

HINTS & SOLUTIONS

Classification of Elements and Periodicity in Properties

[Set-2]

SECTION-A

1. (i): This is because O^- requires only one electron to attain the noble gas configuration. F^- is isoelectronic with Ne, Be already has a stable fully filled $2s^2$ subshell.
2. (iv): $1s^2 2s^2 2p^6 3s^2$, after the loss of two electrons from 3s, the element acquires a noble gas configuration of neon. The removal of third electron is highly difficult. Therefore, there is high difference between $\Delta_i H_2$ and $\Delta_i H_3$.
3. (iii): For isoelectronic species, ionic size increases as the charge on the ion decreases (or p to e ratio decreases $Mg^{2-} < Na^+ < F^- < O^{2-}$
4. (iv): Tl has an exceptionally high ionization enthalpy due to ineffective shielding of valence electrons by 4f and 5d electrons. The ionization enthalpy order as
 $In < Al < Ga < Tl < B$
5. (iv): F \rightarrow most electronegative element
 Cl \rightarrow most negative electron gain enthalpy
 He \rightarrow highest $\Delta_i H$
 Cs \rightarrow most electropositive element
6. (iii): $\Delta_i H_i$ of N $>$ $\Delta_i H$ of O due to the presence of stable half-filled $2p^3$ in nitrogen.
7. (i): Metallic character is the ability to lose electron and form positive ion. Metallic character increases as atomic size increases.
8. (ii): (i), (ii) and (iii), these element belong to the third period and $\Delta_i H$ increases across the period $[Ne]3s^2 3p^3$ will have the highest $\Delta_i H$ and $[Ar] 3d^{10} 4s^2 4p^3$ will have the lowest ionization enthalpy.
9. (ii): Metallic character increases down the group and decreases across the period.
10. (iv): $[Ne] 3s^2 3p^5$ will have the most negative electron gain enthalpy $[He]2s^2 2p^5$ should have the most negative electron gain enthalpy but is less due to small size, high electron density that addition of any extra electron increases the electron-electron repulsions.

11.	Symbol	Name
(i) $Z = 120$	Ubn	Unbinilium
(ii) $Z = 117$	Uus	Ununseptium

12. (i) Be and Mg have positive electron gain enthalpies because of the presence of fully filled s-subshell. So, addition of any extra electron results in the loss in stability. Hence, Be and Mg have positive electron gain enthalpies.

(ii) Due to small size and high electron density, addition of any extra electron in oxygen increases the inter electronic repulsion. So, the gain of electron by oxygen is less favorable. Hence, oxygen has a less negative electron gain enthalpy than sulphur in group 16.

OR

(i) Na^+ is smaller in size than Na because removal of electron increases the proton to electron ratio, effective nuclear charge increases. This results in strong attraction between the nucleus and the electron. Hence, size decreases.

Cl^- is larger in size than Cl because addition of electron decreases the proton to electron ratio and increases the electron-electron repulsion. This results in the decrease in effective nuclear charge and expansion of electron cloud. Hence, Cl^- is larger in size than Cl.

(ii) Due to small size and high effective nuclear charge, electrons are more tightly held in boron than in aluminium so, removal of electron is more difficult in boron. Hence, boron has a higher first ionization enthalpy than aluminum

13.

	Electron gain enthalpy		Electronegativity
(a)	It is the enthalpy change when an electron is added to an isolated gaseous atom.	(a)	It is defined as the tendency of an atom to attract the bond pair of electrons towards itself in a covalent bond.
(b)	It has a units of kJ/mol	(b)	It has no units.
(c)	It is an absolute term.	(c)	It is a relative term

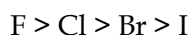
14.

	Block	General electronic configuration	Number of groups
(i)	s-	ns^{1-2}	2 group 1 and 2
(ii)	p-	$ns^2 np^{1-6}$	6 Group 13 to group 18
(iii)	d-	$(n-1)d^{1-10} ns^{1-2}$	10 Group 3 to group 12

OR

	Electronic configuration	Group	Period	Block
(i)	$ns^2 np^4$ for $n = 3$	16	3	p
(ii)	$(n-1)d^2 ns^2$ for $n = 4$	4	4	d
(iii)	$(n-2) f^7 (n-1)d^1 ns^2$ for $n = 6$	-	6	f

15. (i) Group 1 elements are reactive metals, highly electropositive with low ionization enthalpy. They have a tendency to lose electrons. This tendency to lose electrons increases down the group. Hence, the reactivity increases in the order $Li < Na < K < Rb < Cs$. Group 17 elements are reactive non-metals, are short of one electron to attain nearest noble gas configuration. They have high electronegative and high electron affinity. This reactivity decreases down the group. Hence, the order is



- (ii) (a) Decrease in atomic size
 (b) Increase in effective nuclear charge
 (c) Increase stability of half filled and fully filled configuration.
 (d) Decreases in shielding effect of the p-electron.

OR

- (i) (a) $S < P < O < N$
 → increasing $\Delta_i H_1$
 (b) $S < P < N < O$
 → increasing non-metallic character
 (c) $N < P < O < S$
 → increasing electron gain enthalpy
- (ii) As the metallic character increases with increase in size, basic character of oxide increases.

In group 14, C, Si, Ge, Sn, Pb

CO_2, SiO_2 → acidic oxides

GeO_2 → amphoteric oxide

SnO_2 and PbO_2 → basic oxide

In third period of p-block

Al_2O_3 → amphoteric

SiO_2, P_4O_{10} → weakly acidic

SO_3 → acidic

Cl_2O_7 → strongly acidic.