NEET REVISION SERIES

CLASSIFICATION OF ELEMENTS AND PERIODICITY OF PROPERTIES

Revise Most Important Questions to Crack NEET 2020

Q-1 - 18237341

The straing element of fifth period is

(A) K

(B) Rb

(C) Kr

(D) Xe

CORRECT ANSWER: B

Q-2 - 18237347

The element with electron configuration

$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^5$ belongs to

(A) 4th period, VA group

(B) 5th period, IVA group

(C) 4th period, VIIA group

(D) 7th period, IVA group

CORRECT ANSWER: C

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Q-3 - 18237375

Vander waal's radius is used for

(A) Molecular substances in gaseous state only

(B) Molecular substance in liquid state only

(C) Molecular substances in solid state only

(D) Molecular substances in any state

CORRECT ANSWER: C

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Q-4 - 18237457

In which of the following pairs, the first atom or ion is not large than the second?

(A) Fe^{2+}, Fe^{3+}

(B) O, S

(C) N, O

(D) Cl^{-}, Cl

CORRECT ANSWER: B

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Q-5 - 18237480

The correct order of ionization energies is

(A) $Zn < Cd < Hg$

(B) $Hg < Cd < Zn$

(C) $Ar > Ne > He$

(D) $Cs < Rb < Na$

CORRECT ANSWER: D

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Q-6 - 15631066

The formation of the oxide ion $O^{2-}_{(g)}$ requires first an exothermic and then an endothermic step as shown below.

$O_{(g)} + e^- = O^-_{(g)} \Delta H =$

$-142 kJ mol^{-1}$

$O^-_{(g)} + e^- = O^{2-}_{(g)} \Delta H$

$= 844 kJ mol^{-1}$

This is because of :

(A) O^- ion will tend to resist tha addition of another electron

(B) Oxygen has high electron affinity

(C) Oxygen is more electronegative

(D) O^- ion has comparatively larger size than oxygen atom

CORRECT ANSWER: A

SOLUTION:

[$\left(\Delta H_{eg}\right)_2$ is an endothermic process]

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Q-7 - 18237503

Regarding the electronegativity

(i) The element with maximum electornegativity: Fluorine (ii) In Pauling scale, the reference element is: Silicon

(iii) Elements with stable configuration have high electronegativity

(iv) the electron with maximum electronpositivity: Hydrogen

(A) Only (i) correct

(B) Only (ii) correct

(C) only (iii) correct

(D) Only (iv) is correct

CORRECT ANSWER: A

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Q-8 - 18237507

Which of the following statements are wrong

(I) Bi^{3+} is more stable than Bi^{5+}

(II) Mn shows $+8$ oxidation state

(III) The oxidation state of an element is always less than or equal to its group number

(IV) s-block elements show variable oxidation states

The answer is

(A) II and IV

(B) II and III

(C) I, II and III

(D) II, III and IV

CORRECT ANSWER: A

Q-9 - 18237521

H-H, X-X and $H-X$ bond energies are

$104 Kcal/\text{mole} 60 Kcal/\text{mole}$ and $101 kcal/\text{mole}$. Assuming the electronegativity of hydrogen to be 2.1 the electronegativity of unknown element X is $\left(\sqrt{19}=4.36\right)$

(A) 3.5

(B) 3

(C) 4

(D) 2.5

CORRECT ANSWER: B

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Q-10 - 18237730

Which one of the following is correct order of second ionisation potential of Na, $NeMg$ and Al?

(A) $Al < Na < Mg < Ne$

(B) $Ne < Al < Na < Mg$

(C) $Na < Mg < Ne < Al$

(D) $Mg < Al < Ne < Na$

CORRECT ANSWER: D

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Q-11 - 18237872

Which one of the following arrangements is the incorrect representation of the property indicated with it ?

(A) $Br < Cl < F$: Electronegativity

(B) $F < Br < Cl$: Electron - affinity

(C) $F_2 < Br_2 < Cl_2$: Bond energy

(D) $Br_2 < Cl_2 < F_2$: Oxidising strength

CORRECT ANSWER: B

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Q-12 - 18237974

In which of the following arrangements, the order is correct

according to the property indicated aganst it:

(A) Increasing size:

$Al^{3+} > Mg^{2+}$

$> Na^{+} > F^{-}$

(B) Increasing $I.E._1$: $B < C < N > O$

(C) Increasing $E.A._1$: $I > Br > F > Cl$

(D) Increasing metallic radius : $Li > Na > K > Rb$

CORRECT ANSWER: B

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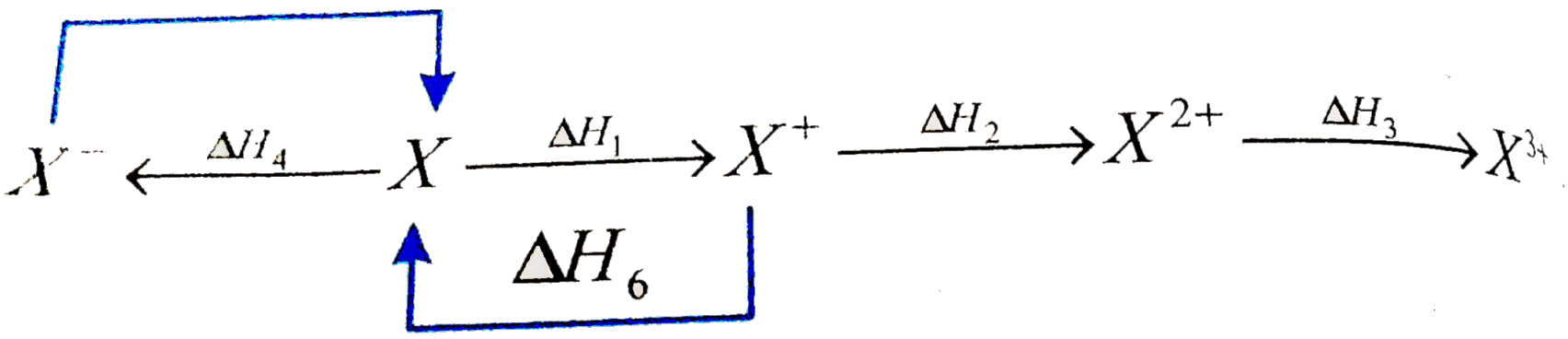
Q-13 - 18238029

Consider the following sequence of reaction :



If electronic configuration of element X is $[Ne]3s^1$, then which of the following order is correct regarding given enthalpies ?

