

- The English, Physicist, Henry Moseley observed regularity in characteristics of x-ray spectra of the elements.
- Henry Moseley plotted two types of graphs $\sqrt{\nu} \rightarrow Z$ and $\sqrt{\nu} \rightarrow A$.
- Where, ν is frequency of x-rays emitted.
- Graph of $\sqrt{\nu} \rightarrow Z$ was found to be a straight line but graph $\sqrt{\nu} \rightarrow A$ was not found to be straight line.
- It indicated that atomic number is the fundamental property and not the atomic weight.
- As a result, periodic law of Mendeleev was corrected by putting the word 'atomic number' instead of 'atomic weight'.
- It is known as modern periodic law. It can be stated that :
"The physical and chemical properties of elements are periodic function of their atomic numbers."
- Elements are classified into groups and periods according to increasing order of their atomic number and electronic configuration in their outermost orbit that classification called modern periodic table.

Period no.	No. of elements in period	Name of period according to no. of element	Elements of the period and electron configuration in their outermost orbit
1.	2	very small period	Hydrogen ($1s^1$) to Helium ($1s^2$)
2.	8	first small period	Lithium ($2s^1$) Neon ($2s^2 2p^6$)
3.	8	second small period	Sodium ($3s^1$) Argon ($3s^2 3p^6$)
4.	18	first long period	Potassium ($4s^1$) to Krypton ($4s^2 4p^6$)
5.	18	second long period	Rubidium ($5s^1$) to Xenon ($5s^2 5p^6$)
6.	32	first very long period	Cesium ($6s^1$) to Radon ($6s^2 6p^6$)
7.	Incomplete	second very long period	Francium ($7s^1$) to incomplete

• Types of Elements : s-, p-, d-, f-blocks

The s-block

$\left(\begin{array}{c} \text{group } -1 \\ \text{alkali metals} \end{array} \right)$
 $\left(\begin{array}{c} \text{group } -2 \\ \text{alkaline earth metals} \end{array} \right)$

- The last electron enters into S orbital.
- Electronic configuration of outermost orbit of elements are ns^{1-2}
- They are reactive metals with low ionization Enthalpy.

The d-block

(group 3 to group 12)

- elements in which last electron fill in d-orbital are known as d-block element
- Electronic configuration : $(n-1) d^{1-10} ns^{1-2}$
- Four series are available for these elements, which is in period 4, 5, 6 and 7.
- These elements are transition metals.
- Most of the elements will give colour in aqueous solution.

The p-block

(group 13 to group 18)

- The last electron enters into p-orbital.
- Electronic configuration : $ns^2 np^1$ to $ns^2 np^6$
- Group 16 elements are known as chalcogen.
- Group 17 elements are known as Halogen.
- All orbitals of valence shell of elements of group 18 are completely fill with electrons. Hence these elements do not gain or lose electrons. These gaseous element are known as noble gases.

● The f block (inner transition elements)

Electronic configuration : $(n-2)f^{1-14} (n-1)d^{0-1} ns^2$

Lanthanoids Ce(Z = 58) to Lu(Z = 71), Common electronic configuration : $[Xe] 4f^n 5d^{0-1} 6s^2$ where n = 1 to 14

Actinoids Th(Z = 90) to Lr(Z = 103), Common electronic configuration : $[Rn] 5f^n 6d^{0-2} 7s^2$ where n = 1 to 14

Due to electronic configuration of helium, it should be the element of s block, but its place is considered in group 18 of p-block in the periodic table.

Electronic configuration of Hydrogen is $1s^1$. So it can be placed in group 1 but it can achieve the electronic configuration of noble gas helium by gaining one electron. Thus its behaviour is similar to elements of group 17. Hence as a special case Hydrogen is placed separately in the middle at the top of the periodic table.

• Nomenclature of elements with Atomic Numbers (Z) > 100

Notation for IUPAC Nomenclature of elements have atomic number more than 100.

Digit	Name	Abbreviation	Z	Name	Symbol	IUPAC official Name	IUPAC symbol
0	nil	n	101	Unnilunium	Unu	Mendelevium	Md
1	un	u	102	Unnilbium	Unb	Nobelium	No
2	bi	b	103	Unniltrium	Unt	Lawrencium	Lr
3	tri	t	104	Unnilquadium	Unq	Rutherfordium	Rf
4	quad	q	105	Unnilpentium	Unp	Dubnium	Db
5	pent	p	106	Unnilhexium	Unh	Seaborgium	Sg
6	hex	h	107	Unnilseptium	Uns	Bohrium	Bh
7	sept	s	108	Unniloctium	Uno	Hassium	Hs
8	oct	o	109	Unnilennium	Une	Meitnerium	Mt
9	enn	e	110	Ununillium	Uun	Darmstadtium	Ds
			111	Unununnium	Uuu	Röntgenium	Rg
			112	Ununbium	Uub	Copernicium	Cn
			113	Ununtrium	Uut		
			114	Ununquadium	Unq		
			115	Ununpentium	Uup		
			116	Ununhexium	Uuh		
			117	Ununseptium	Uus		
			118	Ununoctium	Uuo		

