$**
**In the light of the above statements, choose the correct answer from the options given below.**
**[10-Apr-2023 shift 2]**

**Options:**

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

B. A is true but R is false

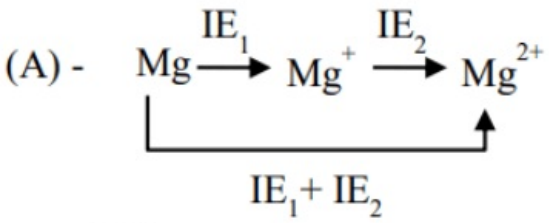
C. A is false but R is true

D. Both A and R are true but R is NOT the correct explanation of A

**Answer: A**

## Solution:

**Solution:**




In formation of $Mg^{2+}$ $IE_1 + IE_2$ is required while in formation of $Mg^{+}IE_1$ is required
(R) $Mg^{2+}$ is small ion and carry more change than $Mg^{\oplus}$

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# Question14

**The correct order of metallic character is =**
**[10-Apr-2023 shift 2]**

**Options:**

A. K > Be > Ca

B. Be > Ca > K

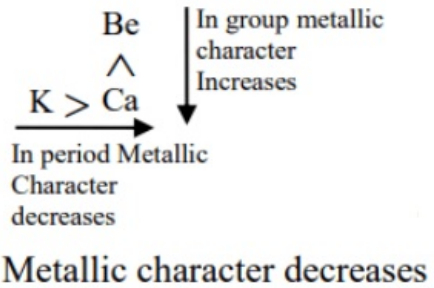
C. K > Ca > Be

D. Ca > K > Be

**Answer: C**

## Solution:

**Solution:**




Metallic character decreases
So K > Ca > Be

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# Question15

**For compound having the formula $GaAlCl_4$, the correct option form the following is**
**[11-Apr-2023 shift 1]**

**Options:**

A. Cl forms bond with both Al and Ga in $GaAlCl_4$

B. Ga is coordinated with Cl in $GaAlCl_4$

C. Ga is more electronegative than Al and is present as a cationic part of the salt

D. Oxidation state of Ga in the salt $GaAlCl_4$ is +3

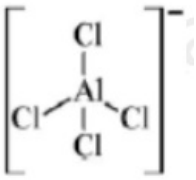
**Answer: C**

## Solution:

**Solution:**
Gallous tetrachloro aluminate $Ga^+AlCl_4^-$

$$2\,Ga + Ga^+Cl_4^- + 2Al_2Cl_6 \xrightarrow{190^\circ} 4Ga^+AlCl_4^-$$

Structure of $Ga^+AlCl_4^-$



Ga is cationic part of salt $GaAlCl_4$.

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# Question16

**For elements B, C, N, Li, Be, O and F, the correct order of first ionization enthalpy is**
**[11-Apr-2023 shift 1]**

**Options:**

A. B > Li > Be > C > N > O > F

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

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

D. Li< B < Be < C < O < N < F

**Answer: D**

## Solution:

First I.E.
F > N > O > C > Be > B > Li
Li − 520 kJ / mol
Be − 899 kJ / mol
B − 801 kJ / mol
C − 1086 kJ / mol
N − 1402 kJ / mol
O − 1314 kJ / mol
F − 1681 kJ / mol

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# Question17

**Which of the following statements are not correct?**
**A. The electron gain enthalpy of F is more negative than that of Cl.**
**B. Ionization enthalpy decreases in a group of periodic table.**
**C. The electronegativity of an atom depends upon the atoms bonded to it.**
**D. $Al_2O_3$ and NO are examples of amphoteric oxides.**
**Choose the most appropriate answer from the options given below :**
**[13-Apr-2023 shift 1]**

**Options:**

A. A, C and D Only

B. B and D Only

C. A, B and D Only

D. A, B, C and D

**Answer: A**

## Solution:

Electronegativity of an element depends on the atom with which it is attached.
NO = neutral oxide
$Al_2O_3$ = amphoteric oxide

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# Question18

## Identify the correct order of standard enthalpy of formation of sodium halides.
## [13-Apr-2023 shift 2]

**Options:**

A. NaI < NaBr < NaF < NaCl

B. NaF < NaCl < NaBr < Nal

C. NaCl < NaF < NaBr < Nal

D. Nal < NaBr < NaCl < NaF

**Answer: D**

## Solution:

**Solution:**
For a given metal $\Delta_f H^0$ always becomes less negative from fluoride to iodide.

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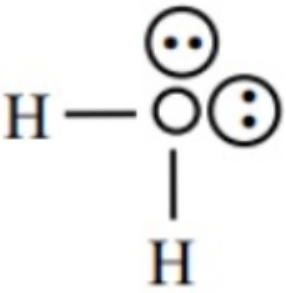
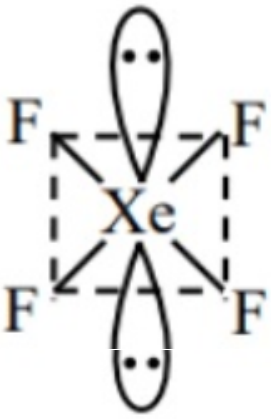
# Question19

## The number of molecules from the following which contain only two lone pair of electrons is _____
## $H_2O$, $N_2$, CO, $XeF_4$, $NH_3$, NO, $CO_2$, $F_2$
## [10-Apr-2023 shift 2]

**Answer: 4**

## Solution:

| | lp |
|---|---|
|  | 2 |
| $:N \equiv N:$ | 2 |
| $:C \equiv O:$ | 2 |
|  | 2 |
| $\ddot{N}H_3$ | 1 |
| $.N \equiv \ddot{O}:$ | 3 |

# Question20

**Metals generally melt at very high temperature. Amongst the following, the metal with the highest melting point will be**
**[24-Jun-2022-Shift-2]**

**Options:**

A. Hg

B. Ag

C. Ga

D. Cs

**Answer: B**

## Solution:

Melting points of the given metals
Hg : $-38.83^{\circ}C$
Ag : $961.8^{\circ}C$
Ga : $29.76^{\circ}C$
Cs : $28.44^{\circ}C$
$\therefore$ Metal having highest melting point is Ag.

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# Question21

**The correct order of electron gain enthalpies of Cl, F, Te and Po is**
**[25-Jun-2022-Shift-2]**

**Options:**

A. F < Cl < Te < Po

B. Po < Te < F < Cl

C. Te < Po < Cl < F

D. Cl < F < Te < Po

**Answer: B**

### Solution:

$Te \rightarrow -190\,kJ\,mol^{-1}$
$Po \rightarrow -174\,kJ\,mol^{-1}$
$F \rightarrow -333\,kJ\,mol^{-1}$
$Cl \rightarrow -349\,kJ\,mol^{-1}$
Hence, correct order is Cl > F > Te > Po

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# Question22

### Which of the following elements is considered as a metalloid? [26-Jun-2022-Shift-2]

**Options:**

A. Sc

B. Pb

C. Bi

D. Te

**Answer: D**

### Solution:

**Solution:**
Sc, Pb, Bi are metals
Te is a metalloid

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# Question23

### Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
### Assertion (A) : The ionic radii of $O^{2-}$ and $Mg^{2+}$ are same.
### Reason (R): Both $O^{2-}$ and $Mg^{2+}$ are isoelectronic species.
### In the light of the above statements, choose the correct answer from the options given below.
### [27-Jun-2022-Shift-1]

**Options:**

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

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

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

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

**Answer: D**

## Solution:

**Solution:**
Correct order of ionic radii:
$O^{-2} > Mg^{+2}$
This is because among isoelectronic species, the size of anions are greater than the size of cations. Statement (II) is correct as both $O^{-2}$ and $Mg^{+2}$ are isoelectronic.