(A) $|\Delta H_4| = |\Delta H_5|$

(B) $|\Delta H_2| > |\Delta H_1|$

(C) $|\Delta H_2| > |\Delta H_3|$

(D) $|\Delta H_1| = |\Delta H_6|$

CORRECT ANSWER: A::B::D

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Q-14 - 12227104

Electronic configuration of chalcogens in their outermost orbit is

(A) s^2p^3

(B) s^2p^5

(C) s^2p^4

(D) p^6

CORRECT ANSWER: C

SOLUTION:

Chalcogens are oxygen family.

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Q-15 - 12227151

Which of the following does not represent the correct order of the property indicated?

(A)

$Sc^{3+} > Cr^{3+} > Fe^{3+} > Mn^{3+}$

ionic radii

(B) $Sc < Ti < Cr <$ Mn Density

(C)

$Mn^{2+} > Ni^{2+} < Co^{2+} < Fe^{2+}$

ionic radii

(D)

$Feo < Cao < Mno < CuO$

Basic nature

CORRECT ANSWER: A

SOLUTION:

$$Sc^{3+} > Cr^{3+} > Fe^{3+} > Mn^{3+}$$

the correct order is

$$Cr^{+3} > Mn^{+3} > Fe^{+3} > Sc^{+3}$$

.

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Q-16 - 12979194

The correct order of ionic radii Y^{3+} , La^{3+} , Eu^{3+} and Lu^{3+} is $(AT.No: Y = 39, La = 57, Eu = 63, Lu = 71)$

(A)

$$Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$$

(B)

$$La^{3+} < Eu^{3+} < Lu^{3+} < Y^{3+}$$

(C)

$Y^{3+} < La^{3+} < Eu^{3+} < Lu^{3+}$

(D)

$Y^{3+} < Lu^{3+} < Eu^{3+} < La^{3+}$

CORRECT ANSWER: D

SOLUTION:

On account of lanthanide contraction, we have the order

$La^{3+} > Eu^{3+} > Lu^{3+}$

The correct order of ionic radii of given ions is actucally

$Lu^{3+} < Y^{3+} < Eu^{3+} < La^{3+}$

$(0.861A) \quad (0.900) \quad (0.947) \quad (1.032A)$

Y^{3+} ion has lower ionic radius in comparison to La^{3+}

because it lies immediately above it in the periodic table.

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Q-17 - 11466916

Calculate the screening constant in Zn.

a. For a $4s$-electron b. For a $3d$-electron

CORRECT ANSWER: N/A

SOLUTION:

The electronic configuration of $zn(Z = 30)$ is $1s^2, 2s^2 2p^6, 3s^2 3p^6, 3d^{10}, 4s^2$.

Since σ is calculated for one electron in $4s$ shell, so one electron is left in $4s$ shell.

a.

$$\sigma = \left[\begin{array}{c} (0.35 \\ \times \text{ number of electrons left} \\ \text{in 4s or nth shell}) \\ +(0.85 \times \text{number of} \\ \text{electrons in(n-1)th shell}) \\ +(1.00 \\ \times \text{total number of electrons in the inner shells}) \end{array}\right]$$

$$= (0.35 \times 1)$$
$$+ (0.85 \times 18)$$
$$+ (1.00 \times 10)$$

$$= 25.65$$

b. i. σ for $4s = 0$, [Rule (b)]. [σ for right of (ns, np) zero].

ii. Since σ is calculated for one electron in $3d$-orbital, so, 9 electrons are left in $3d$-orbital.

$$\therefore \sigma$$

$$=$$

$$\left[\begin{array}{c}\left(\begin{array}{c}0.35\\ \times \text{ number of electrons left in}\\ 3d\text{shell or nth shell}\end{array}\right)\\ +\\ \left(\begin{array}{c}1.00\\ \times \text{ number of electrons in the}\\ \text{inner shell}\end{array}\right)\end{array}\right]$$

$$= (0.35 \times 9)$$

$$+ (1.0 \times 18)$$

$$= 21.15$$

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Q-18 - 11466927

The electronic configuration for the following atoms are given

below :

a. $1s^2 2s^2 2p^5$, b. $1s^2 2s^2 2p^4$, c. $1s^2 2s^2 2p^6 3s^2$

d. $1s^2 2s^2 2p^6$, e. $1s^2 2s^2 2p^6 3s^1$

i. From the above configuration, arrange them in decreasing IE.

ii. Which of the electronic configuration given above wil have the lowest IE ?

iii. Which of the electronic configuration given above will be for noble gases ?

CORRECT ANSWER: N/A

SOLUTION:

i. Arrange the electronic configuration of all the atoms in decreasing order of atomic number, in such a manner that atoms containing the same outer energy shell are grouped together, e.g.

$$1s^2 2s^2 2p^6 3s^2 (Z = 12)$$
$$(c)$$

$$> 1s^2 2s^2 2p^6 3s^1 (Z$$
$$(e)$$

$$= 11) \ldots .\ \text{M-shell}$$

$$> 1s^2 2s^2 2p^6 (Z = 10)$$
$$(d)$$

$$> 1s^2 2s^2 2p^5 (Z = 9)$$
$$(a)$$

$$> 1s^2 2s^2 2p^4 (Z = 8)$$
$$(b)$$

$$\ldots L\text{shell}$$

ii. Since the M-shell is far away from the nucleus than L -shell, so lesser amount of energy is required to remove an electron from M-shell than from L-shell.

Thus, the IE of atoms (c) and (e) should be lower than that of atoms (a), (b) and (d).

Moreover, in case of atom (c) the electron is to be removed from the more stable completely filled $3s$-orbitals, whereas in case of atom (e) is not so.

