

PERIODIC TABLE

- Consider the elements Mg, Al, S, P and Si, the correct increasing order of their first ionization enthalpy is :
 (1) $Mg < Al < Si < S < P$
 (2) $Al < Mg < Si < S < P$
 (3) $Mg < Al < Si < P < S$
 (4) $Al < Mg < S < Si < P$

- In which of the following pairs, the outer most electronic configuration will be the same?
 (1) Cr^+ and Mn^{2+} (2) Ni^{2+} and Cu^+
 (3) Fe^{2+} and Co^+ (4) V^{2+} and Cr^+

- Match List -I with List - II

List - I	List - II
Electronic configuration of elements	Δ_f 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 -

- (1) (a) \rightarrow (ii), (b) \rightarrow (iii), (c) \rightarrow (iv), (d) \rightarrow (i)
 (2) (a) \rightarrow (i), (b) \rightarrow (iv), (c) \rightarrow (iii), (d) \rightarrow (ii)
 (3) (a) \rightarrow (i), (b) \rightarrow (iii), (c) \rightarrow (iv), (d) \rightarrow (ii)
 (4) (a) \rightarrow (iv), (b) \rightarrow (i), (c) \rightarrow (ii), (d) \rightarrow (iii)
- The correct order of electron gain enthalpy is
 (1) $S > Se > Te > O$ (2) $Te > Se > S > O$
 (3) $O > S > Se > Te$ (4) $S > O > Se > Te$
- Which pair of oxides is acidic in nature?
 (1) B_2O_3, CaO (2) B_2O_3, SiO_2
 (3) N_2O, BaO (4) CaO, SiO_2
- Identify the elements X and Y using the ionisation energy values given below :

	Ionization energy (kJ/mol)	
	1 st	2 nd
X	495	4563
Y	731	1450

- (1) $X = Na ; Y = Mg$ (2) $X = Mg ; Y = F$
 (3) $X = Mg ; Y = Na$ (4) $X = F ; Y = Mg$

- The characteristics of elements X, Y and Z with atomic numbers, respectively, 33, 53 and 83 are:
 (1) X and Y are metalloids and Z is a metal.
 (2) X is a metalloid, Y is a non-metal and Z is a metal.
 (3) X, Y and Z are metals.
 (4) X and Z are non-metals and Y is a metalloid
- The absolute value of the electron gain enthalpy of halogens satisfies:
 (1) $I > Br > Cl > F$ (2) $Cl > Br > F > I$
 (3) $Cl > F > Br > I$ (4) $F > Cl > Br > I$
- The correct order of conductivity of ions in water is :
 (1) $Na^+ > K^+ > Rb^+ > Cs^+$
 (2) $Cs^+ > Rb^+ > K^+ > Na^+$
 (3) $K^+ > Na^+ > Cs^+ > Rb^+$
 (4) $Rb^+ > Na^+ > K^+ > Li^+$
- The set of elements that differ in mutual relationship from those of the other sets is :
 (1) Li – Mg (2) B – Si
 (3) Be – Al (4) Li – Na
- The set that represents the pair of neutral oxides of nitrogen is :
 (1) NO and N_2O (2) N_2O and N_2O_3
 (3) N_2O and NO_2 (4) NO and NO_2
- The ionic radius of Na^+ ions is 1.02 \AA . The ionic radii (in \AA) of Mg^{2+} and Al^{3+} , respectively, are-
 (1) 1.05 and 0.99 (2) 0.72 and 0.54
 (3) 0.85 and 0.99 (4) 0.68 and 0.72
- The first ionization 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 :
 (1) chlorine, lithium and sodium
 (2) argon, lithium and sodium
 (3) argon, chlorine and sodium
 (4) neon, sodium and chlorine