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# Question24

## The correct order of increasing ionic radii is [27-Jun-2022-Shift-2]

**Options:**

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

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

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

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

**Answer: A**

## Solution:

**Solution:**
For isoelectronic species
Ionic radii $\propto \frac{(-)\ \text{ve charge}}{(+)\ \text{ve charge}}$
Hence, correct order of ionic radii is
$Mg^{2+} < Na^{+} < F^{-} < O^{2-} < N^{3-}$

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# Question25

## Element "E" belongs to the period 4 and group 16 of the periodic table. The valence shell electron configuration of the element, which is just above "E" in the group is [28-Jun-2022-Shift-1]

**Options:**

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

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

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

D. $2s^2$, $2p^4$

**Answer: A**

## Solution:

**Solution:**
Element E is Selenium (Se)
Electronic configuration of E is $[Ar]3d^{10}4s^24p^4$
The element which is just above ' E ' in periodic table is sulphur, its electronic configuration is [Ne] $3s^23p^4$

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# Question26

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

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

## [28-Jun-2022-Shift-2]

**Options:**

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

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

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

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

**Answer: B**

## Solution:

**Solution:**
(A) $Cl_2O_7$→ Acidic
(B) $Na_2O$→ Basic
(C) $Al_2O_3$→ Amphoteric
(D) $N_2O$→ Neutral
Oxides of metals are basic in nature whereas oxides of non-metals are acidic in nature. $N_2O$ is a neutral oxide.

# Question27

**Given below are two statements. One is labelled as Assertion A and the other is labelled as Reason R.**
**Assertion A : The first ionization enthalpy for oxygen is lower than that of nitrogen.**
**Reason R : The four electrons in 2p orbitals of oxygen experience more electron-electron repulsion.**
**In the light of the above statements, choose the correct answer from the options given below.**
**[29-Jun-2022-Shift-2]**

**Options:**

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

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

C. A is correct but R is not correct.

D. A is not correct but R is correct.

**Answer: B**

## Solution:

**Solution:**
Nitrogen has half-filled p-orbitals which is stable. Due to this, its $1^{st}$ ionization energy is more than oxygen.

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# Question28

**The IUPAC nomenclature of an element with electronic configuration $[Rn]5f^{14}6d^{1}7s^{2}$ is :**
**[25-Jul-2022-Shift-1]**

**Options:**

A. Unnilbium

B. Unnilunium

C. Unnilquadium

D. Unniltrium

**Answer: D**

## Solution:

The element with electronic configuration $[Rn]5f^{14}6d^{1}7s^{2}$ has atomic number $\rightarrow 103$
$\therefore$ Its IUPAC name is: Unniltrium

# Question29

## The first ionization enthalpies of Be, B, N and O follow the order [25-Jul-2022-Shift-2]

**Options:**

A. 0 < N < B < Be

B. Be < B < N < O

C. B < Be < N < O

D. B < Be < O < N

**Answer: D**

## Solution:

**Solution:**
The first ionization energy increase from left to right along $2^{nd}$ period with the following exceptions
$IE_1$ : Be > B and N > O
This is due to stable configuration of Be in comparison to B and that of N in comparison to O.
Hence the correct order is N > O > Be > B

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# Question30

## Given two statements below :
## Statement I : In $Cl_2$ molecule the covalent radius is double of the atomic radius of chlorine.
## Statement II : Radius of anionic species is always greater than their parent atomic radius.
## Choose the most appropriate answer from options given below : [26-Jul-2022-Shift-1]

**Options:**

A. Both Statement I and Statement II are correct.

B. Both Statement I and Statement II are incorrect.

C. Statement I is correct but Statement II is incorrect.

D. Statement I is incorrect but Statement II is correct.

**Answer: D**

## Solution:

**Solution:**
Covalent radius is not double of atomic radius.
Radius of anionic species is always greater than their parent atomic radius as nuclear charge decreases in anionic

counterpart.

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# Question31

**Outermost electronic configurations of four elements A, B, C, D are given below :**
**(A) $3s^2$**
**(B) $3s^2 3p^1$**
**(C) $3s^2 3p^3$**
**(D) $3s^2 3p^4$**
**The correct order of first ionization enthalpy for them is :**
**[27-Jul-2022-Shift-2]**

**Options:**

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

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

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

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

**Answer: B**

## Solution:

**Solution:**
Orbitals with fully filled and half-filled electronic configuration are stable, and require more energy for ionization
Elements with greater electronegativity require more energy for ionisation
Hence the correct order is C > D > A > B

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# Question32

**In which of the following pairs, electron gain enthalpies of constituent elements are nearly the same or identical?**
**(A) Rb and Cs**
**(B) Na and K**
**(C) Ar and Kr**
**(D) I and At**
**Choose the correct answer from the options given below:**
**[28-Jul-2022-Shift-1]**

**Options:**

A. (A) and (B) only

B. (B) and (C) only

C. (A) and (C) only

D. (C) and (D) only

**Answer: C**

## Solution:

Rb& Cs have nearly same electron gain enthalpy electron gain enthalpy $= -46\,\text{kj / ml}$
Ar \& Kr have same $\Delta H_{eq}$. Value is $+96\,\text{kj / ml}$

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# Question33

## The correct decreasing order for metallic character is [28-Jul-2022-Shift-2]

**Options:**

A. Na > Mg > Be > Si > P

B. P > Si > Be > Mg > Na

C. Si > P > Be > Na > Mg

D. Be > Na > Mg > Si > P

**Answer: A**

## Solution:

**Solution:**
Metallic character increases top to bottom in group and decreases left to right in a period.
Mg is from second group it will be less metallic than Na. Be comes above Mg hence less metallic than Mg. Si is more metallic than phosphorous.

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# Question34

## Which of the following pair of molecules contain odd electron molecule and an expanded octet molecule? [29-Jul-2022-Shift-1]

**Options:**

A. $BCl_3$ and $SF_6$

B. NO and $H_2SO_4$

C. $SF_6$ and $H_2SO_4$

D. $BCl_3$ and NO

**Answer: B**

## Solution:

(A) $BCl_3$ - Even electron molecules
$SF_6$ - Expended octet molecules
(B) NO - Odd electron molecules $H_2SO_4$ - Expanded octet
(C) $SF_6$ - Even electron molecules $H_2SO_4$ - Expanded octet
(D) $BCl_3$ - Even electron molecules NO - odd electron molecules

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# Question35

**The first ionization enthalpy of Na, Mg and Si, respectively, are : 496, 737 and 786 $kJ\,mol^{-1}$. The first ionization enthalpy ($kJ\,mol^{-1}$) of Al is : [29-Jul-2022-Shift-1]**

**Options:**

A. 487

B. 768

C. 577

D. 856

**Answer: C**

## Solution:

I.E. Na < Al < Mg < Si
$\because 496 <$ I.E. (Al) $< 737$
Option (C), matches the condition
i.e. I.E. (Al) = $577\,kJ\,mol^{-1}$

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# Question36

**Which pair of oxides is acidic in nature?
[26 Feb 2021 Shift 2]**

**Options:**

A. $B_2O_3$, CaO

B. $B_2O_3$, $SiO_2$

C. $N_2O$, BaO

D. CaO, $SiO_2$

**Answer: B**

## Solution:

(a) $B_2O_3 \longrightarrow$ oxide of boron (non-metal) :acidic
$CaO \longrightarrow$ oxide of calcium (metal) : basic
(b) $B_2O_3 \longrightarrow$ oxide of boron (non-metal) : acidic
$SiO_2 \longrightarrow$ oxide of silicon (non-metal) : acidic
(c) $N_2O \longrightarrow$ oxide of nitrogen (non-metal) : neutral
$BaO \longrightarrow$ oxide of barium (metal) : basic
(d) $CaO \longrightarrow$ oxide of calcium (metal): basic
$SiO_2 \longrightarrow$ oxide of silicon (non-metal): acidic
So, option (b) is the correct answer. $B_2O_3$ and $SiO_2$ are being acidic oxide they react with base to give salt and water.

$$B_2O_3 + 2NaOH \longrightarrow \underset{\text{Sodium metaborate}}{2NaBO_2} + H_2O$$

$$SiO_2 + 2NaOH \longrightarrow \underset{\text{Sodium silicate}}{Na_2SiO_3} + H_2O$$