Therefore, the IE of atom (c) should be higher than that of atom $(e)[i.\, e.\, (c) > (e)]$.

iii. The nuclear charge on atoms (d), (a) and (b) is $+10,\ +9$ and $+8$ repectively. Since the IE increases with the increase in nuclear charge so the decreasing order of IEs are:

$(d) > (a) > (b)$

iv. Therefore, decreasing order of IEs of all the atoms is

$(d) > (a) > (b) > (c)$

$> (e)$

v. From the above discussion it is clear that atom (e) has the lowest IE.

vi. The electronic configuration of atom (d) represents the noble gas $1s^2 2s^2 2p^6$ since the configuration of noble gases is $ns^2 np^6$.

Q-19 - 18237999

the amount of energy released when 10^6 atoms of iodine in vapour state are converted to I^- ions is $4.8 \times 10^{-13} J$. What is the electron affinity of iodine in ev/atom.

(A) $6eV$

(B) $3eV$

(C) $5eV$

(D) $1.5eV$

CORRECT ANSWER: B

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Q-20 - 11467080

Inert pair effect is shown by

(A) s-block

(B) p-block

(C) d-block

(D) f-block

CORRECT ANSWER: B

SOLUTION:

Group 13, 14 and 15 show inert pair effect.

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Q-21 - 11467078

Which has the maximum IE ?

(A) $O^{\oplus}$

(B) N

(C) O

(D) Na

CORRECT ANSWER: A

SOLUTION:

Due to the positive charge.

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Q-22 - 11466985

Among the elements, Ar, Si, Na and Cl. Select an elements with

a. Highest IE b. Highest EA

c. Smallest size d. Highest electrical conductivity

CORRECT ANSWER: N/A

SOLUTION:

All of them belongs to the same $3rd$ period.

a. Highest $IE = Ar$ (Since it is a nobel gas)

b. Highest $EA = \text{Chlorine}$

$$\left[\begin{array}{c} \text{since} \quad EA \ \text{or} \\ \Delta_{eg}H^{?}\,\text{invreases} \\ \text{along the period}(\ \rightarrow\ ) \end{array}\right]$$

$(EA\text{of}Cl > F > Br$

$> I)$

c. Smallest size $=$ Chlorine (since size decreases along the same period $(\ \rightarrow\ )$)

d. Highest electrical conductivity $=$ Sodium [alkali metals have highest conductivity]

Q-23 - 14625799

An element with atomic number 107 has recently been discovered.

Its block, group number, period and outshell electronic

configuration respectively are :

(A) $s-$ block, group 2, period 6,$6s^2$

(B) $p-$ block, group 13,period, 5, $5s^25p^4$

(C) $d-$ block, group 7, period 7,$7s^2$

(D) $f-$ block, group 3, period 6, $6s^2$

CORRECT ANSWER: 3

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Q-24 - 11466911

Arrange the following in order of decreasing radii?

a. $F^{?}, O^{2-}, N^{3-}, S^{2-}$, b. P, Si, N, C, c. $I^{?}, I^{\oplus}, I$

CORRECT ANSWER: N/A

SOLUTION:

a. Since $F^{?}, N^{3-}, O^{2-}$ are isoelectronic species (with 10 electrons). So, size of anions decreases as nuclear charge increases (Z for $F^{?}, O^{2-}, N^{3-} = 9, 8$ and 7 respectively) So, decreasing order of size among isoelectronic anions are as:

$N^{3-} > O^{2-} > F^{?}$

Since S belongs to the 3rd period while F, O, N all belong to the 2nd period. Therefore, size of S^{2-} is largest.

Thus overall order of decreasing size is

$S^{2-} > N^{3-}$
$> O^{2-} F^{?}$

b. C and N belong to the 2nd period whereas Si and P belong to the 3rd period. Elements in the 3rd period have higher atomic sizes than those of the 2nd period due to increase in shell. Thus, size of Si and P are higher than those of C and N respectively.

Moreover, along the period atomic size decrease from the left to the right due to the increased nuclear charge.

Thus, size of $C > N$ and $Si > P$. Thus, overall decreasing order of atomic sizes is

$Si > P > C > N$

c. Decreasing order of radii is

$I^{?} > I > I^{\oplus}$

because the size of anion is always greater than while that of an cation is always smaller than the parent atom.

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Q-25 - 11467117

The correct order of IE_2 of C, N, O and F is

(A) $O > F > N > C$

(B) $F > O > N > C$

(C) $C > N > O > F$

(D) $O > N > F > C$

CORRECT ANSWER: A

SOLUTION:

a. $O > F > N > C$

i.

$O\left(2s^2 2p^4\right.$

$\left.\right) \xrightarrow[IE_1]{-e^-} O^{\oplus} \xrightarrow[IE_2]{-e^-} O^{2+}$

$\left(2s^2 2p^2\right)$

$$\therefore \left[\begin{array}{c}\text{Stable half-filled} \\ \text{p-shell,} \\ \text{hence} IE_2 is \\ \text{very high}\end{array}\right] \left[\begin{array}{c}\text{Difficult} \\ \text{to remove} \\ e^-\end{array}\right]$$

ii.

$$F\left(2s^2 2p^5\right) \xrightarrow{-e^-} F^{\oplus}$$

$$\left(2s^2 2p^4\right) \xrightarrow{-e^-} F^{2+}$$

$$\left(2s^2 2p^3\right)$$

$$\therefore \left[\begin{array}{c} IE_2 \text{is less} \\ \text{than that of O}\end{array}\right] \left[\begin{array}{c}\text{Easly to} \\ \text{remove} e^-\end{array}\right]$$

$$\left[\begin{array}{c}\text{Stable half-filled} \\ \text{p-shell}\end{array}\right]$$

iii.

$$N\left(2s^2 2p^3\right) \xrightarrow{-e^-} N^{\oplus}$$

$$\left(2s^2 2p^2\right) \xrightarrow{-e^-} N^{2+}$$

$$\left(2s^2 2p^1\right)$$

$$\therefore \begin{bmatrix} \text{Stable half-filled} \\ \text{p-shell} \\ \text{hence} IE_1 is \\ \text{higher than} \\ \text{O and F} \end{bmatrix}$$

$$\begin{bmatrix} \begin{pmatrix} IE_1 is \\ \text{less than} \\ \text{O and F} \end{pmatrix} \end{bmatrix}$$

$$\begin{bmatrix} \text{Easy to} \\ \text{remove} \\ e^- \end{bmatrix}$$

iv.