14. The set in which compounds have different nature is :
- (1) $B(OH)_3$ and H_3PO_3
 - (2) $B(OH)_3$ and $Al(OH)_3$
 - (3) $NaOH$ and $Ca(OH)_2$
 - (4) $Be(OH)_2$ and $Al(OH)_3$
15. 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 :
- (1) $[Kr] 3d^{10} 4s^2 4p^2$
 - (2) $[Ar] 3d^{10} 4s^2 4p^2$
 - (3) $[Xe] 5d^{10} 6s^2 6p^2$
 - (4) $[Kr] 4d^{10} 5s^2 5p^2$
16. Which one of the following statements for D.I. Mendeleeff, is **incorrect**?
- (1) He authored the textbook – Principles of Chemistry.
 - (2) At the time, he proposed Periodic Table of elements structure of atom was known.
 - (3) Element with atomic number 101 is named after him.
 - (4) He invented accurate barometer.
17. Number of electrons that Vanadium ($Z = 23$) has in p-orbitals is equal to _____
18. The ionic radii of K^+ , Na^+ , Al^{3+} and Mg^{2+} are in the order :
- (1) $Na^+ < K^+ < Mg^{2+} < Al^{3+}$
 - (2) $Al^{3+} < Mg^{2+} < K^+ < Na^+$
 - (3) $Al^{3+} < Mg^{2+} < Na^+ < K^+$
 - (4) $K^+ < Al^{3+} < Mg^{2+} < Na^+$
19. The correct order of following 3d metal oxides, according to their oxidation numbers is :
- (a) CrO_3 (b) Fe_2O_3
 - (c) MnO_2 (d) V_2O_5 (e) Cu_2O
- (1) (d) > (a) > (b) > (c) > (e)
 - (2) (a) > (c) > (d) > (b) > (e)
 - (3) (a) > (d) > (c) > (b) > (e)
 - (4) (c) > (a) > (d) > (e) > (b)
20. The ionic radii of F^- and O^{2-} respectively are 1.33 Å and 1.4 Å, while the covalent radius of N is 0.74 Å. The correct statement for the ionic radius of N^{3-} from the following is :
- (1) It is smaller than F^- and N
 - (2) It is bigger than O^{2-} and F^-
 - (3) It is bigger than F^- and N, but smaller than of O^{2-}
 - (4) It is smaller than O^{2-} and F^- , but bigger than of N
21. The spin only magnetic moments (in BM) for free Ti^{3+} , V^{2+} and Sc^{3+} ions respectively are (At.No. Sc : 21, Ti : 22, V : 23)
- (1) 3.87, 1.73, 0 (2) 1.73, 3.87, 0
 - (3) 1.73, 0, 3.87 (4) 0, 3.87, 1.73
22. Match List - I with List - II :
- | List - I | List - II |
|----------------|------------------|
| (a) $NaOH$ | (i) Acidic |
| (b) $Be(OH)_2$ | (ii) Basic |
| (c) $Ca(OH)_2$ | (iii) Amphoteric |
| (d) $B(OH)_3$ | |
| (e) $Al(OH)_3$ | |
- Choose the **most appropriate** answer from the options given below
- (1) (a)-(ii), (b)-(ii), (c)-(iii), (d)-(ii), (e)-(iii)
 - (2) (a)-(ii), (b)-(iii), (c)-(ii), (d)-(i), (e)-(iii)
 - (3) (a)-(ii), (b)-(ii), (c)-(iii), (d)-(i), (e)-(iii)
 - (4) (a)-(ii), (b)-(i), (c)-(ii), (d)-(iii), (e)-(iii)

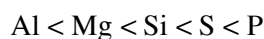
23. The CORRECT order of first ionisation enthalpy is :
- (1) $Mg < S < Al < P$
 - (2) $Mg < Al < S < P$
 - (3) $Al < Mg < S < P$
 - (4) $Mg < Al < P < S$
24. The Azimuthal quantum number for the valence electrons of Ga^+ ion is _____.
(Atomic number of $Ga = 31$)
25. The correct order of ionic radii for the ions, P^{3-} , S^{2-} , Ca^{2+} , K^+ , Cl^- is :
- (1) $P^{3-} > S^{2-} > Cl^- > K^+ > Ca^{2+}$
 - (2) $Cl^- > S^{2-} > P^{3-} > Ca^{2+} > K^+$
 - (3) $P^{3-} > S^{2-} > Cl^- > Ca^{2+} > K^+$
 - (4) $K^+ > Ca^{2+} > P^{3-} > S^{2-} > Cl^-$
26. 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 :
- (1) **(A)** is false but **(R)** is true.
 - (2) **(A)** is true but **(R)** is false
 - (3) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**
 - (4) Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A)**