1. Which of the following graph is straight line drawn by Moseley ? ν and λ are frequency and wave length respectively ?

(A) $\sqrt{\nu}$ → atomic number

(B) $\sqrt{\nu}$ → Atomic mass

(C) $\sqrt{\lambda}$ → Atomic number

(D) $\sqrt{\lambda}$ → Atomic mass

2. Why atomic number is more useful than atomic mass in periodic law ? or why atomic number was the fundamental property and not the atomic weight ?
- (A) graph of $\sqrt{\nu} \rightarrow$ atomic number is a straight line.
 (B) graph of $\sqrt{\nu} \rightarrow$ atomic mass is a straight line.
 (C) $\sqrt{l} \rightarrow$ atomic number is a straight line.
 (D) $\sqrt{l} \rightarrow$ atomic weight is a straight line.
- (ν and λ are frequency and wavelength respectively.)
3. What is the name and notation for Number '4' in nomenclature of elements with atomic number > 100 .
- (A) quod, d (B) tetra, t (C) four, f (D) quod, q
4. What is the name for atomic number 106 according to nomenclature of elements with atomic number > 100 ?
- (A) Unnilhexium (B) Ununhexium (C) Unnilseptium (D) Unnilpentium
5. What is IUPAC Name of atomic number 109 ?
- (A) Hassium (B) Rontgenium (C) Meitnerium (D) Darmstadtium
6. What is IUPAC name of atomic number 111 ?
- (A) Hassium (B) Darmstadtium (C) Meitnerium (D) Rontgenium
7. What is symbol of Darmstadtium according to nomenclature of elements with atomic number > 100 ?
- (A) Unh (B) Uus (C) Uun (D) Unh
8. Which is period number and group number for element which contain configuration of $4s^2 4p^3$?
- (A) 4, 13 (B) 4, 5 (C) 4, 15 (D) 5, 13
9. In modern periodic table which elements place are controversial ?
- (A) He and Ne (B) H and Ne (C) H and N (D) H and He
10. How many elements are there in s block in modern periodic table ?
- (A) 18 (B) 12 (C) 14 (D) 17
11. Which elements are known as 'Representative elements' in modern periodic table ?
- (A) d block elements (B) p and d block elements
 (C) s and p block elements (D) f block elements
12. Which of the following electronic configuration is of s block elements ?
- (A) $1s^2 2s^2 2p^6$ (B) $[\text{Ar}]3d^3 4s^2$ (C) $1s^2 2s^2 2p^1$ (D) $[\text{Ne}]3s^2$
13. What is common electronic configuration of d block elements ?
- (A) $(n-1)d^{10} ns^{1-2}$ (B) $(n-1)d^{1-10} ns^{1-2}$ (C) $nd^{1-10}(n-1)s^{1-2}$ (D) None of above

14. What is outer most electronic configuration of f block elements ?
 (A) $(n-2)f^{1-14}(n-1)d^{0-1}ns^{1-2}$ (B) $(n-2)f^{2-14}(n-1)d^{1-10}ns^{1-2}$
 (C) $(n-2)f^{1-14}(n-1)d^{0-1}ns^2$ (D) $(n-2)f^{1-14}(n-1)d^{0-1}ns^2$
15. What is the common outer most electronic configuration of Lanthanoids ?
 (A) $4f^n5d^{0-1}6s^{1-2}$ (B) $(n-2)f^5d^{1-10}6s^{1-2}$ (C) $4f^n5d^{0-1}6s^2$ (D) $4f^{1-14}5d^{0-1}7s^2$
16. What is the common outer most electronic configuration of Actinoids ?
 (A) $5f^{1-14}6d^{0-1}7s^2$ (B) $5f^{1-14}6d^{1-10}7s^{1-2}$ (C) $5f^{1-7}6d^{0-1}7s^2$ (D) $5f^{1-10}6d^{0-2}7s^2$
17. What is the common electronic configuration of element which is in 16th group and 4th period ?
 (A) $4s^24p^4$ (B) $4s^24p^6$ (C) $4s^2np^3$ (D) $4s^24p^5$
18. What is common outer most electronic configuration of 3rd group of d block elements ?
 (A) $3d^{1-10}4s^{1-2}$ (B) $5d^{1-10}6s^{1-2}$ (C) $4d^{1-10}5s^{1-2}$ (D) $6d^{1-10}7s^{1-2}$
19. Which of the given element is semimetal or metalloids ?
 (A) Hg (B) As (C) Sc (D) Ga
20. By going down in group '1' of modern periodic table what is the change in reactivity by increasing in atomic number ?
 (A) decreases (B) increases (C) constant (D) can't explain

Answers : 1. (A), 2. (A), 3. (D), 4. (A), 5. (C), 6. (D), 7. (C), 8. (D), 9. (B), 10. (C), 11. (D), 12. (D), 13. (B), 14. (C), 15. (D), 16. (A), 17. (A), 18. (B), 19. (B), 20. (B)

● Periodic Trends

- (1) Atomic Radius (2) Ionization Enthalpy ($\Delta_i H$) (3) electron gain enthalpy ($\Delta_{eg} H$)
 (4) Electronegativity (5) Oxidation state.