$$C\left(2s^2 2p^2\right) \frac{-e^-}{IE_1} C^{\oplus}$$

$$\left(2s^2 2p^1\right) \frac{-e^{-1}}{IE_2} C^{2+}$$

$$\left(2s^2 2p^0\right)$$

$$\left[\begin{array}{c} IE_1 is \\ \text{less than} \\ O, F \text{ and } N \end{array}\right]$$

$$\left[\begin{array}{c} \text{Very} \\ easy \\ \text{to remove} \\ e^- \end{array}\right]$$

$$\left[\begin{array}{c} \text{Very} \\ \text{stable} \\ \text{configuration} \end{array}\right]$$

Hence order of IE_2 is

$$O > F > N > C$$

Q-26 - 18237422

Let electronegativity, ionisation energy and electron affinity by represented as EN, IP and EA respectively. Which one of the following equation is correct according to Mulliken ?

(A) $EN = IP'EA$

(B) $EN = IP/EA$

(C) $EN = (IP + EA)/2$

(D) $EN = IP - EA$

CORRECT ANSWER: C

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Q-27 - 11466936

Write the electronic configuration of the element with atomic

number of 9, 11, 21 and 36. Preedict the folloiwng from these configurations:

(a) Which of them has the lowest ionisation potential ?

(b) Which of them has the hihest electron gain enthalpy ?

(c) Which of them are non-metals?

(d) Which of them has zero electron gain enthalpy ?

CORRECT ANSWER: N/A

SOLUTION:

The electronic configuration of the given elements are

Atomic number

$9 : 1s^2 2s^2 2p^5$

$11 : 1s^2 2s^2 2p^6 3s^1$

21

$: 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$

36

$: 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^6$

a. The element with atomic number 11 has the lowest ionisation potential.

Reason: because after losing the most loosely bound electron it acquires a stable configuration.

b. The element with atomic number 9 has the highest electron gain enthalpy.

Reason: Tendency to acquire stable configuration on receiving an electron.

c. The element with atomic numbers 9 and 36 are non-metals.

d. The elements with atomic number 36 has zero electron gain enthalpy.

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Q-28 - 18237487

Which of the following are the correct statements

(I) EA of noble gases is endothermic

(II) EA of Fluorine is less than chlorine

(III) EA of oxygen is less than sulphur

(IV) EA of N is more than phosphorous The correct answer is

(A) I,II,III and IV

(B) I, II and III

(C) II and IV

(D) I and IV

CORRECT ANSWER: B

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Q-29 - 18237971

Two elements A and B belonging to same group have electrones

affinity as $(EA)_A$ and $(EA)_B$ and ionistation potentials I_A and I_B.

If A is more electronegative element than B, then, there must be

(A) $(EA)_A > (EA)_B$ and $I_A = I_B$

(B)
$(EA)_A + I_A < (EA)_B + I_B$

(C)
$(EA)_A + I_A > (EA)_B + I_B$

(D) $(EA)_A > (EA)_B$ but $I_A < I_B$

CORRECT ANSWER: C

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Q-30 - 11467233

Which of the following does not reflect periodicity of elements ?

(A) Bonding behaviour

(B) EN

(C) IE

(D) Neutron / proton ratio

CORRECT ANSWER: D

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Q-31 - 11467257

Which of the following represent increasing order of size of $4th$ period element ?

(A) K, Kr, Ca, Br

(B) Kr, Br, Ca, K

(C) K, Ca, Br, Kr

(D) Br, Kr, Ca, K

CORRECT ANSWER: D

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Q-32 - 18237950

The number of species among the following , having insert gas

configuration is _____ .

$K^+, Ca^{2+}, S^{2-}, Br^-,$

$Se^{2-}, H^+, H^-, Mn^{2+}$

CORRECT ANSWER: 6

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Q-33 - 18237888

The decreasing order of the second ionisation potential of K , Ca

and Ba is

(At. No : K = 19 , Ca = 20 , Ba = 56)

(A) $K > Ca > Ba$

(B) $Ca > Ba > K$

(C) $Ba > K > Ca$

(D) $K > Ba > Ca$

CORRECT ANSWER: A

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Q-34 - 11467286

Which of the following in an energy consuming process ?

(A) $O_{(g)} + e^- \rightarrow O^?_{(g)}$

(B) $Na^{\oplus}_{(g)} + e^- \rightarrow Na_{(g)}$

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

(D) $O^{2-}_{(g)} \rightarrow O^{?} + e^{-}$

CORRECT ANSWER: C

SOLUTION:

Second EA of $O^{?}_{(g)}$ is positive.

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Q-35 - 11467321

IE_1 and IE_2 of Mg are 178 and $348 kcal mol^{-1}$. The energy required for the reaction $Mg \rightarrow Mg^{2+} + 2e^{-}$ is

(A) $+170 kcal$

(B) $+526 kcal$

(C) $-170 kcal$

(D) $-526 kcal$

CORRECT ANSWER: B

SOLUTION:

(i)

$$Mg_{(g)} \rightarrow Mg^{\oplus}_{(g)}$$

$$+ e^{-}, IE_1$$

$$= 178 kcal mol^{-1}$$

(ii)

$$Mg^{\oplus}_{(g)} \rightarrow Mg^{2+}_{(g)}$$

$$+ e^{-} \quad IE_2$$

$$= 348 kcal mol^{-1}$$

Adding (i) and (ii), we have

$$\overline{Mg_{(g)} \rightarrow Mg^{2+}_{(g)}}$$

$$\overline{+ 2e^{-}}$$

$$\therefore E = IE_2 + IE_2$$

$$= 178 + 348$$

$$= 526 kcal$$

Q-36 - 11035676

Calculate the enthalpy change for the following reaction:

$XeF_4 \rightarrow Xe^{\oplus} + F^{\Theta} + F_2$
$+ F$
. The average $Xe - F$ bond energy is $34kcalmol^{-1}$, first IE of

Xe is $279kcalmol^{-1}$, EA of F is $85kcalmol^{-1}$ and bond

dissociation enegry of F_2 is $38kcalmol^{-1}$

SOLUTION:

$XeF_4 \rightarrow Xe^{\oplus} + F^{\Theta}$
$+ F_2 + F$

$Xe \rightarrow Xe^{\oplus} + e^{-}(IE)$

$e^{-} + F \rightarrow F^{\Theta}(EA)$

$2F \rightarrow F_2(\Delta_{diss}H =$
$- ve)$

$\Delta H = (4 \times 34)$
$+ (1 \times 279)$
$+ (1 \times \ -38) + 1$
$\times (-85)$

$= 292 kJ mol^{-1}$ or
$XeF_4(s) \rightarrow Xe$
$+ 4F (\Delta H = 4 \times 34)$

$Xe \rightarrow Xe^{\oplus} + e^{-} (IE$
$= 279)$

$Fe + e^{-} \rightarrow F^{\ominus} (EA$
$= \ -85)$

$XeF_4 \rightarrow Xe^{\oplus} + F^{\ominus}$
$+ F_2 + F$

$\Delta H = 4 \times 34 + 279$
$-85 - 38$
Itbr. $= 292 kJ mol^{-1}$

Q-37 - 12003915

Calculate electronegativity of carbon at Pauling scale Given that :

E_{H-H}

$= 104.2 kcal \text{mol}^{-1} E_{C-C}$

$= 83.1 kcal \text{mol}^{-1}$

,

$E_{C-H} = 98.8 kcal \text{mol}^{-1}$.

Electronegativity of hydrogen $= 2.1$.

SOLUTION:

According to Pauling eqwuation ,

$X_C - X - H = 0$

$. 208 \left[E_{C-H} - (E_{H-H} \right.$

$\left. \times E_{C-C})^{1/2} \right]^{1/2}$

Where X_C and X_H are electronegativity of C and H

respectively .

$$X_C - 2.1$$

$$= 0.208\left[98.8 - (104.2 \times 83.1)^{1/2}\right]^{1/2}\left]^{1/2} 83.1\right)^{1/2}\Big]^{1/2}$$

$$X - C - 2.1 = 0.498 \text{ or } X_C = 2.598.$$

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Q-38 - 11467325

Second and successive electron affinity of an element

(A) is always successive (energy is released)

(B) is always positive (energy is absorbed)

(C) can be positive or negative

(D) is always zero

CORRECT ANSWER: B

SOLUTION:

$$O_{(g)} + e^- \xrightarrow[-EA_1]{} O^{?}_{(g)}$$

$$+ e^- \xrightarrow[+EA_2]{} O^{2-}_{(g)}$$

Energy is required to add an eelctron to the negatively charge species due to electron-electron repulsion.

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Q-39 - 11467341

Due to screening effect of electrons in an atom

(A) IE decreases

(B) IE increases

(C) No change in IE

(D) Attraction of nucleus on the valence electron

increases

CORRECT ANSWER: A

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Q-40 - 14160680

ionisation energies of Ni and Pt in $Kjmol^{-1}$ are given below

	$\underbrace{(IE)_1 + (IE)_2}$	$\underbrace{(IE)_3 + (IE)_4}$
Ni	2.49	8.80
Pt	2.60	6.70

So, (select the correct statement)

(A) (A) nickle (II) compounds tend to be

thermodynamically more stable than platinum(II)

(B) Platinum (IV) compounds tend to be more stable

than nickel (IV)

(C) (A) & (B) both

(D) None is correct

CORRECT ANSWER: C

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Q-41 - 11467078

Which has the maximum IE ?

(A) $O^{\oplus}$

(B) N

(C) O

(D) Na

CORRECT ANSWER: A

SOLUTION:

Due to the positive charge.

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Q-42 - 14160678

First IE of $5d$ seties element are higher than those of $3d$ and $4d$ series elements. This is due to:

(A) bigger size of atoms of $5d$ -series elements than $3d$ series elements

(B) Greater effective nuclear charge is experienced by valence electrons because of the weak shielding of the nuclear by $4f$-electrons in $5d$ series.

(C) (A) and (B) both

(D) None of these

CORRECT ANSWER: B

SOLUTION:

The order of shielding effect of various orbital electrons is $s > p > d > f$.Due to the poor shielding effect of $4f -$ electrons in $5d - series$ elements, there is enhanced increase in effective nuclear charge. As a result of this the valence electrons are tightly bound with the nucleus and thus their removal required higher energy.

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Q-43 - 12973279

How many elements belong to the p-block of the periodic table on the basis of their chemical behavior?

(A) 30

(B) 31

(C) 33

(D) 32

CORRECT ANSWER: D

SOLUTION:

Groups 13, 15, 16, and 17 contains 5 elements each

while groups 14 and 18 contains 6 elements each.

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Q-44 - 12973267

The sixth period $(n = 6)$ of the periodic table contains 32 elements

and successive electrons enter_____subshells.

(A) $6s$, $6p$, $6d$, and $6f$

(B) $6s$, $5f$, $4d$, and $6p$

(C) $6s$, $5f$, $5d$,and $6p$

(D) $6s$, $4f$, $5d$,and $6p$

CORRECT ANSWER: D

SOLUTION:

Filling of different subshells is done according to the $(n + l)$ rule.

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Q-45 - 12973326

Atomic radii can be measured by

(A) X-ray diffraction

(B) spectroscopic methods

(C) both (1) and (2)

(D) photoelectric effect

CORRECT ANSWER: B

SOLUTION:

Wavelength of Xrays metches with the size of atoms.

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Q-46 - 12973440

Which of the following has the lowest ionization enthalpy?