---

# Question37

## Match List-I with List-II.

| List-I(Electronicconfiguration ofelements) | List-II ($\Delta_i$ in $kJ\,mol^{-1}$) |
|---|---|
| A. $1s^2 2s^2$ | (i) 801 |
| B. $1s^2 2s^2 2p^4$ | (ii) 899 |
| C. $1s^2 2s^2 2p^3$ | (iii) 1314 |
| D. $1s^2 2s^2 2p^1$ | (iv) 1402 |

## Choose the most appropriate answer from the options given below. [26 Feb 2021 Shift 1]

**Options:**

A. (A-ii), (b-iii), (c-iv), (d-i)

B. (A-i), (b-iv), (c-iii), (d-ii)

C. (A-i), (b-iii), (c-iv), (d-ii)

D. (A-iv), (b-i), (c-ii), (d-iii)

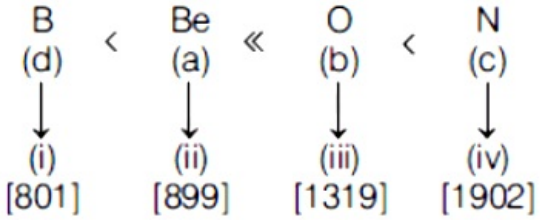
**Answer: A**

## Solution:

Here, (B), (C) and (D) are p-block elements of the 2 nd period.
(D) $\longrightarrow p^1$ configuration → B of group 13
(C) $\longrightarrow p^3$ configuration →N of group 15
(B) $\longrightarrow p^4$ configuration → O of group 16

Stability order : $\underbrace{p^3}_{\text{Half- filled}} > \underbrace{p^4 >> p^1}_{\text{Partially filled}}$

We know, ionisation enthalpy ($\Delta_i H$) $\propto$ stability of the subshell concerned.
Therefore, half-filled subshell is more stable than partially filled.
$\therefore \Delta_i H$ order is c > b> > d
(A) is a s-block element (group 2) of 2nd period with $s^2$-configuration → Be of group 2 [fully-filled; stable]
So, the correct order of IE, or $\Delta_i H_1$ (in $kJ\ mol^{-1}$) of the 2 nd period elements will be




The correct matching is (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)
Note The order of IE, or $\Delta_i H_1$ of 2 nd period elements is
Li < B < Be < C < O < N < F < Ne

---

# Question38

## Consider the elements Mg, Al , S, P and Si, the correct increasing order of their first ionization enthalpy is : [24feb2021shift1]

**Options:**

A. Mg < Al < Si < S < P

B. Al < Mg < Si < S < P

C. Mg < Al < Si < P < S

D. Al < Mg < S < Si < P

**Answer: B**

## Solution:

**Solution:**
Mg and P exhibit abnormal behaviour. Due to extra stability of half-filled and fullfilled electronic configuration. First ionisation enthalpy order is Al < Mg < Si < S < P

---

# Question39

## AX is a covalent diatomic molecule, where A and X are second row elements of periodic table. Based on molecular orbital theory, the bond order of AX is 2.5. The total number of electrons in AX is ..... (Round off to the nearest integer). [18 Mar 2021 Shift 1]

**Answer: 15**

## Solution:

$AX$ is a covalent diatomic molecule. The molecule is NO (Nitric oxide). Its bond order is $2.5$ and it has a total of 15 electrons $(7 + 8 = 15)$ .
Here ' $A$ ' denotes nitrogen (N) and ' $X$ ' denotes oxygen (O). $NO$ is colourless and toxic gas.
Note : Total number of electrons equal to 13 will also have the $2.5$ bond order, but in this case neutral diatomic molecule will not be possible.

---

# Question40

## The set of elements that differ in mutual relationship from those of the other sets is
## [17 Mar 2021 Shift 2]

**Options:**

A. Li - Mg

B. B-Si

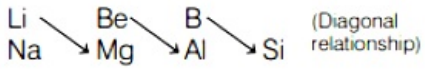
C. Be - Al

D. Li-Na

**Answer: D**

## Solution:

Li-Na pair is different from remaining three options as it do not shows diagonal relationship. Both Li-Na belongs to same group and are not placed diagonally.
$Li - Mg$, $B - Si$ and $Be - Al$ show diagonal relationship.

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# Question41

## Identify the elements X and Y using the ionisation energy values given below.

| | Ionisation energy (Ist) | *kJ/mol* (IInd) |
|---|---|---|
| X | 495 | 4563 |
| Y | 71 | 1450 |

## [18 Mar 2021 Shift 1]

**Options:**

A. $X = Na$, $Y = Mg$

B. $X = Mg$, $Y = F$

C. $X = Mg$, $Y = Na$

D. $X = F, Y = Mg$

**Answer: A**

## Solution:

Given data,

| | $IE_1$ | $IE_2$ |
|---|---|---|
| X | 495 | 4563 kJ/mol |
| Y | 71 | 1450 kJ/mol |

$IE_1$ $IE_2$

X 495 4563 kJ/mol

Y 71 1450 kJ/mol

X is $Na(3s^1)$ as it has very high second ionisation energy due to removal of electron from highly stable noble gas configuration.

$$\underset{1s^2 2s^2 2p^6 3s^1}{Na} \xrightarrow{IE_1} \underset{1s^2 2s^2 2p^6 \text{ or } [Ne]}{Na^+} + e^-; \quad IE_1 = 495 kJ/mol$$

$$\underset{1s^2 2s^2 2p^6}{Na^+} \xrightarrow{IE_2} \underset{1s^2 2s^2 2p^5}{Na^{2+}} + e^-; IE_2 = 4563 kJ/mol$$

(Stable noble gas configuration).

In case of Mg, noble gas configuration is achieved after removal of second electron. So, $IE_2$ is comparatively less.

$$\underset{[Ne]3s^2}{Mg} \longrightarrow \underset{[Ne]3s^1}{Mg^+} + e^-; IE_1 = 731 kJ/mol$$

$$\underset{[Ne]3s^1}{Mg^+} \longrightarrow \underset{[Ne]}{Mg^{2+}} + e^-; IE_2 = 1450 kJ/mol$$

---

# Question42

## The first ionisation energy of magnesium is smaller as compared to that of elements X and Y, but higher than that of Z. The elements X, Y and Z, respectively, are [18 Mar 2021 Shift 2]

**Options:**

A. chlorine, lithium and sodium

B. argon, lithium and sodium

C. argon, chlorine and sodium

D. neon, sodium and chlorine

**Answer: C**

## Solution:

**Solution:**

The order of first ionisation energy of $3^{nd}$ period is as follows

Na < Al < Mg < Si < S < P < Cl < Ar

On moving along a period from left to right, nuclear charge increases that outweighs the shielding effect. As a result, outermost electrons are held more tightly. Hence, ionisation enthalpy increases.

Ionisation enthalpy of group 2 is greater than group 13 and that of group 15 is greater than group 16. This is due to fully filled and half-filled orbital.
$\therefore X, Y$ and $Z$ are argon, chlorine and sodium respectively.

---

# Question43

## Outermost electronic configuration of a group 13 element, E, is $4s^2, 4p^1$. The electronic configuration of an element of p-block period-five placed diagonally to element, E is : [20 Jul 2021 Shift 2]

**Options:**

A. $[Kr]3d^{10}4s^24p^2$

B. $[Ar]3d^{10}4s^24p^2$

C. $[Xe]5d^{10}6s^26p^2$

D. $[Kr]4d^{10}5s^25p^2$

**Answer: D**

## Solution:

**Solution:**
The element E is Ga and the diagonal element of $5^{th}$ period is $_{50}Sn$ having outer electronic configuration will be $[Kr]5s^24d^{10}5p^2$.