(1) Atomic Radius :

Atomic Radius can be measured by X-Rays or other spectroscopic methods.

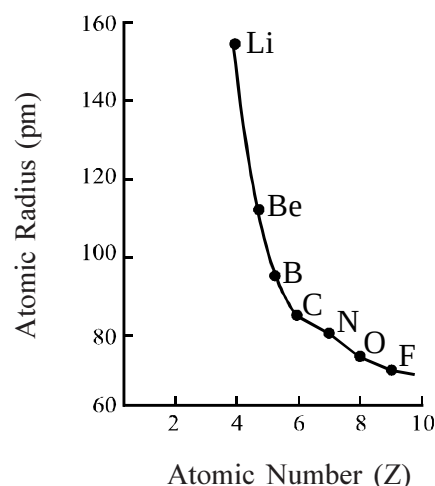
● **Covalent Atomic Radius :** "Average half value of distance between nuclei of two atoms in covalent molecules is considered as covalent radius of element." eg. covalent radius of Cl_2 gas is 99 pm.

● **Metallic Radius :** Average half value of distance of nucleus between two adjacent atoms in metallic crystal is called radius of metal element. eg. metallic radius of copper will be 128 pm.

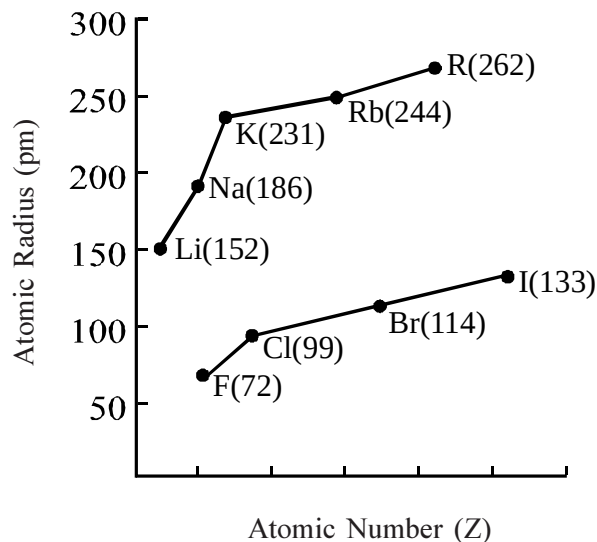
● Atomic Radius decreases of elements when we move from left to right in the period.

● Because of almost same electronic configuration there is a negligible change in the atomic radius of a block and f-block elements present in the middle of long period.

● order of atomic Radius in 2nd period.



- Order of atomic Radius in 3rd period.
Na > Mg > Al > Si > P > S > Cl
- When we move from top to bottom in a group atomic radius decreases.
- Atomic radius in 1st group :
Li < Na < K < Rb < Cs < Fr
- In isoelectronic species effective nuclear charge is increased due to higher positive charge in positive ion so its radius will be small, the effective nuclear charge is decreased due to higher negative charge in a negative ion which results in bigger radius.



Ex., $N^{3-} > O^{2-} > F^- > Ne > Na^+ > Mg^{2+} >$

Al^{3+} (Here No. of electrons are 10.)

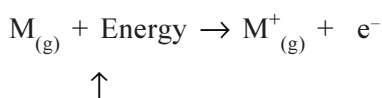
$P^{3-} > S^{2-} > Cl^- > Ar > K^+ > Ca^{2+}$ (all contain 18 electron.)

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

If effective nuclear charge increases, atomic/ionic radius decreases.

• Ionization Enthalpy ($\Delta_i H$)

“The minimum energy required for formation of positive ion from gaseous neutral atom (M) by removing electron is called ionization enthalpy” ($\Delta_i H$).

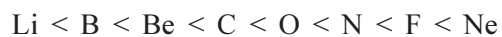


Required Minimum Energy ($\Delta_i H$)

The value of successive ionization enthalpy increases gradually as

$$\Delta_i H_1 < \Delta_i H_2 < \Delta_i H_3 < \Delta_i H_4 < \dots$$

In second period order of ionization enthalpy :



Exception : Be : $1s^2 2s^2$ B : $1s^2 2s^2 2p^1$

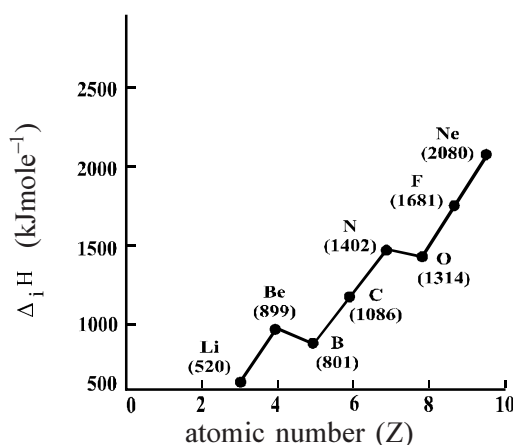
The energy required to remove electron from 2s orbital of Be is more than the energy required to remove electron from 2p orbital in B.