(A) Oxygen

(B) Nitrogen

(C) Fluorine

(D) Sulphur

CORRECT ANSWER: D

SOLUTION:

In general, $\Delta_i H_1$ increases across the period (left to right) on account of the increase of effective nuclear charge while decreases on moving down the group on account of the increases in the number of shells. O, N and F are elements of teh $2nd$ period while S(which comes below O)is an element of the $3rd$ period. Thus, correct order of the increase of $\Delta_i H_1$ is

$$F\left(1680kJmol^{-1}\right) > N(1402) > O(1314) > S(1000)$$

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Q-47 - 12978997

Which of the following statement is correct regarding 3d-series of elements ?

(1) Sc has the lowest while Zn has the highest first ionization

enthlpy.

(2) Cu has the highest while Sc has the lowest second ionization enthalpy

(3) Zn has the highest third ionization enthalpy

(4) Fe has lower third ionization enthalpy relative to Mn

(A) (i), (ii), (iii)

(B) (ii), (iii)

(C) (i), (ii), (iii), (iv)

(D) (i), (iv)

CORRECT ANSWER: C

SOLUTION:

In the case of d-block metals, the variation of ionization enthalpy across the periods and down the groups parallel quite closely the trend in atomic size. As we

move across a period, the effective nuclear charge experienced by ns electrons goes on increasing causing the shells to shrink in size and thus making it difficult to removed the electrons. Thus along a period the ionization enthalpy generally increases. The second and third ionization enthalpies follow the same pattern, except for the second ionization enthalpies of Cr and Cu which are comparatively higher due to extra ionization enthalpies of Mn and Zn are comparatively higher due to extra stability of $3d^5$ and $3d^{10}$ configuration. Similarly the third ionization enthalpies of Mn and Zn are comparatively higher due to extra stability of $3d^5$ and $3d^{10}$ configuration. As the decrease in the size of atoms of the d-block metals is less than that of the main group elements along a period, the ionization enthalpies to the increase along the series only slightly as compared to the main group elements. For example, in 3d-series the

elements Ti, V and Cr have similar first ionization enthalpies. Similarly the elements Fe, Co, Ni and Cu have similar first ionization enthalpies. Since (n-1) d and ns electrons do not differ much in energy, the difference in the successive ionization enthalpies is relatively small. As we move down a group form the elements of first d series to those of the second d series, there is a decrease in the ionization enthalpy on account of increasing size. But it again increases when we move further down the group from second to the third d-series. This trend is consistent with relatively small size of the atoms of elements of the third d series due to the insertion of the lanthanides which causes the third row d-block elements to have grater than expected effective nuclear charge.

Q-48 - 12974514

Which of the following group 14 element has the lowest first ionization enthalpy?

(A) Si

(B) Ge

(C) Sn

(D) Pb

CORRECT ANSWER: C

SOLUTION:

The first ionization enthalpy decreases on moving down the group from C to Sn while there is a slight increase the effect of increased nuclear charge $(82 - 50 = 32units)$ outweighs the shielding effect of

$4f$ and $5d$ electrons.

In fact, all other ionization enthalpies of Pb are higher than those of Sn.

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Q-49 - 12227321

The species Ar, K^+ and Ca^{2+} contain the same number of electrons. In which order do their radii increase ?

(A) $Ca^{2+} < K^+ < Ar$

(B) $K^+ Ar < Ca^{2+}$

(C) $Ar < K^+ < Ca^{2+}$

(D) $Ca^{2+} < Ar < K^+$

CORRECT ANSWER: A

SOLUTION:

In case of isoelectronic species, radius decreases with increase in nuclear charge.

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Q-50 - 18237534

Which of the following represent the correct order of increasing first ionisation enthalpy for Ca, Ba, S, Se and Ar

(A)

$Ca < S < Ba < Se < Ar$

(B)

$S < Se < Ca < Ba < Ar$

(C)

$Ba < Ca < Se < S < Ar$

(D)

$Ca < Ba < S < Se < Ar$

CORRECT ANSWER: C

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Q-51 - 11041071

Which of the following are isoelectronic species, i.e., those having the same number of electrons:

$Na^{\oplus}, K^{\oplus}, Mg^{2+}, Ca^{2+},$
S^{2-}, Ar

SOLUTION:

$(Na^{\oplus}, Mg^{2+}),$
$Na^{\oplus} = 11 - 1$
$= 10$

$Mg^{2+} = 12 - 2 = 10$
$Ca^{2+}, Ar, \quad Ca^{2+}$
$= 20 - 2 = 18$

$Ar = 18$

$S^{2-}, \quad K^{\oplus}, S^{2-}$

$= 16 + 2 = 18$

$K^{\oplus} = 19 - 1 = 18$

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Q-52 - 11466981

Arrange the order of decreasing/increasing properties given below:

1. Decreasing order of atomic and ionic radii

a. $Mg^{2+}, O^{2-}, Na^{\oplus}, F^{?}$

b. $Cl^{?}, S^{2-}, Ca^{2+}, Ar$

c.

$N^{3-}, Na^{\oplus}, F^{?}, O^{2-},$
Mg^{2+}

d. S, O, Se, Ce. B, , Be, Li, Na

f. $Li^{\oplus}, Na^{\oplus}, K^{\oplus}, Rb^{\oplus}, Cs^{\oplus}$ (in aqueous solution)

g. $Cl^{7+}, Si^{4+}, Mg^{2+}, Na^{\oplus}$

h. $H^{\oplus}, Li, H^{?}$

i. $O^{2-}, B^{3+}, Li^{\oplus}, F^{?}$

j. $Br^{?}, I, I^{?}, I^{\oplus}$

k. $I^{?}, I, I^{\oplus}$

l. $K^{\oplus}, Ca^{2+}, Ti^{3+}, Ti^{4+}$

m. Ce, Sn, Yb, Lu

n. $F, F^{?}, O, O^{2-}$

o. Ar, Br, Ca^{2+}, Mg^{2+}

CORRECT ANSWER: N/A

SOLUTION:

a.

$$O^{-2} > F > Na^{\oplus} > Mg^{2+}$$

Z	O = 8	F = 9	Na = 11	Mg = 12	
$\bar{e}$	8 + 2 = 10	9 + 1 = 10	11 − 1 = 10	12 − 2 = 10	(All species are iso-electronic)
$\frac{Z}{\bar{e}}$	$\frac{8}{10}$ = 0.8	$\frac{9}{10}$ = 0.9	$\frac{11}{10}$ = 1.1	$\frac{12}{10}$ = 1.2	

Smaller the value of $\frac{Z}{\bar{e}}$, larger is the size.