---

# Question44

## The CORRECT order of first ionisation enthalpy is : [27 Jul 2021 Shift 2]

**Options:**

A. Mg < S < Al < P

B. Mg < Al < S < P

C. Al < Mg < S < P

D. Mg < Al < P < S

**Answer: C**

## Solution:

Mg Al P S $\rightarrow$ IE. order $\Rightarrow$ Al< Mg < S < P

Valence $[N_e]$ : $\overset{Mg}{3s^2}$ $\overset{Al}{3s^2 3p^1}$ $\overset{P}{3s^2 3p^3}$ $\overset{S}{3s^2 3p^4}$

↑ ↑

Full Filled Stable — Half Filled Stable

---

# Question45

## The ionic radii of $F^-$ and $O^{2-}$ respectively are 1.33 Å and 1.4Å, while the covalent radius of N is 0.74ÅThe correct statement for the ionic radius of $N^{3-}$ from the following is :
## [25 Jul 2021 Shift 2]

**Options:**

A. It is smaller than $F^-$ and N

B. It is bigger than $O^{2-}$ and $F^-$

C. It is bigger than $F^-$ and N , but smaller than of $O^{2-}$

D. It is smaller than $O^{2-}$ and $F^-$, but bigger than of N

**Answer: B**

## Solution:

**Solution:**
$F^-$, $O^{2-}$ and $N^{3-}$ all are isoelectronic species in which $N^{3-}$ have least number of protons due to which it's size increases as least nuclear attraction is experienced by the outer shell electrons.
Size order $N^{3-} > O^{2-} > F^-$

---

# Question46

## The correct order of ionic radii for the ions, $P^{3-}$, $S^{2-}$, $Ca^{2+}$, $K^+$, $Cl^-$ is
## [27 Aug 2021 Shift 2]

**Options:**

A. $P^{3-} > S^{2-} > Cl^- > K^+ > Ca^{2+}$

B. $Cl^- > S^{2-} > P^{3-} > Ca^{2+} > K^+$

C. $P^{3-} > S^{2-} > Cl^- > Ca^{2+} > K^+$

D. $K^+ > Ca^{2+} > P^{3-} > S^{2-} > Cl^-$

**Answer: A**

## Solution:

**Solution:**
The electronic configuration of given ions are as follows:
$K_{19}$ = 2, 8, 8, 1 $K^+$ = 2, 8, 8
$Ca_{20}$ = 2, 8, 8, 2 $Ca^{2+}$ = 2, 8, 8
$P_{15}$ = 2, 8, 5 $P^{3-}$ = 2, 8, 8
$S_{16}$ = 2, 8, 6 $S^{2-}$ = 2, 8, 8
$Cl_{17}$ = 2, 8, 7 $Cl^-$ = 2, 8, 8
As the effective nuclear charge increases from P to Ca, the atomic size decreases in the same order.
Order of ionic radii
$\underset{15}{P^{3-}} > \underset{16}{S^{2-}} > \underset{17}{Cl^-} > \underset{19}{K^+} > \underset{20}{Ca^{2+}}$
Therefore, option (a) is correct.

---

# Question47

**Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).**
**Assertion (A) Metallic character decreases and non-metallic character increases on moving from left to right in a period.**
**Reason (R) It is due to increase in ionisation enthalpy and decrease in electron gain enthalpy, when one moves from left to right in a period.**
**In the light of the above statements, choose the most appropriate answer from the options given below.**
**[31 Aug 2021 Shift 1]**

**Options:**

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

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

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

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

**Answer: B**

## Solution:

**Solution:**
On moving from left to right in periodic table, metallic character decreases while non-metallic character increases. This is due to decrease in ionisation enthalpy and increase in electron gain enthalpy when we move from left to right in periodic table.
Hence, (A) is true while (R) is false.
Hence, correct option is (b).

---

# Question48

**Identify the element for which electronic configuration in +3 oxidation state is [Ar] $3d^5$.**

**[1 Sep 2021 Shift 2]**

**Options:**

A. Ru

B. Mn

C. Co

D. Fe

**Answer: D**

## Solution:

Iron (Fe) has electronic configuration $[Ar]3d^5$ in +3 oxidation state.
Electronic configuration of Fe = $[Ar]3d^6, 4s^2$
Electronic configuration of $Fe^{3+}$ = $[Ar]3d^5$.

---

# Question49

## B has a smaller first ionization cnthalpy than Be. Consider the following statements:
## (I) it is casier to remove 2p electron than 2s electron
## (II) 2p electron of B is more shielded from the nucleus by the inner core of electrons than the 2s electrons of Be
## (III) 2s electron has more penetration power than 2p electron (IV) atomic radius of B is more than Be (atomic number B = 5, Bc = 4 )
## The correct statements are:
## [Jan. 09,2020 (I)]

**Options:**

A. (I), (II) and (IV)

B. (II), (III) and (IV)

C. (I), (II) and (III)

D. (I), (III) and (IV)

**Answer: C**

## Solution:

**Solution:**
$_5B : 1s^2 2s^2 2p^1$
$_4Be : 1s^2 2s^2$
First ionisation enthalpy of B is lower than Be because Be has a stable electronic configuration. It required more energy to remove the first electron from 2s( in Be ) than 2p (in B) because $2se^-$ has more penetration power than 2p. Therefore options (I), (II) and (III) are correct. Atomic radius of B is less than Be.

---

# Question50

## The acidic, basic and amphoteric oxides, respectively, are: [Jan. 09,2020 (I)]

**Options:**

A. $Na_2O$, $SO_3$, $A_2O_3$

B. $Cl_2O$, $CaO$, $P_4O_{10}$

C. $N_2O_3$, $Li_2O$, $Al_2O_3$

D. $MgO$, $Cl_2O$, $Al_2O_3$

**Answer: C**

## Solution:

**Solution:**
Generally, non-metal oxides are acidic in nature and metal oxides are basic in nature, $Al_2O_3$ is amphoteric.

---

# Question51

## The first and second ionisation enthalpies of a metal are 496 and 4560kJ $mol^{-1}$, respectively. How many moles of HCl and $H_2SO_4$, respectively, will be needed to react completely with 1 mole of the metal hydroxide? [NV, Jan. 09,2020(II)]

**Options:**

A. 1 and 1

B. 2 and 0.5

C. 1 and 2

D. 1 and 0.5

**Answer: D**

## Solution:

**Solution:**
A large difference between first and second ionisation enthalpies ($4560 - 496 - 4064 kJ\ mol^{-1}$) confirms the metal to be an alkali metal and thus is monovalent and form hydroxide of the type $M(OH)$

$$\underset{1\,mol}{MOH} + \underset{1\,mol}{HCl} \rightarrow MCl + H_2O$$

$$\underset{1\,mol}{2MOH} + H_2SO_4 \rightarrow M_2SO_4 + \underset{1/2\,mol}{H_2O}$$

---

# Question52

## The first ionization energy (in kJ / mol ) of Na, Mg, Al and Si respectively, are:
## [Jan. 08,2020(I)]

**Options:**

A. 496, 737, 577, 786

B. 496, 577, 737, 786

C. 786, 737, 577, 496

D. 496, 577, 786, 737

**Answer: A**

## Solution:

**Solution:**
All given elements belongs to period III and generally their ionisation energy will increase along the period but Mg will show higher ionisation potential compared to Al due to its stable configuration. Thus correct order of ionisation energy will be: Na < Al < Mg < Si.
Ionisation energy (kJ / mol ) of the given metals are
Na : 496; Al : 577; Mg : 737; Si : 786

---

# Question53

## The increasing order of the atomic radii of the following elements is:
## (i) C
## (ii) O
## (iii) F
## (iv) Cl
## (v) Br
## [Jan. 08,2020 (II)]

**Options:**

A. (ii) <( iii ) < (iv) < (i) < (v)

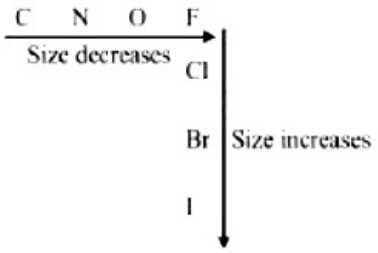
B. (iv) <( iii ) < ( ii ) < (i) < (v)

C. (iii) <(ii) < (i) < (iv) < (v)

D. (i) < (ii) < (iii) < (iv) < (v)

**Answer: C**

## Solution:




Correct increasing order of atomic radii is
F < O < C < Cl < Br

---

# Question54

## The electron gain enthalpy (in kJ / mol ) of fluorine, chlorine, bromine and iodine, respectively, are:
## [Jan. 07,2020 (I)]

**Options:**

A. −296, −325, −333 and −349

B. −349, −333, −325 and −296

C. −333, −349, −325 and −296

D. −333, −325, −349 and −296

**Answer: C**

## Solution:

**Solution:**
Chlorine has highest electron gain enthalpy (most negative) among the given elements, the electron gain enthalpy decreases down the group i.e., moves to least negative.