Exception : N : $1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$, O : $1s^2 2s^2 2p_x^2 2p_y^1 2p_z^1$

In N 2p orbital is half filled and stable

so it requires more energy. In 'O' the electron-electron repulsion value increases due to two electrons paired in $2p_x$ orbital.

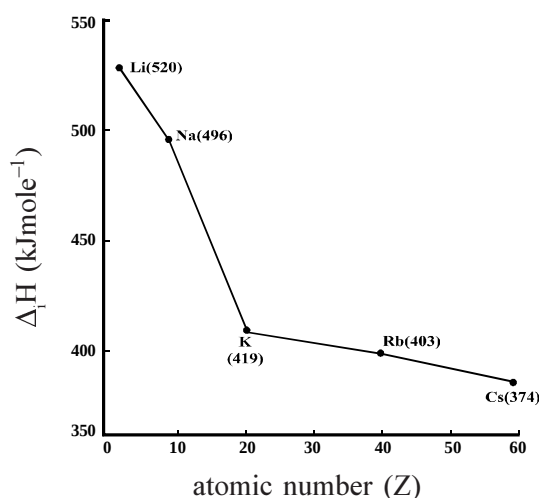
So it requires less energy to remove an electron compared to N.



Order of 1st ionization enthalpy of Na, Mg, Al and Si of 3rd period : $\text{Na} < \text{Al} < \text{Mg} < \text{Si}$.

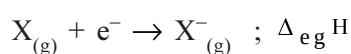
Ionization enthalpy decreases as we go down in group.

order of ionization enthalpy in 1st period : $\text{Li} > \text{Na} > \text{K} > \text{Rb} > \text{Cs}$.



If all the factors remain same then the ionization enthalpy decreases from s → p → d → f orbitals. ex: $\Delta_{iH} \text{B} < \Delta_{iH} \text{Be}$, $\Delta_{iH} \text{Al} < \Delta_{iH} \text{Mg}$

Electron gain enthalpy ($\Delta_{eg} H$) : Addition of an electron to neutral gaseous atom (X) converts it into negative ion which results in change of enthalpy. This is known as electron gain Enthalpy ($\Delta_{eg} H$).



elements of group 17 (Halogens) have very high negative electron gain enthalpy. Because it contains $ns^2 np^5$ electronic configuration so it accepts one electron and achieves the stable electronic configuration similar to nearest noble gas element.

Order of electron gain enthalpy of 2nd period : Li > Be < B < C > N < O

Exception : Be : 1s² 2s²

Electron is added in 2p which is higher than the valance orbital 2s so electron gain enthalpy becomes more negative than lithium.

Exception : N : 1s² 2s² 2p_x¹ 2p_y¹ 2p_z¹ so electron added in 2p_x orbital and two electrons get paired. This causes increase in electron-electron repulsion due to which it becomes unstable. So negative value of electron gain enthalpy of N is less than that of C atom :

Negative value of electron gain enthalpy decreases as we go down from top to bottom in group.

exceptionally the electron gain enthalpy of O or F is less negative than that of succeeding elements S or Cl of the same group. So, $\Delta_{\text{eg}}H_{(\text{O})} < (\Delta_{\text{eg}}H)_{(\text{S})} < (\Delta_{\text{eg}}H)_{(\text{F})} < (\Delta_{\text{eg}}H)_{(\text{Cl})}$

In 'O' and 'F' the added electron takes place in lower energy level n = 2 which is more electron. Electron repulsion which decreases the stability of negative ion. where as in 'S' and 'Cl' added electron takes the place at higher energy level n = 3. Therefore less electron repulsion occurs.

Order of negative value of electron gain enthalpy of group 17 (Halogen) F < Cl > Br > I or Cl > F > Br > I

Value of electron gain enthalpy for ideal gas, group 1 and group 2 is positive.

● Electronegativity

"The tendency of an atom to attract the shared electorn pair towards itself is called electronegativity"

It is not possible to measure its absolute value. Although many numerical scales of electronegativity of elements have been developed such as Pauling scale. Mulliken-Jaffe scale and Alfred Rochow scale.

As per Pauling scale

$$\chi_A - \chi_B = 0.208\sqrt{\Delta E}$$

$$\text{Where } \Delta E = E_{AB} - (E_{AA} \times E_{BB})^{\frac{1}{2}}$$

E_{AB} = Bond Enthalpy of A – B (ev/mole), E_{AA} = Bond Enthalpy of A – A (ev/mole)

E_{BB} = Bond Enthalpy of B – B (ev/mole), χ_A and χ_B are electonegativity.