Hence the order is as given above.

$$\underbrace{S^{2-} > Cl^{\ominus} > Ar >}_{\text{All belong to 3rd period}} \quad \underbrace{Ca^{2+}}_{\text{4th period}}$$

b. ,

$\left(\begin{array}{c}\text{All species are}\\ \text{isoelectronic}\end{array}\right)$

i. Size of element decreases along the same period

$(\rightarrow)$ (due to greater electron-electron repulsion).

ii. Size of Ca (4th period) gt size of Ar (3rd period), but the size of Ar gt size of Ca^{+}. Therefore, Size of dinegative ion gt size of mononegative ion gt noble gas (of the same period) gt size of dipositive cation.

hence the order is as given above.

c.

$$N^{3-} > O^{2-} > F^{-} > Na^{\oplus} > Mg^{2+}$$

(All species are isoelectronic)

$$\begin{vmatrix} Z & N=7 & O=8 & F=9 & Na=11 \\ e^- & 7+3=10 & 8+2=10 & 9+1=10 & 11-1= \end{vmatrix}$$

Same explanation as in parts (a) and (b) above

d.

$$\frac{Se}{\text{4th Period}} > \frac{S}{\text{3rd Period}} > \frac{C}{\text{2nd Period}} > \frac{O}{\text{2nd Period}}$$

size of atom increases down the group because of addtion of new shell (or increase in principal quantum number n).

Size of atm decreases along the period ($\rightarrow$), i.e.

decreases from C to O.

e.

$$\frac{Ni >}{\text{3rd Period}} \quad \frac{Li >}{\text{2nd Period}} \quad \frac{Be > B}{\text{2nd Period}}$$

Same explanation as in part (d) above.

f.

$Li^{\oplus} > Na^{\oplus} > K^{\oplus}$
$> Rb^{\oplus} > Cs^{\oplus}$

(in aqueous solution)

The ions in solution are present as hydrate ions. The

smaller the size of the ion, greater is the charge density

and hence greater is the extent of hydration. So, the size

of hydrated ions becomes larger for the smaller sized ion

and vice versa.

g.

$Na^{\oplus} > Mg^{2+}$
$> Si^{4+} > Cl^{7+}$

(All species are isoelectronic)

Z	$Na = 11$	$Mg = 12$	$Si = 14$	$Cl =$
$\bar{e}$	$11 - 1 = 10$	$12 - 2 = 10$	$14 - 4 = 10$	$17 - 7$

Smaller the charge on the cation, larger is the size and

vice versa.

h. $H^{?} > Li > H^{\oplus}$ (The species are not isoelectronic)

Z	$H = 1$	$Li = 3$	$H = 1$
$\bar{e}$	$1 + 1 = 2$	$3 + 0 = 3$	$1 - 1 = 0$
$\frac{Z}{e}$	$\frac{1}{2} = 0.5$	$\frac{3}{8} = 1.0$	$-$

Smaller the value of $\frac{Z}{e^{-}}$, larger is the size.

i.

$O^{2-} > F^{?} > Li^{\oplus}$

$> B^{3+}$

(All species are not isoelectronic but all of them belong

to the same 2nd period)

Z	$O = 8$	$F = 9$	$Li = 3$	$B = 5$
$\bar{e}$	$8 + 2 = 10$	$9 + 1 = 10$	$3 - 1 = 2$	$5 - 3 = 2$

Higher the $-ve$ charge, larger is the size and higher the

$+v$ charge, smaller is the size of an ion j.

Z	$I = 53$	$I = 53$	$I = 53$	$Br = 35$
e^-	$53 + 1 =$ 54	$53 + 0 =$ 53	$53 - 1 =$ 52	$35 + 1 =$ 36

, [All the

species are not-isoelectronic]

$$\begin{array}{llll} Z & I = 53 & I = 53 & I = 53 \quad Br = \\ e^- & 53 + 1 = 54 & 53 + 0 = 53 & 53 - 1 = 52 \quad 35 + \end{array}$$

Same explanation as in (a) and (b) above.

k. $I^? > I > I^\oplus$ [Same explanation as in (j)]

l.

$K^\oplus > Ca^{2+} > Ti^{3+}$

$> Ti^{4+}$

[Same explanation as in (g)]

m.

$(Z\text{for}Ce = 58, Sn$

$= 60, Yb = 70\text{and}Lu$

$= 71)$

Group	1	2	–	13	14	15	16	17	18
Element	Na	Mg		Al	Si	P	S	Cl	Ar

In lanthanides, the size decreases from La to

$Lu(Z = 57\text{to}71)$ due to lanthanide contration.

Although Sn belongs to the 5th period but its size is larger than lanthanides.

n. $O^{2-} > F^{?} > O > F$

(The species are not isoelectronic)

[Same explanationas in parts (a) and (b) above]

o.

$Br > Ar > Ca^{2+}$
$> Mg^{2+}$

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Q-53 - 11467412

Among the following elements how many of them are inner

transition elements ?

(a) Sg , (b) Bk, (c) Er , (d) Em

(e) Fe , (f) Pb , (g) Cr , (h) Ca

(i) Ar , (j) Zr , (k) Ce

CORRECT ANSWER: 4

SOLUTION:

Inner transition elements are Bk, Er, Fm, Ce .

Transition elements are Sg, Fe, Cr, Zr.

p-block elements are Pb and Ar.

s-block element is Ca.

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Q-54 - 12979187

Four successive members of the first row transition elements are listed below with their atomic number. Which one of them is

expected to have the highest third ionisation enthalpy ?