---

# Question55

## Within each pair of elements F & Cl , S & Se, and Li & N a, respectively, the elements that release more cnergy upon an electron gain are:
## [Jan. 07, 2020 (II)]

**Options:**

A. Cl , Se and N a

B. Cl , S and Li

C. F , S and Li

D. F , Se and N a

**Answer: B**

## Solution:

Down the group electron affinity decrease due to increasing size. So, the electron affinity of S > Se and Li > Na so energy release will also be more. But in case of F and Cl, there is exception, Cl > F. It is due to the small size of F atom where the incoming electron face high electron-electron repulsion. So, the energy release will be more in Cl.

---

# Question56

## The atomic number of Unnilunium is _____. [NV,Sep. 06,2020(II)]

**Answer: 101**

## Solution:

IUPAC symbol = Unu
Atomic no. (Z) = 101

---

# Question57

## The atomic number of the element unnilennium is: [Sep. 03,2020 (I)]

**Options:**

A. 109

B. 102

C. 108

D. 119

**Answer: A**

## Solution:

**Solution:**
un = 1
nil = 0
enn = 9
So, atomic number = 109

---

# Question58

## The set that contains atomic numbers of only transition elements, is : [Sep. 06,2020(I)]

**Options:**

A. 37, 42, 50, 64

B. 21, 25, 42, 72

C. 9, 17, 34, 38

D. 21, 32, 53, 64

**Answer: B**

## Solution:

**Solution:**
Elements with atomic number 21, 25, 42 and 72 belongs to transition metals.

---

# Question59

## The correct order of the ionic radii of $O^{2-}$, $N^{3-}$, $F^{-}$, $Mg^{2+}$, $Na^{+}$ and $Al^{3+}$ is : [Sep. 05, 2020 (II)]

**Options:**

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

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

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

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

**Answer: C**

## Solution:

**Solution:**
All are isoelectronic species, so more is the $Z_{eff}$ less will be the ionic size.
∴ Correct order of ionic radii is
$Al^{3+} < Mg^{2+} < Na^{+} < F^{-} < O^{2-} < N^{3-}$

---

# Question60

## The elements with atomic numbers 101 and 104 belong to, respectively: [Sep .04,2020(I)]

**Options:**

A. Group 11 and Group 4

B. Actinoids and Group 6

C. Actinoids and Group 4

D. Group 6 and Actinoids

**Answer: C**

## Solution:

**Solution:**
$_{89}AC \longrightarrow {}_{103}Lr$
Belongs to actinoids series and they all belongs to $3^{id}$ group. So atomic no. 101 element is actinoids and atomic number 104 element belongs to $4^{th}$ group.

---

# Question61

## The process that is NOT endothermic in nature is: [Sep. 04, 2020 (II)]

**Options:**

A. $Ar(g) + e^- \rightarrow Ar^-(g)$

B. $H(g) + e^- \rightarrow H^-(g)$

C. $O^-(g) + e^- \rightarrow O^{2-}(g)$

D. $Na(g) \rightarrow Na^+(g) + e^-$

**Answer: B**

## Solution:

**Solution:**
$Ar(g) + e^- \longrightarrow Ar^-(g)$ (endothermic)
$H(g) + e^- \longrightarrow H^-(g)$ (exothermic)
$Na(g) \longrightarrow Na^+(g) + e^-$ (endothermic)
$O^-(g) + e^- \longrightarrow O^{2-}(g)$ (endothermic)
- Electron gaining enthalpy (EGE) of $H(g)$ is negative while that of $Ar(g)$ is positive due to $ns^2np^6$ configuration.
- Second EGE is always positive for an atom.
- Ionization potential of an atom is positive.

---

# Question62

## The ionic radii of $O^{2-}$, $F^-$, $Na^+$ and $Mg^{2+}$ are in the order: [Sep. 04,2020(I)]

**Options:**

A. $F^- > O^{2-} > Na^+ > Mg^{2+}$

B. $O^{2-} > F^- > Na^+ > Mg^{2+}$

C. $Mg^{2+} > Na^+ > F^- > O^2$

D. $O^{2-} > F^{-} > Mg^{2+} > Na^{+}$

**Answer: B**

## Solution:

| | $O^{2-}$ | $F^{-}$ | $Na^{+}$ | $Mg^{2+}$ |
|---|---|---|---|---|
| Z | 8 | 9 | 11 | 12 |
| No. of $e^{-}$ | 10 | 10 | 10 | 10 |

In isoelectronic species greater is $Z_{effe.}$ smaller is radius so order is $O^{2-} > F^{-} > Na^{+} > Mg^{2+}$.

---

# Question63

**Among the statements (I - IV), the correct ones are:**
**(I) Be has smaller atomic radius compared to Mg.**
**(II) Be has higher ionization enthalpy than Al.**
**(III) Charge\/radius ratio of Be is greater than that of Al.**
**(IV) Both Be and Al form mainly covalent compounds.**
**[Sep. 03,2020 (II)]**

**Options:**

A. (I), (II) and (IV)

B. (I), (III) and (IV)

C. (II),(III) and(IV)

D. (I), (II) and (III)

**Answer: A**

## Solution:

**Solution:**
Charge/ radius ratio of Be and Al is same because of diagonal relationship. Remaining statements are correct.

---

# Question64

**The five successive ionization enthalpies of an element are 800, 2427, 3658, 25024 and 32824kJ $mol^{-1}$. The number of valence electrons in the clement is:**
**[Sep. 03, 2020 (II)]**

**Options:**

A. 5

B. 4

C. 3

D. 2

**Answer: C**

## Solution:

**Solution:**
As difference in $3^{id}$ and $4^{th}$ ionisation energies is high so atom contains 3 valence electrons.

---

# Question65

## In general, the property (magnitudes only) that shows an opposite trend in comparison to other properties across a period is: [Sep .02,2020(1)]

**Options:**

A. lonization enthalpy

B. Electronegativity

C. Electron gain enthalpy

D. Atomic radius

**Answer: D**

## Solution:

**Solution:**
On moving left to right along a period in the periodic table atomic radius decreases while electronegativity, electron gain enthalpy and ionisation enthalpy increases, along a period.

---

# Question66

## Three elements X , Y and Z are in the $3^{nd}$ period of the periodic table. The oxides of X , Y and Z , respectively, arc basic, amphoteric and acidic. The correct order of the atomic numbers of X, Yand Zis : [Sep. 02,2020(II)]

**Options:**

A. Z < Y < X

B. X < Y < Z

C. X < Z < Y

D. Y < X < Z

**Answer: B**

## Solution:

On moving left to right in a period, the acidic character of oxides increases. $3^{nd}$ period element oxides.
Acidic character ∝ Atomic No.
So, X have minimum atomic number while Z have maximum atomic number.
Thus, the correct order of the atomic number is
X < Y < Z

---

# Question67

## The element with Z = 120 (not yet discovered) will be an\/a: [Jan. 12,2019 (I)]

**Options:**

A. Inner-transition metal

B. Alkalineearth metal

C. Alkalimetal

D. Transition metal

**Answer: B**

## Solution:

**Solution:**
Elements with Z = 120 will belong to alkaline earth metals.
Its electronic con figuration may be represented as [Og] $8s^2$

---

# Question68

## The correct order of the atomic radii of C, Cs, Al , and S is: [Jan. 11, 2019 (I)]

**Options:**

A. C < S < A| < Cs

B. S < C < Cs < Al

C. S < C < Al < Cs

D. C < S < Cs < Al

**Answer: A**

## Solution:

On going down the group, size increases while going from left to right in a period size decreases, so order is
C < S < A| < CCs

---

# Question69

## The correct option with respect to the Pauling electronegativity values of the elements is:
## [Jan. 11,2019 (II)]

**Options:**

A. T e > Se

B. Ga < Ge

C. Si < Al

D. P > S

**Answer: B**

## Solution:

**Solution:**
Correct order of electronegativity values of the elements is
Si > Al ; S > P; Se > T e; Ge > Ga

---

# Question70

## The 71 $^{st}$ electron of an element X with an atomic number of 71 enters into the orbital:
## [Jan.10,2019 (II)]

**Options:**

A. 6p

B. 4f

C. 5d

D. 65

**Answer: C**

## Solution:

$_{71}X = [X e]6s^2 4f^{14} 5d^1$
∴ Orbital occupied by last $e^-$ is 5d .