SOLUTION**1. Official Ans. by NTA (2)**

Sol. In general from left to right in a period, ionisation enthalpy increases due to effective nuclear charge increases.

but due to extra stability of half filled and full filled electronic configuration, required ionisation enthalpy is more from neighbouring elements.

i.e. first ionisation enthalpy order is

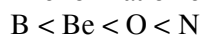
**2. Official Ans. by NTA (1)**

Sol. Option -1 $\text{Mn}^{+2}[\text{Ar}]3d^5, \text{Cr}^{+}[\text{Ar}]3d^5$
 Option -2 $\text{Ni}^{+2}[\text{Ar}]3d^8, \text{Cu}^{+}[\text{Ar}]3d^{10}$
 Option -3 $\text{Fe}^{+2}[\text{Ar}]3d^6, \text{Co}^{+}[\text{Ar}]3d^7 4s^1$
 Option -4 $\text{V}^{+2}[\text{Ar}]3d^3, \text{Cr}^{+}[\text{Ar}]3d^5$

3. Official Ans. by NTA (1)

Sol. (a) $1s^2 2s^2 \rightarrow \text{Be}$
 (b) $1s^2 2s^2 2p^4 \rightarrow \text{O}$
 (c) $1s^2 2s^2 2p^3 \rightarrow \text{N}$
 (d) $1s^2 2s^2 2p^1 \rightarrow \text{B}$

The ionization enthalpy order is

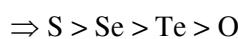
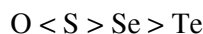


Be has more IE compared to B due to extra stability & N has more IE compared to oxygen due to extra stability

Hence, $\text{N} \rightarrow 1402 \text{ kJ/mol}$
 $\text{O} \rightarrow 1314 \text{ kJ/mol}$
 $\text{B} \rightarrow 801 \text{ kJ/mol}$
 $\text{Be} \rightarrow 899 \text{ kJ/mol}$

4. Official Ans. by NTA (1)

Sol. correct order of electron gain enthalpy is :-



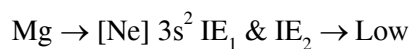
(Oxygen shows least electron gain enthalpy due to small size of atom)

5. Official Ans. by NTA (2)

Sol. $\begin{cases} \text{CaO, BaO} = \text{Basic Nature} \\ \text{B}_2\text{O}_3, \text{SiO}_2 = \text{Acidic Nature} \\ \text{N}_2\text{O} = \text{Neutral oxide} \end{cases}$

6. Official Ans. by NTA (1)

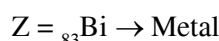
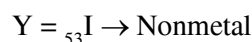
Sol. $\text{Na} \rightarrow [\text{Ne}] 3s^1$ IE₁ is very low but IE₂ is very high due to stable noble gas configuration of Na⁺.



IE₃ is very high.

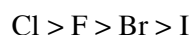
7. Official Ans. by NTA (2)

Sol. $\text{X} = {}_{33}\text{As} \rightarrow \text{Metalloid}$

**8. Official Ans. by NTA (3)**

Sol. Order of electron gain enthalpy

(Absolute value)

**9. Official Ans. by NTA (2)**

Sol. $\xrightarrow{\text{Li}^+ \text{ Na}^+ \text{ K}^+ \text{ Rb}^+ \text{ Cs}^+}$ Hydration energy ↑

—————→ Ionic mobility ↓

—————→ Conductivity ↓

∴ Correct option is $\text{Na}^+ > \text{K}^+ > \text{Rb}^+ > \text{Cs}^+$.

OR

Sol. As the size of gaseous ion decreases, it get more hydrated in water and hence, the size of aqueous ion increases. When this bulky ion move in solution, it experience greater resistance and hence lower conductivity.

Size of gaseous ion : $\text{Cs}^+ > \text{Rb}^+ > \text{K}^+ > \text{Na}^+$

Size of aqueous ion : $\text{Cs}^+ < \text{Rb}^+ < \text{K}^+ < \text{Na}^+$

Conductivity : $\text{Cs}^+ > \text{Rb}^+ > \text{K}^+ > \text{Na}^+$

10. Official Ans. by NTA (4)

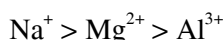
Sol. Li–Mg, B–Si, Be–Al show diagonal relationship but Li and Na do not show diagonal relationship as both belongs to same group and not placed diagonally.