As per Pauling scale electronegativity of H, C and F elements are respectively 2.1, 2.5 and 4.0. Which is used as reference to measure electronegativity of other elements.

$$1 \text{ eV} = 23 \text{ kilo calories mole}^{-1}$$

Electronegativity increases by increasing atomic number as we go left to right side in period.

In group electronegativity decreases as go down in group.

Electronegativity decreases as electropositivity increases.

Electronegativity increases as non-metallic character increases and metallic characteristic decreases.

In a period as we move to left to right side electronegativity increases.

So non metallic character increases and metallic character decreases.

In a group from top to bottom electronegativity decreases so non metallic character decreases and metallic character increases.

Two elements with different electronegativity combine by a covalent bond then electron pair of bond will set more near to more electronegative element. So, more negative element possess partial negative charge and second element possess partial positive charge that is why that bond becomes polar and possess ionic characteristics.

Two elements with same electronegativity combine by a covalent bond then bonded electron pair, retain at centre so that bond becomes non polar in nature.

Two element combine by a chemical bond, contain more difference in electronegativity then ionic character of bond is more than covalent character.

In diatomic compound electronegativity of element having negative oxidation state increases, the ionic character of that compound increases while covalent character of that compound decreases.

In a diatomic compound electro negativity of positive oxidation state element having increases. the ionic character of that compound decreases while covalent character of that compound increases.

$$\text{Ionic character of Bond} = \frac{\text{Practicle dipole moment}}{\text{Theoretical dipole moment}} \times 100 \%$$

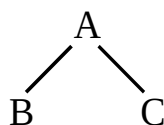
Theoretical dipole moment $\mu = e \times d$ where, e = charge of electron = 4.803×10^{-10} esu, d = Bond length, unit = cm.

$$1.0 \text{ D} = 10^{-18} \text{ esu cm} = 3.3564 \times 10^{-30} \text{ cm}$$

If χ_A and χ_B are electronegativity of elements combine by bond,

then Ionic character according to Pauling equation is $= 18 [\chi_A - \chi_B]^{1.4}$ or

According to Henery and Smith Ionic character $= 16 [\chi_A - \chi_B] + 3.5 [\chi_A - \chi_B]^2 (\chi_A > \chi_B)$



Polarity of this type of angular molecule $\mu = \sqrt{\mu_1^2 + \mu_2^2 + 2\mu_1\mu_2 \cos \theta}$

If the difference in electronegativity is 1.7 then bond will contain 50 % ionic character.

Oxidation state or valency : an element loses electron from their outer most orbit and become positive charged ion or get positive oxidation state.

If an nutrul elements gain electron in their outer most orbit and get that much negative charge on it self and get negative oxidation state.

The valence of representative elements is usually equal to the number of electrons in the outermost orbit and elements of p block gain the negative valence by minus 8 from valence electron.