---

# Question71

## In general, the properties that decrease and increase down a group in the periodic table, respectively, are:
## [Jan. 9,2019(I)]

**Options:**

A. atomic radius and electronegativity.

B. electron gain enthalpy and electronegativity.

C. electronegativity and atomic radius.

D. electronegativity and electron gain enthalpy.

**Answer: C**

## Solution:

**Solution:**
Generally, electronegativity decreases down the group as the size increases. This can also be formulated as:
Electronegativity $\propto \frac{1}{\text{size}}$

---

# Question72

## When the first electron gain enthalpy ($\Delta_{eg}H$) of oxygen is $-141 kJ / mol$, its second electron gain enthalpy is:
## [Jan. 09,2019(II)]

**Options:**

A. a more negative value than the first

B. almost the same as that of the first

C. negative, but less negative than the first

D. a positive value

**Answer: D**

## Solution:

**Solution:**
The second electron gain enthalpy of oxygen is positive as energy has to be added for the addition of another electron.

---

# Question73

## The group number, number of valence electrons, and valency of an element with atomic number 15 , respectively, are:

**[April 12, 2019 (I)]**

**Options:**

A. 16,5 and 2

B. 15,5 and 3

C. 16,6 and 3

D. 15,6 and 2

**Answer: B**

## Solution:

**Solution:**
Phosphorus has atomic number 15. Its group number is 15, number of valence electrons is 5 and valency is 3.

---

# Question74

## The IUPAC symbol for the element with atomic number 119 would be : [April 8, 2019 (II)]

**Options:**

A. uue

B. une

C. unh

D. uun

**Answer: A**

## Solution:

**Solution:**
Symbol for 1 is u and for 9 is e.
∴ IUPAC symbol for 119 is uue.

---

# Question75

## In comparison to boron, berylium has: [April 12, 2019 (II)]

**Options:**

A. lesser nuclear charge and lesser first ionisation enthalpy.

B. greater nuclear charge and lesser first ionisation enthalpy.

C. greater nulear charge and greater first ionisation enthalpy.

D. lesser nuclear charge and greater first ionisation enthalpy.

**Answer: D**

## Solution:

Nuclear charge : B > Be
Be = $1s^2 2s^2$ (more stable)
B = $1s^2 2s^2 2p^1$
∴ Ionisation energy of Be is greater than B due to $ns^2$ outer electronic configuration.

---

# Question76

## The element having greatest difference between its first and second ionization energies, is:
## [April 9,2019(I)]

**Options:**

A. Ca

B. Sc

C. Ba

D. K

**Answer: D**

## Solution:

**Solution:**
Alkali metals have high difference in first and second ionisation energy as they achieve stable noble gas configuration after first ionisation.

---

# Question77

## The correct order of electron affinity is:
## [Online April 15, 2018 (II)]

**Options:**

A. O > F > Cl

B. F > O > Cl

C. F > Cl > O

D. Cl > F > O

**Answer: D**

## Solution:

On moving from left to right across a period, the electron affinity becomes more negative. On moving from top to bottom in a group, the electron affinity becomes less negative. Chlorine has exceptionally more negative electron affinity than fluorine, because adding an electron to fluorine ( 2p orbital) causes greater repulsion than adding an electron to chlorine ( 3p orbital) which is larger in size.

---

# Question78

## For $Na^{+}$, $Mg^{2+}$, $F^{-}$ and $O^{2-}$; the correct order of increasing Ionic radii is : [Online April 15, 2018(I)]

**Options:**

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

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

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

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

**Answer: C**

## Solution:

**Solution:**
All species are isoelectronic (10e-).
In isoelectronic series, when negative charge increases the radius of ion increases.
$\therefore Mg^{2+} < Na^{+} < F^{-} < O^{2}$

---

# Question79

## Both lithium and magnesium display several similar properties due to the diagonal relationship; however, the one which is incorrect is : [2017]

**Options:**

A. Both form basic carbonates

B. Both form soluble bicarbonates

C. Both form nitrides

D. Nitrates of both Li and Mg yield $NO_2$ and $O_2$ on heating

**Answer: A**

## Solution:

**Solution:**
Mg can form basic carbonate
$3MgCO_3 \cdot Mg(OH)_2.3H_2O\downarrow$

While Li can form only carbonate ($Li_2CO_3$), not basic carbonate.

---

# Question80

## The group having isoelectronic species is : [2017]

**Options:**

A. $O^{2-}$, $F^-$, $Na^+$, $Mg^{2+}$

B. O, $F^-$, Na, $Mg^+$

C. $O^{2-}$, $F^-$, Na, $Mg^{2+}$

D. $O^-$, $F^-$, $Na^+$, $Mg^{2+}$

**Answer: A**

## Solution:

Isoelectronic species have same no. of electrons.
**Ions ⇒**
$O^{2-}$ - 8 + 2
$F^-$ - 9 + 1
$Na^+$ - 11 − 1
$Mg^{2+}$ - 12 − 2
**No. of $e^-$⇒μ**
10 - $O^{2-}$,
10 - $F^-$,
10 - $Na^+$,
10 - $Mg^{2+}$
Thereforeare isoelectronic.

---

# Question81

## Consider the following ionization enthalpies of two elements 'A' and 'B'.

| Element | Ionization | enthalpy | (kJ/mol) |
|---|---|---|---|
| | 1 st | 2 nd | 3 rd |
| A | 899 | 1757 | 14847 |
| B | 737 | 1450 | 7731 |

## [Online April 8, 2017|

**Options:**

A. Both 'A' and 'B' belong to group- 1 where ' B ' comes below 'A:

B. Both 'A' and 'B' belong to group- 1 where 'A' comes below 'B'.

C. Both 'A' and 'B' belong to group- 2 where ' B ' comes below 'A?

D. Both 'A' and ' B ' belong to group- 2 where 'A' comes below 'B'.

**Answer: C**

## Solution:

**Solution:**
Generally, the ionization enthalpies or energy increases from left to right in a period and decreases from top to bottom in a group. Several factor such as atomic radius, nuclear charge, shielding effect are responsible for change of ionization enthalpies. Here, Ist ionization enthalpy of A and B is greater than group I (Li $520 \mathrm{kJ\ mol^{-1}}$ to Cs $374 \mathrm{kJ\ mol^{-1}}$ ), which means element A and B belong to group $-2$ and all three given ionization enthalpy values are less for element B means B will come below A.

---

# Question82

## The electronic configuration with the highest ionization enthalpy is: [Online April 9, 2017]

**Options:**

A. [Ne] $3s^2 3p^{'}$

B. [Ne] $3s^2 3p^2$

C. [Ne] $3s^2 3p^3$

D. [Ar]$3d^{10} 4s^2 4p^3$

**Answer: C**

## Solution:

**Solution:**
The smaller the atomic size, larger is the value of IP. Further the atoms having half filled or fully filled orbitals are comparatively more stable, hence more energy is required to remove the electron from such atoms.

---

# Question83

## Which of the following atoms has the highest first ionization energy? [2016]

**Options:**

A. K

B. Sc

C. Rb

D. N a

**Answer: B**

## Solution:

**Solution:**
Alkali metals have the lowest ionization energy in each period, on the other hand Sc is a d - block element. Transition metals have smaller atomic radii and higher nuclear charge leading to high ionisation energy.