(A) Vanadium $(Z = 23)$

(B) Manganese $(Z = 25)$

(C) Chromium $(Z = 24)$

(D) Iron $(Z = 26)$

CORRECT ANSWER: B

SOLUTION:

$V(Z = 23) \Rightarrow 3d^3 4s^2$,
$Mn(Z = 25)$
$\Rightarrow 3d^5 4s^2$

$Cr(Z = 24) \Rightarrow 3d^5 4s^1$, $Fe(Z = 26) \Rightarrow 3d^6 4s^2$

Third ionisation enthalpy will be highest for Mn on

account of extra stability of half-filled d subshell

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Q-55 - 12973448

Math list I with list Ii and select the correct answer with the code given below

ListI (Successie ionization energies $/KJmol^{-1}$)			$ListII$ (Elements)
IE_1	IE_2	IE_3	
$(i)2080$	3963	6130	$(a)H$
$(ii)520$	7297	11810	$(b)Li$
$(iii)900$	1758	14810	$(c)Be$
$(iv)800$	2428	3660	$(d)B$
			$(e)Ne$

CORRECT ANSWER: D

SOLUTION:

$H\left(1s^1\right)$ cannot have $IE_2$and IE_3. $Li\left(1s^22s^1\right)$ will have the lowest IE_1 but will have very high

IE_2. $Be\left(1s^2 2s^2\right)$ will have low IE_1(relatively higher than Li) but will be characterized by very high IE_3. The IE_1 of $B\left(1s^2 2s^2 2p^1\right)$ will be less than the IE_1 of Be. $Ne\left(1s^2 2s^2 2p^6\right)$ will have the highest IE_1. Thus, option (4) is correct.

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Q-56 - 11466989

Predict from each set, the atom/ion which has the greatest IE_1 with explanation:

a. Cl of F , b. S or Cl

c. Ar or K , d. Xe or Kr

e. O or N , f. $Na^{\oplus}$ or Na

g. $Be^{\oplus}$ or Mg^{2+} , h. $I^{?}$ or I

i. B or C , j. Ne or F

k. N, O, F l. P, Ar, Mg

m. B, Al, Ga

CORRECT ANSWER: N/A

SOLUTION:

a. F [Small size, more Z_{eff}, less shielding effect, high IE_1 of F]

b. $Cl[Cl]$ has high IE_1 due to small size, high nuclear charge]

c. Ar [Ar has high IE, due to stable configuration K has low IE than Ar, becuae K has one more electron than Ar, and hence can easily lose this electron to acquire stable Ar configuration]

d. Kr [Kr has high IE_1, because of smaller size than that of Xe, and weaker shielding effect in Kr]

e. $N[N$ has high IE_1 because an electron has to be lost from a stable half-filled electronic configuration. In

case of O, loss of electron gives $O^{\oplus}$ which has stable exactly half-filled electronic configuration]

g. Mg^{2+} [In case of Mg^{2+}, the electron has to be lost from the stable gas inert gas configuration, but in case of Na, loss of electron gives a stableinert gas configuration. Hence IE of $Mg^{2+} > Be^{\oplus}$]

h. $I^{?}$ [IE of $I^{?} > I$, becasue in case of $I^{?}$ an electron has to be lost from inert gas configuration]

i. C[IE of $C > B$, because of higher muclear charge in C]

j. Ne[IE of $Ne > F$, because of stable inert gas configuration in Ne]

k. F [All belong to 2nd period. IE of $F > N > O$ since F has the highest charge, and the smallest size among them]

l. Ar[All belong to 3rd period, IE of $Ar > P > Mg$. Ar has stable inert gas configuration]

m. B[All belong to group 12. IE_1 of $B > Ga > Al(800 > 578 > 577)$, because of the smallest size and weaker shielding effect of B]

Q-57 - 12973372

Which of the following elements has the most negative electron gain enthalpy?

(A) K

(B) Cl

(C) Br

(D) Cs

CORRECT ANSWER: B

SOLUTION:

Electron gain enthalpies generally become more negative from left to right across a period, with major anomali9es at groups $IIA(Be)$ and $VA(N)$. They generally become more negative from bottom to top. Thus, the order of increasing values of electron gain enthalpy is

$$\underset{\Delta_{eg}H}{\text{Most negative}} \quad Cl < Br < K < Cs \quad \underset{\Delta_{eg}H}{\text{Least negative}}$$

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Q-58 - 12973368

Which of the following elements have the most negative electron gain enthalpies corresponding to the largest release of enegry?

(A) Group 2 elements

(B) Group 16 elements

(C) Group 17elements

(D) Group18elements

CORRECT ANSWER: C

SOLUTION:

Halogen atoms, which have the oueter electron configuration ns^2np^5, have the most negative electron gain enthalpies because by gaining one extra electron, they form stable anions with noble gas configuration,. ns^2np^6. Group 2 and group 18 elements on account of stable configuration have positive electron gain enthalpies corresponding to an absorption of energy.

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Q-59 - 12973367

Electron gain enthalpy is greater than zero for

(A) Na

(B) Mg

(C) $A1$

(D) Sn

CORRECT ANSWER: B

SOLUTION:

The outermost shell electron configuration of the alkaline earth metals is ns. For the process

$$M(g) + e^- \rightarrow M^-(g)$$

where M denotes a member of group 2 family, the extra electron must enter the np subshell, which is effectively shielded by the two ns electron (the np electrons are farther away from the nucleus than the ns eletrons) and the inner electrons. consequently, alkaline earth metals

such as Mg have no natural tendecy to pick up an extra electrons as they from unstable anions. An atom that forms an ustable anion on addition of an eletron has a positive value of $\Delta_{eg}H$.

Q-60 - 12973355

The largest ionization enthalpies in any period occur for the

(A) alkali metals

(B) halogens

(C) noble gas elements

(D) alkaline earth metals

CORRECT ANSWER: C

SOLUTION:

This is consistent with the fact that most noble gases are chemically unreactive because they have such ionization able to the stability of the $1s^2$ configuration of He and the completely filled outer $s-$ and p-subshell of the other noble gases. In general, shielding is effective when the orbitals in the inner sheels are completely filled. This situation occurs in the case of alkali metals, which have a lone ns-outermost electron preceded by a noble gas configuration. Thus, the lowest values in a period are found for the alkali metals. It is a characteristic of reactive metals such as these to lose electrons easily.