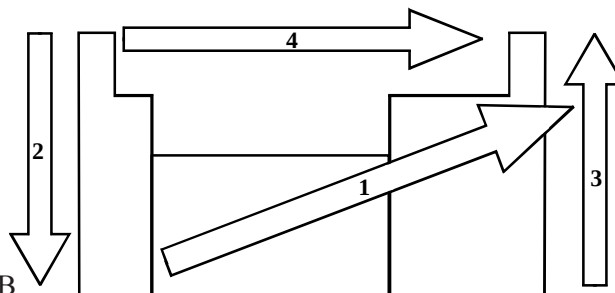
21. **Assertion (A) :** In modern periodic table ionisation enthalpy decreases of group 1 by going down group.
- Reason (R) :** Screening effect increases by going down in a group.
- (A) If both (A) and (R) are correct and (R) is the correct explanation of the (A).
 (B) If both (A) and (R) are not correct and (R) is not correct explanation of (A).
 (C) If (A) is correct and (R) is incorrect.
 (D) If both (A) and (R) is incorrect.
22. **Assertion (A) :** In modern periodic table if we go down in group 17 value of electron gain enthalpy increases.
- Reason (R) :** atomic size increases as we go down group.
- (A) If both (A) and (R) are correct and (R) is the correct explanation of the (A).
 (B) If both (A) and (R) are not correct and (R) is not correct explanation of (A).
 (C) If (A) is correct and (R) is incorrect.
 (D) If both (A) and (R) is incorrect.
23. What is difference in reactivity if we move down in group 17 in modern periodic table ?
 (A) increases (B) decreases (C) stay constant (D) can not say
24. What is difference in reactivity if we go left to Right in period in modern periodic table ?
 (A) increases (B) decreases (C) stay constant (D) can not say
25. Which of the following element has highest atomic radius ?
 (A) P (B) Mg (C) O (D) Sr
26. Which of the following relation is true for atomic radius ?
 (A) $\text{Na} > \text{K} > \text{Rb} > \text{Cs}$ (B) $\text{Ca} < \text{Mg} < \text{Sr} < \text{Ba}$
 (C) $\text{Al} > \text{Si} > \text{P} > \text{S}$ (D) $\text{F} > \text{Cl} > \text{Br} > \text{I}$
27. Which of the following relation is true for atomic/ionic radius ?
 (A) $\text{S} > \text{S}^{2-}$ (B) $\text{Al}^{3+} < \text{Mg}^{2+}$ (C) $\text{Br} > \text{I}$ (D) $\text{F} > \text{Cl}$
28. Which of the following relation is true for atomic ionic radius ?
 (A) $\text{Mg} > \text{Al} > \text{Mg}^{2+} > \text{Al}^{3+}$ (B) $\text{Al} > \text{Mg} > \text{Mg}^{2+} > \text{Al}^{3+}$
 (C) $\text{Mg} > \text{Mg}^{2+} > \text{Al} > \text{Al}^{3+}$ (D) $\text{Mg} > \text{Al} > \text{Al}^{3+} > \text{Mg}^{2+}$
29. Which of the following process is endothermic ?
 (A) electron gain reaction (B) Ionization reaction
 (C) Crystallization reaction (D) above all
30. Which of the following energy change considered as enthalpy change ?
 (A) $\text{M}_{(s)} \rightarrow \text{M}_{(g)}^+ + \text{e}^-$ (B) $\text{M}_{(s)} \rightarrow \text{M}_{(s)}^+ + \text{e}^-$ (C) $\text{M}_{(g)} \rightarrow \text{M}_{(g)}^+ + \text{e}^-$ (D) $\text{M}_{(s)} \rightarrow \text{M}_{(s)}^+ + \text{e}^-$
31. Which of the following is correct for 1st ionisation enthalpy ?
 (A) $\text{Li} < \text{B} < \text{Be} < \text{C} < \text{O} < \text{N}$ (B) $\text{Li} < \text{Be} < \text{B} < \text{C} < \text{O} < \text{N}$
 (C) $\text{Li} > \text{B} > \text{Be} > \text{C} > \text{N} > \text{O}$ (D) $\text{Li} < \text{B} < \text{Be} < \text{C} < \text{N} < \text{O}$

32. If all the factors remain constant than which one of following order is correct for the ionization enthalpy decreases for same principal quantum number ?
 (A) $s \rightarrow p \rightarrow d \rightarrow f$ (B) $f \rightarrow d \rightarrow p \rightarrow s$ (C) $f \rightarrow p \rightarrow d \rightarrow s$ (D) $s \rightarrow p \rightarrow d \rightarrow f$
33. Which of the following species have highest effective nuclear charge ?
 (A) Mg (B) Al (C) Mg^{2+} (D) Al^{3+}
34. Which of the following element contain highest negative value of electron gain enthalpy ?
 (A) F (B) Cl (C) Br (D) I
35. Which of the following Relation is true for High negative value of electron gain enthalpy ?
 (A) $F < Cl$ (B) $B < Be$ (C) $C < N$ (D) $C < B$
36. Which of the following relation is true for high negative electron gain enthalpy of same group elements ?
 (A) increases (B) decreases
 (C) No change (D) increases or decreases
37. What is effect on metallic character of electro negativity ?
 (A) increases (B) decreases
 (C) no change (D) increases then decreases
38. Which of the following is not correct for electronegativity ?
 (A) $Cs > K$ (B) $O > N$ (C) $C < N$ (D) $Na > K$
39. Which of the following Bond is most polar ?
 (A) C-F (B) N-F (C) O-F (D) B-F
40. Which of the following possess more tendency to form covalent bond ?
 (A) S (B) P (C) B-Cl (D) B-F
41. On which orbital of outer orbit the screening effect is maximum for s, p, d, f orbital of a same orbit for a given atom ?
 (A) s (B) p (C) d (D) f
42. From which of the following is correct order for screening effect of an electron of s, p, d, f orbit of same orbital in an element ?
 (A) $s < p < d < f$ (B) $s < d < p < f$ (C) $s > p > d > f$ (D) $s > p > f > d$
43. Which of the following order is correct for a specis for atomic size ?
 (A) $I < I^- < I^+$ (B) $I^+ < I < I^-$ (C) $I < I^+ < I^-$ (D) $I^- < I < I^+$
44. Which of the following electronic configuration is possess more negative value for electron gain enthalpy ?
 (A) $1s^2 2s^2 2p^5$ (B) $1s^2 2s^2 2p^6 3s^2 3p^5$ (C) $1s^2 2s^2 2p^6 3s^1$ (D) $1s^2 2s^2 2p^6 3s^2$
45. Which of the following electronic configuration have more difference between 1st and 2nd ionization Enthalpy ?
 (A) $1s^2 2s^2 2p^1$ (B) $1s^2 2s^2 2p^6 3s^2 3p^1$ (C) $1s^2 2s^2 2p^6 3s^1$ (D) $1s^2 2s^2 2p^6 3p^4$
46. Which of the following element possess more difference between 1st and 2nd ionization enthalpy ?
 (A) N (B) B (C) Na (D) Ca