---

# Question84

## The following statements concern elements in the periodic table. Which of the following is true? [Online April 10,2016]

**Options:**

A. For Group 15 clements, the stability of +5 oxidation state increases down the group

B. Elements of Group 16 have lower ionization enthalpy values compared to those of Group 15 in the corresponding periods.

C. The Group 13 elements are all metals

D. All the elements in Group 17 are gases.

**Answer: B**

## Solution:

**Solution:**
Due to extra stable half-filled p -orbital electronic configurations of Group 15 elements, larger amount of energy is required to remove electrons compared to Group 16 elements.

---

# Question85

## The ionic radii (in Å ) of $N^{3-}$, $O^{2-}$ and $F^{-}$ are respectively: [2015]

**Options:**

A. 1.71, 1.40 and 1.36

B. 1.71, 1.36 and 1.40

C. 1.36, 1.40 and 1.71

D. 1.36, 1.71 and 1.40

**Answer: A**

## Solution:

For isoelectronic species, size of anion increases as negative charge increases. Thus the correct order is (a).

# Question86

## In the long form of the periodic table, the valence shell electronic configuration of $5s^2 5p^4$ corresponds to the element present in: [Online April 10, 2015]

**Options:**

A. Group 16 and period 6

B. Group 17 and period 6

C. Group 16 and period 5

D. Group 17 and period 5

**Answer: C**

## Solution:

**Solution:**
Tellurium (Te) has $5s^2 5p^4$ valence shell configuration. It belongs to group 16 and present in period 5 of the periodic table.

---

# Question87

## Similarity in chemical properties of the atoms of elements in a group of the periodic table is most closely related to: [Online April 12, 2014]

**Options:**

A. atomic numbers

B. atomic masses

C. number of principal energy levels

D. number of valence electrons

**Answer: A**

## Solution:

**Solution:**
If elements are arranged in order of their increasing atomic numbers, element coming at intervals of 2, 8, 8, 18, 18, 32 and 32 will have similar physical and chemical

---

# Question88

## Which of the following series correctly represents relations between the

**elements from X to Y ?**

**X → Y**
**[Online April 11,2014]**

**Options:**

A. $_{3}Li \rightarrow {}_{19}K$ Ionization enthalpy increases

B. $_{9}F \rightarrow {}_{35}Br$ Electron gain enthalpy (negative sign) increases

C. $_{6}C \rightarrow {}_{32}Ge$ Atomic radii increases

D. 18Ar → 54X e Noble character increases

**Answer: C**

## Solution:

**Solution:**
On moving down in a group atomic radii increases.

---

# Question89

**Which of the following arrangements represents the increasing order (smallest to largest) of ionic radii of the given species**
**$O^{2-}$, $S^{2-}$, $N^{3-}$, $P^{3-}$ ?**
**[Online April 12, 2014]**

**Options:**

A. $O^{2^{2}} < N^{3-} < S^{2-} < P^{3}$

B. $O^{2-} < P^{3-} < N^{3} < S^{2}$

C. $N^{3-} < O^{2-} < P^{3-} < S^{2-}$

D. $N^{3-} < S^{2-} < O^{2-} < P^{3-}$

**Answer: A**

## Solution:

**Solution:**
For isoelectronic species ionic radii decreases as the charge on ion decreases. Further on moving down in a group ionic radii increases. Hence the correct order is $O^{2}$
$<N^{3-} < S^{2-} < P^{3}$

---

# Question90

**Which one of the following has largest ionic radius?**

**[Online April 19,2014]**

**Options:**

A. $Li^{+}$

B. $O_2^{2-}$

C. $B^{3+}$

D. $F^{-}$

**Answer: B**

## Solution:

**Solution:**
The ionic radii of elements exhibit the same trend as the atomic radii. The atomic size generally decreases across a period for the elements of the second period. It is because, within the period, the outer electrons are in the same valence shell and the effective nuclear charge increases as the atomic number increases resulting in the increased attraction of electrons to the nucleus. The size of an anion will be larger than that of the parent atom because the addition of one or more electrons would result in increased repulsion among the electrons and a decrease in effective nuclear charge.
In given question option A and C are cations in the second period. So they will have less ionic radius than that of the anions o same period. oxygen falls left to the Fluorine and also has one extra negative charge ($O_2^{-2}$) than Fluorine ion ($F^{-}$)

---

# Question91

## Which of the following represents the correct order of increasing first ionization enthalpy for Ca, Ba, S, Se and Ar ?
## [2013]

**Options:**

A. Ca < S < Ba < Se < Ar

B. SSe < Ca < Ba < Ar

C. Ba < Ca < Se < S < Ar

D. Ca < Ba < S < Se < Ar

**Answer: C**

## Solution:

**Solution:**
On moving down a group size increases, hence ionisation enthalpy decreases. Hence Se < S and Ba < Ca.
Further, Ar being an inert gas has maximum IE.

---

# Question92

## The order of increasing sizes of atomic radii among the elements O, S, Se and As is:

**[Online April 22, 2013]**

**Options:**

A. As < S < O < Se

B. Se < S < As < O

C. O < S < As < Se

D. O < S < Se < As

**Answer: D**

## Solution:

**Solution:**
On moving down in a group atomic radii increases due to successive addition of extra shell hence, order is
O < S < Se
Further, As is in group 15 having one less electron in its p orbital compared to group 16 , hence as has higher atomic radii than group 16 elements.
i.e., O < S < Se < As

---

# Question93

## Which is the correct order of second ionization potential of C, N , O and F in the following?
## [Online May 26, 2012; April 23, 2013]

**Options:**

A. O > N > F > C

B. O > F > N > C

C. F > O > N > C

D. C > N ≥ O > F

**Answer: B**

## Solution:

**Solution:**
The second ionization potential means removal of electron from cation
$C^+ = 1s^2 2s^2 2p^1$; $N^+ = 1s^2 2s^2 2p^2$
$O^+ = 1s^2 2s^2 2p^3$; $F^+ = 1s^2 2s^2 2p^4$
Therefore, the correct order is
O > F > N > C

---

# Question94

## The electron affinity of chlorine is 3.7eV .1 gram of chlorine is completely converted to $Cl^-$ ion in a gaseous state.

**($1eV = 23.06kcal\,mol^{-1}$) Energy released in the process is [Online May 7,2012]**

**Options:**

A. 4.8kcal

B. 7.2kcal

C. 8.2k cal

D. 2.4kcal

**Answer: D**

## Solution:

Number of moles of chlorine $= \frac{1}{35.5}$ mol

Given, $1eV = 23.06kcal\,mo]^{-1}$

$3.7eV = 3.7 \times 23.06kcal\,mol^{-1}$

i.e. 1 mole of chlorine releases energy

$= 3.7 \times 23.06kcal$

$\therefore \frac{1}{35.5}$ mole of chlorine will release energy

$= \frac{1}{35.5} \times 3.7 \times 23.06kcal = 2.4kcal$

---

# Question95

**Which among the following elements has the highest first ionization enthalpy? [Online May 12, 2012]**

**Options:**

A. Nitrogen

B. Boron

C. Carbon

D. Oxygen

**Answer: A**

## Solution:

**Solution:**

Due to stable $2s^2 2p^3$ configuration (half filled p -orbital). Nitrogen atom has highest energy.