11. Official Ans. by NTA (1)

Sol. N₂O and NO are neutral oxides of nitrogen NO₂ and N₂O₃ are acidic oxides.

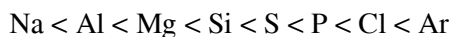
12. Official Ans. by NTA (2)

Sol. The ionic radii order is



13. Official Ans. by NTA (3)

Sol. The 1st IE order of 3rd period is



X & Y are Ar & Cl

Z is sodium (Na).

14. Official Ans. by NTA (2)

- Sol.** 1) B(OH)₃ acidic and H₃PO₃ acidic
 2) B(OH)₃ acidic and Al(OH)₃ amphoteric
 3) NaOH basic and Ca(OH)₂ basic
 4) Be(OH)₂ amphoteric and Al(OH)₃ amphoteric

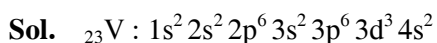
15. Official Ans. by NTA (4)

Sol. The element E is Ga and the diagonal element of 5th period is ₅₀Sn having outer electronic configuration will be [Kr] 5s² 4d¹⁰ 5p².

16. Official Ans. by NTA (2)

Sol. At the time, he proposed the periodic table but structure of atom was unknown.

17. Official Ans. by NTA (12)



Number of electrons in p-orbitals is equal to 12.00

18. Official Ans. by NTA (3)

Sol. Al³⁺, Mg²⁺ and Na⁺ are isoelectronic ionic species. For monoatomic ionic isoelectronic species as positive charge increases ionic size decreases.

The order of size of Na⁺ & K⁺ is Na⁺ < K⁺,
 ∴ order of ionic radii is : Al³⁺ < Mg²⁺ < Na⁺ < K⁺

19. Official Ans. by NTA (3)

- Sol.** (a) Cr⁺⁶ O₃ (d) V⁺⁵ O₅
 (b) Fe⁺³ O₃ (e) Cu⁺¹ O
 (c) Mn⁺⁴ O₂

So order of oxidation state
 a > d > c > b > e

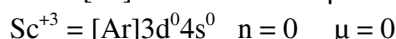
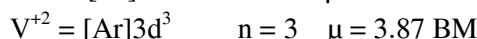
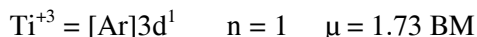
20. Official Ans. by NTA (2)

Sol. F⁻, O²⁻ and N³⁻ all are isoelectronic species in which N³⁻ have least number of protons due to which it's size increases as least nuclear attraction is experienced by the outer shell electrons.



21. Official Ans. by NTA (2)

Sol. $\mu = \sqrt{n(n+2)} \text{ BM}$



22. Official Ans. by NTA (2)

- Sol.** NaOH → Basic
 Be(OH)₂ → Amphoteric
 Ca(OH)₂ → Basic
 B(OH)₃ → Acidic
 Al(OH)₃ → Amphoteric

23. Official Ans. by NTA (3)

Sol. Mg Al P S → IE. order ⇒ Al < Mg < S < P

	Mg	Al	P	S
Valence	[Ne] : 3s ²	3s ² 3p ¹	3s ² 3p ³	3s ² 3p ⁴
	↑		↑	
	Full		Half	
	Filled		Filled	
	Stable		Stable	

24. Official Ans. by NTA (0)

Sol. Ga⁺ : 1s² 2s² 2p⁶ 3s² 3p⁶ 3d¹⁰ 4s²
 The azimuthal quantum number for the valence electrons (4s-subshell) of Ga⁺ ion is zero(0).

25. Official Ans. by NTA (1)

Sol. P³⁻ > S²⁻ > Cl⁻ > K⁺ > Ca²⁺
 (Correct order of ionic radii)
 all the given species are isoelectronic species. In isoelectronic species size increases with increase of negative charge and size decreases with increase in positive charge.

26. Official Ans. by NTA (2)

Sol. From left to right in periodic table :-
 Metallic character decreases
 Non-metallic character increases
 ⇒ It is due to increase in ionization enthalpy and increase in electron gain enthalpy.