47. Which of the following element possess more shielding effect in outer most orbit electron ?
 (A) group 14th and 2nd period element (B) element of 14th group and 5th period
 (C) element of 14th group and 3rd period (D) element of 14th group and 4th period
48. Which of the following Relation is true for more negative electron gain enthalpy ?
 (A) $B < C < N$ (B) $N < O < C$ (C) $C < N < O$ (D) $N > C < O$
49. Which of the following atomic number group is belonged to same group in modern periodic table ?
 (A) 4, 12, 20, 28 (B) 7, 15, 33, 83 (C) 14, 22, 40, 72 (D) 13, 21, 39, 61

50. Choose correct option for number draw of arrow from following figure. (arrow indicate increasing in characteristics)

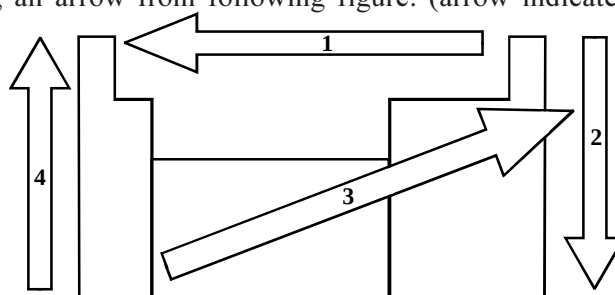
- (A) Ionisation enthalpy
 (B) Electronegativity
 (C) Atomic radius
 (D) Non-metallic characteristic



- (A) 1-D, 2-B, 3-C, 4-A (B) 1-D, 2-C, 3-A, 4-B
 (C) 1-B, 2-D, 3-C, 4-A (D) 1-D, 2-A, 3-C, 4-B

51. Choose correct option for number indicating an arrow from following figure. (arrow indicates increase in characteristics)

- (A) Ionization enthalpy
 (B) Electronegativity
 (C) Atomic radius
 (D) Non-metallic character



- (A) 1-C, 2-C, 3-D, 4-A (B) 1-D, 2-C, 3-A, 4-B (C) 1-B, 2-D, 3-C, 4-A (D) 1-C, 2-A, 3-B, 4-D

52. Which of the following relation is true for atomic radius ?

- (A) $F < S < Mg < Rb < Sr < Cs$ (B) $F < Mg < S < Sr < Cs$
 (C) $F < S < Mg < Sr < Cs < Rb$ (D) $F < S < Mg < Sr < Rb < Cs$

53. Which of the following two element's bond will be less covalent ?

- (A) 17 and 8 (B) 16 and 55 (C) 6 and 14 (D) 9 and 7

54. Which of the following statement is wrong ?

- (1) Atomic number increases, electronegativity increases.
 (2) Positive oxidation state increases in diatom electronegativity increases as ionic character of compound increases.
 (3) Negative ion has higher radius than its parent natural atom.
 (4) Negative oxidation state increases in diatom electronegativity increases as covalent character decreases.