---

# Question96

**The correct order of electron gain enthalpy with negative sign of $F$, $Cl$, $Br$ and $I$, having atomic numbers 9, 17, 35 and 53 respectively, is:**
**[2011RS]**

**Options:**

A. $F > Cl > Br > I$

B. $Cl > F > Br > I$

C. $Br > Cl > I > F$

D. $I > Br > Cl > F$

**Answer: B**

## Solution:

**Solution:**
As we move down in a group, electron gain enthalpy becomes less negative because the size of the atom increases and the distance of added electron from the nucleus increases. Negative electron gain enthalpy of $F$ is less than $Cl$. This is due to the fact that when an electron is added to $F$, the added electron goes to the smaller $n = 2$ energy level and experiences significant repulsion from the other electrons present in this level. In Cl, the electron goes to the larger $n = 3$ energy level and consequently occupies a larger region of space leading to much less electron-electron repulsion. So the correct order is
$Cl > F > Br > I$

---

# Question97

**The correct sequence which shows decreasing order of the ionic radii of the elements is**
**[2010]**

**Options:**

A. $Al^{3+} > Mg^{2+} > Na^{+} > F^{-} > O^{2-}$

B. $Na^{+} > Mg^{2+} > Al^{3+} > O^{2-} > F$

C. $Na^{+} > F^{-} > Mg^{2+} > O^{2-} > Al^{3+}$

D. $O^{2-} > F^{-} > Na^{+} > Mg^{2+} > Al^{3+}$

**Answer: D**

## Solution:

**Solution:**
All the given species contains $10e^{-}$ each i.e. isoelectronic. For isoelectronic species anion having high negative charge is largest in size and the cation having high positive charge is smallest.

---

# Question98

**In which of the following arrangements, the sequence is not strictly according to the property written against it?**
**[2008, Online May 7,2012 ]**

**Options:**

A. $CO_2 < SiO_2 < SnO_2 < PbO_2$ : increasing oxidising power

B. $NH_3 < PH_3 < AsH_3 < SbH_3$ : increasing basic strength

C. $HF < HCl < HBr < HI$ : increasing acid strength

D. $B < C < O < N$ : increasing first ionisation enthalpy.

**Answer: B**

## Solution:

**Solution:**
Correct order of increasing basic strength is
$NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$

---

# Question99

**Following statements regarding the periodic trends of chemical reactivityofalkali metals and halogens are given. Which of these statements gives the correct picture?**
**[2006]**

**Options:**

A. Chemical reactivity increases with increase in atomic number down the group in both the alkali metals and halogens

B. In alkali metals the reactivity increases but in the halogens it decreases with increase in atomic number down the group

C. The reactivity decreases in the alkali metals but increases in the halogens with increase in atomic number down the group

D. In both, alkalimetals and halogens chemical reactivity decreases with increase in atomicnumber down the group

**Answer: B**

## Solution:

**Solution:**
The alkali metals are highlyreactive because their first ionisation potential is very low and hence they have great tendency to give up electron to form unipositive ion. Note: On moving down in group I from Li to C s, ionisation enthalpy decreases hence the reactivity increases. The halogens are most reactive elements due to their low bond dissociation energy, high electron affinity and high enthalpy of hydration of halide ion. However, their reactivity decreases with increase in atomic number.

---

# Question100

## The increasing order of the first ionization enthalpies of the elements B, P, S and F (Lowest first) is [2006]

**Options:**

A. $B \leq P < S \leq F$

B. $B \leq S < P < F$

C. $F < S \leq P < B$

D. $P < S < B < F$

**Answer: B**

## Solution:

**Solution:**
The correct order of ionisation enthalpies is
$F > P > S > B$
**Note:** On moving along a period ionization enthalapy increases from left to right and decreases from top to bottom in a group. But this trend breaks up in case of such element having fully or half filled stable orbitals.
In this case, P has a stable half filled electronic configuration, hence its ionisation enthalapy is greater in comparision to S. Therefore the correct order is
$B < S < P < F$

---

# Question101

## Which of the following oxides is amphoteric in character? [2005]

**Options:**

A. $SnO_2$

B. $SiO_2$

C. $CO_2$

D. CaO

**Answer: A**

## Solution:

**Solution:**
CaO is basic as it formsstrong base $Ca(OH)_2$ on reaction with water.
$CaO + H_2O \longrightarrow Ca(OH)_2$
$CO_2$ is acidic as it dissolves in water forming unstable carbonic acid.
$H_2O + CO_2 \longrightarrow H_2CO_3$
Silica ( $SiO_2$ ) is insoluble in water and acts as a very weak acid.
$SnO_2$ is amphoteric as it reacts with both acid and base.
$SnO_2 + 2H_2SO_4 \longrightarrow Sn(SO_4)_2 + 2H_2O$

$SnO_2 + 2KOH \longrightarrow K_2SnO_3 + H_2O$

---

# Question102

## In which of the following arrangements, the order is NOT according to the property indicated against it? [2005]

**Options:**

A. $L < Na < K < Rb$ :
Increasing metallic radius

B. $I < Br < F < Cl$ :
Increasing electron gain enthalpy (with negative sign)

C. $B < C < N < 0$
Increasing first ionization enthalpy

D. $Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$
Increasing ionic size

**Answer: C**

## Solution:

**Solution:**
In a period the value of ionisation potential increases from left to right with breaks where the atoms have somewhat stable configuration. In the given list Nhas halffilled stable orbitals. Hence N has highest ionisation energy. Thus the correct order is
$B < C < O < N$
and not as given in option (c)

---

# Question103

## Which one of the following ions has the highest value of ionic radius? [2004]

**Options:**

A. $O^{2}$

B. $B^{3+}$

C. $Li^{+}$

D. $F^{-}$

**Answer: A**

## Solution:

**Solution:**

$O^{2-}$ and $F^-$ are isoelectronic ($10c^-$). Hence have same number of electron but different number of proton, $F^-$ has 9 proton whercas $0^{2-}$ has 8 proton. Therefore $F^-$ has greater nuclear charge compared to $O^{2-}$. So $O^{2-}$ will have greater ionic radius, i.e. $O^{2-} > F^-$
Further $Li^+$ and $B^{3+}$ are also isoelectronic ($2e^-$) therefore, no. of proton in Li is 3 and in B is 5 , So,
$Li^+ > B^{3+}$
Hence, the correct order of atomic size is
$O^{2-} > F^- > Li^+ > B^{3+}$
Therefore, $O^{2-}$ has the highest value of ionic radius.

---

# Question104

## Among $Al_2O_3$, $SiO_2$, $P_2O_3$ and $SO_2$ the correct order of acid strength is [2004]

**Options:**

A. $Al_2O_3 < SiO_2 < SO_2 < P_2O_3$

B. $SiO_2 < SO_2 < Al_2O_3 < P_2O_3$

C. $SO_2 < P_2O_3 < SiO_2 < Al_2O_3$

D. $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

**Answer: D**

## Solution:

**Solution:**
As the size decreases the basic nature of oxides changes to acidic nature i.c., acidic nature increases.
$\underset{\text{Acidic}}{SO_2} > P_2O_3 > \underset{\text{Weak acidic}}{SiO_2} > \underset{\text{Ampboteric}}{Al_2O_3}$
$SO_2$ and $P_2O_3$ are acidic as their corresponding acids $H_2SO_3$ and $H_3PO_3$ are strong acids.

---

# Question105

## The formation of the oxide ion $0^{2-}(g)$ requires first an exothermic and then an endothermic step as shown below
## $O(g) + e^- = O^-(g)\ \Delta H^0 = -142 kJ\ mol^{-1}$

## $O^-(g) + e^- = O^{2-}(g)\ \Delta H^0 = 844 kJ\ mol^{-1}$
## This is because
## [2004]

**Options:**

A. O - ion will tend toresist the addition of another electron

B. Oxygen has high electron affinity

C. Oxygen is more elecronegative

D. O -ion has comparativelylarger size than oxygen atom

**Answer: A**

## Solution:

**Solution:**
O ion exerts a force of repulsion on the incoming electron. The energy is required to overcome it.

---

# Question106

## According to the periodic law of elements, the variation in properties of elements is related to their
## [2003]

**Options:**

A. nuclear masses

B. atomic numbers

C. nuclear neutron-proton number ratios

D. atomic masses

**Answer: B**

## Solution:

According to modern periodic law, the properties of the elements are repeated after certain regular intervals when these elements are arranged in order of their increasing atomic numbers.

---

# Question107

## Which one of the following is an amphoteric oxide?
## [2003]

**Options:**

A. $Na_2O$

B. $SO_2$

C. $B_2O_3$

D. ZnO

**Answer: D**

## Solution:

$Na_2O$ (basic), $SO_2$ and $B_2O_3$ (acidic) and ZnO is amphoteric.

---