- (A) 1, 3, 4 (B) 3 (C) 1, 2, 3 (D) 3, 4

55. Calculate electron gain enthalpy of Na^+ if 1st ionisation potential of Na is 5.1 eV.
 (A) -5.1 eV (B) -10.2 eV (C) $+2.55 \text{ eV}$ (D) -2.55 eV
56. What is group of element containing electronic configuration $[\text{Ne}] 3s^2 3p^4$?
 (A) 14 (B) 15 (C) 16 (D) 17
57. Which of the following is electronic configuration of S block element ?
 (A) $[\text{Ar}] 3s^2 3p^4$ (B) $[\text{Ar}] 3s^2$ (C) $[\text{Ar}] 3d^3 4s^2$ (D) $[\text{Xe}] 4f^{14} 5d^1 6s^2$
58. Which of the following is not suitable for atomic radius ?
 (A) Atomic radius decreases as we go down in a group.
 (B) Atomic radius increases as we go down group.
 (C) Atomic number increases atomic radius increases.
 (D) Positive charge increases atomic radius increases.
59. Which of the following is true ?
 (A) Size of $\text{Al}^{3+} <$ size of Al (B) Size of $\text{Al}^{3+} >$ size of Al
 (C) Size of $\text{F}^- <$ size of F (D) Size of $\text{Na}^+ =$ size of Na
60. Which of the following is correct order for species ?
 (A) $\text{Pb} < \text{Pb}^{2+} < \text{Pb}^{4+}$ (B) $\text{Pb}^{4+} > \text{Pb}^{2+} > \text{Pb}$ (C) $\text{Pb} > \text{Pb}^{2+} > \text{Pb}^{4+}$ (D) $\text{Pb}^{2+} < \text{Pb} < \text{Pb}^{4+}$
61. Which of the following element's oxide is acidic ?
 (A) Sodium (B) Cesium (C) Calcium (D) Sulphur
62. Which of the following pair of atomic number have maximum positive oxidation state ?
 (A) $Z = 9, Z = 16$ (B) $Z = 19, Z = 38$ (C) $Z = 15, Z = 51$ (D) $Z = 13, Z = 22$
63. Match group-I and group-II and select the correct answer :
- | Group-1 | Group-2 |
|----------------------------|----------------------------|
| (A) Representative element | (I) Si |
| (B) P-orbital is Half fill | (II) Br |
| (C) Element of group-14 | (III) S |
| (D) Halogen element | (IV) P |
| (a) A-IV, B-III, C-I, D-II | (b) A-II, B-IV, C-I, D-III |
| (c) A-II, B-I, C-IV, D-III | (d) A-III, B-IV, C-I, D-II |
64. Which of the following increasing order is true for metallic characteristics ?
 (A) $\text{Si} < \text{Al} < \text{Mg} < \text{Na}$ (B) $\text{Si} < \text{Mg} < \text{Al} < \text{Na}$
 (C) $\text{Na} < \text{Mg} < \text{Al} < \text{Si}$ (D) $\text{Al} < \text{Si} < \text{Mg} < \text{Na}$
65. Match group-I and group-II and select the correct answer ?
- | Group-1 | Group-2 |
|--|---|
| (A) Correct order for 1st ionization enthalpy | (I) $\text{Li} > \text{Be} < \text{B} < \text{C} > \text{N}$ |
| (B) Correct order for negative value of electron gain enthalpy | (II) $\text{Be} < \text{B} < \text{C} < \text{N} < \text{O}$ |
| (C) Correct order for electronegativity | (III) $\text{Be} > \text{B} < \text{C} < \text{N} > \text{O}$ |
| (A) A-III, B-III, C-I (B) A-I, B-III, C-II (C) A-III, B-II, C-I (D) A-III, B-I, C-II | |

66. Which of the following is isoelectronic with (CN^-) ?
 (A) O_2 (B) CH_4 (C) N_2 (D) NO
67. Which of the following option is isoelectronic ?
 (A) O_2 , S, NaF (B) CH_4 , Ne, N_2 (C) CO_2 , SO_2 , C_4H_8 (D) CO_2 , C_3H_4 , NO_2
68. Which of the following statement is true ?
 (i) Electropositivity increases : increase metallic properties of element
 (ii) If negative oxidation state of element is same then electropositivity of positive oxidation state increases, increasing polar characteristics of bond
 (iii) If positive oxidation state of element is same then electronegativity increases, increasing covalent character of bond
 (iv) If electropositive difference increases between two element than ionic characteristics of bond increases.
 (A) (i), (ii), (iv) (B) (i), (ii) (C) (ii), (iii) (D) (iii), (iv)
69. Which of the following order is correct for atomic/ionic radius ?
 (A) $\text{Al}^{3+} < \text{O}^{2-} < \text{Ne} < \text{Na}^+$ (B) $\text{Al}^{3+} < \text{Ne} < \text{Na}^+ < \text{O}^{2-}$
 (C) $\text{Al}^{3+} < \text{Na}^+ < \text{Ne} < \text{O}^{2-}$ (D) $\text{Na}^+ < \text{Ne} < \text{Al}^{3+} < \text{O}^{2-}$
70. If the electron gain enthalpy of element X, Y and Z is respectively -1.46 , -3.40 and -3.61 Kjoule/mol than which of the following option is true ?
 (A) $\text{X} = \text{N}$, $\text{Y} = \text{Cl}$, $\text{Z} = \text{F}$ (B) $\text{X} = \text{O}$, $\text{Y} = \text{F}$, $\text{Z} = \text{Cl}$
 (C) $\text{X} = \text{F}$, $\text{Y} = \text{Cl}$, $\text{Z} = \text{Br}$ (D) $\text{X} = \text{Li}$, $\text{Y} = \text{Be}$, $\text{Z} = \text{B}$

Answers : 21. (A), 22. (C), 23. (A), 24. (D), 25. (D), 26. (C), 27. (B), 28. (A), 29. (B), 30. (C), 31. (A), 32. (D), 33. (D), 34. (B), 35. (A), 36. (B), 37. (B), 38. (A), 39. (D), 40. (B), 41. (A), 42. (C), 43. (B), 44. (B), 45. (C), 46. (C), 47. (B), 48. (D), 49. (B), 50. (B), 51. (A), 52. (D), 53. (B), 54. (B), 55. (A), 56. (C), 57. (B), 58. (D), 59. (A), 60. (C), 61. (D), 62. (C), 63. (D), 64. (A), 65. (D), 66. (C), 67. (D), 68. (A), 69. (C), 70. (B).

