PERIODIC TABLE

1 What is the correct order of 2nd ionisation energy
(A) C < O < N < F (B) C < N < O < I (C) C < F < N < O (D) C < N < F < O

2 Correct order of electronegative difference between bonded atom is :
(A) $NaCl < AlCl_3 < MgCl_2$ (B) $AlCl_3 < MgCl_2 < NaCl$
(C) $NaCl < MgCl_2 < AlCl_3$ (D) $MgCl_2 < NaCl < AlCl_3$

3 The correct statement among the following is
(A) the first ionisation potential of Al is less than the first ionisation potential of Mg
(B) the second ionisation potential of Mg is more than the second ionisation potential of Na
(C) the first ionisation potential of Na is more than the first ionisation potential of Mg
(D) the second ionisation potential of Mg is less than third ionisation potential of Al.

4 Z_{eff} for 4s electron in $_{30}Zn$ is :
(A) 1.65 (B) 4 (C) 12.85 (D) 14.35

5 As one move down the group from top to bottom then which one among the following will not be observed?
(A) ionisation energy increases (B) electron affinity decreases
(C) electronegativity decreases (D) atomic radii increase.

6 The sizes of the following species increases in the order
(A) $Al^{3+} < Mg^{+2} < Na^+ < F^-$ (B) $F^- < Al^{3+} < Na^+ < Mg^{+2}$
(C) $Al^{3+} < Mg < F^- < Na^+$ (D) $Na^+ < Al^{3+} < F^- < Mg^{+2}$

7 In the isoelectronic species the ionic radii (Å) of N^{3-}, O^{2-} and F^- are respectively given by
(A) 1.36, 1.40, 1.71 (B) 1.36, 1.71, 1.40 (C) 1.71, 1.40, 1.36 (D) 1.71, 1.36, 1.40

8 Which of the following relation is correct with respect to first (I) and second (II) ionization potentials of sodium and magnesium
(A) $I_{Mg} = II_{Na}$ (B) $I_{Na} > I_{Mg}$ (C) $II_{Mg} > II_{Na}$ (D) $II_{Na} > II_{Mg}$

9 The electron affinity values for the halogens show the following trend
(A) F < Cl > Br > I (B) F < Cl < Br < I (C) F > Cl > Br > I (D) F < Cl > Br < I

10 In the long form of the periodic table, silver (Atomic number 47) belongs to the group
(A) 1st (B) 10th (C) 16th (D) 11th

11 Consider the following statements
1. IE_1 of nitrogen atom is more than IE_1 of oxygen atom.
2. Electron affinity of oxygen is less than sulpur atom
3. Electronegativity on pauling scale is 2.8 times than electronegativity on mullikan scale,
The above statements 1, 2, 3 respectively are (T = True, F = False)
(A) T F F (B) T T F (C) F T F (D) T F F

12 For the reactions $O(g) + e^- \rightarrow O^-(g)\ \Delta H_1 = (-)$,
$O^-(g) + e^- \rightarrow O^{-2}(g)\ \Delta H_2 = (+)$
combining these two equations we get
$O(g) + 2e^- \rightarrow O^{-2}(g)\ \Delta H_3$.
What is true about ΔH_1, ΔH_2 and ΔH_3. (Magnitude wise)
(A) $\Delta H_1 = \Delta H_2, \Delta H_3$ = (+) ve (B) $\Delta H_1 < \Delta H_2, \Delta H_3$ = (+) ve
(C) $\Delta H_1 > \Delta H_2, \Delta H_3$ = (–) ve (D) $\Delta H_1 < \Delta H_2, \Delta H_3$ = (–) ve

13 The electron affinity values (in kJ mol^{-1}) of three halogens X, Y and Z are respectively – 349, – 333 and – 325. Then X, Y and Z are respectively
(A) F_2, Cl_2 and Br_2 (B) Cl_2, F_2 and Br_2 (C) Cl_2, Br_2 and F_2 (D) Br_2, Cl_2 and F_2

14 Element of atomic number 23 is placed in the periodic table in
(A) s-block (B) p-block (C) d-block (D) f-block

15 If each orbital can hold a maximum of 3 electrons. Then the number of elements in 2nd period of the periodic table is (Hint : The spin quantum number can have 3 possible values):
(A) 8 (B) 12 (C) 18 (D) 24

16 Electron affinity of 3rd period element is more than 2nd period element due to
(A) smaller size of 3rd period element which decreases the electron density.
(B) larger size of 3rd period element which decreases the electron density.
(C) smaller size of 2nd period element which decreases the electron density.
(D) electron affinity of 2nd period element is less than 3rd period element

17 Which is a true statement :
(A) Larger is the value of I.E. easier is the formation of cation.
(B) Larger is the value of electron affinity easier is the formation of anion.
(C) Larger is the value of I.E. easier is the formation of anion.
(D) Larger is the Z_{eff} larger is the size.

18 Atomic number 38 is the element of
(A) s-block (B) p-block (C) d-block (D) f-block

19 Which of the following is the correct order of ionisation energy
(A) $O^{--} < F^- < Na^+ < Mg^{++}$ (B) $F^- < O^{--} < Na^+ < Mg^{++}$
(C) $O^{--} < Na^+ < F^- < Mg^{++}$ (D) $Mg^{++} < Na^+ < F^- < O^{--}$

20 Which is the true order of size
(A) $I^+ > I^- > I$ (B) $I^- > Br > I$ (C) $I^- > I > Br$ (D) $I^- > I^+ > I$

21 Which is the correct order of 2nd I.E.
(A) Si < S < P < Cl (B) Si < P < S < Cl (C) P < Si < Cl < S (D) Si < P < Cl < S

22 Amongst the following ion Cl^- , K^+ & Ca^{2+} which can be the correct order of the size
(A) $Cl^- < K^+ < Ca^{2+}$ (B) $Ca^{2+} < K^+ < Cl^-$ (C) $K^+ < Cl^- < Ca^{2+}$ (D) $Cl^- < Ca^{2+} < K^+$

23 Which of the following can have an exothermic electron gain enthalpy
(A) Ar (B) O^- (C) P (D) Ne

24 Wavelength of the 6th line of paschen series in Li^{2+} sample is [Take hc = 12400 eV Å]
(A) 975 Å (B) 1026 Å (C) 513 Å (D) 2052 Å

25 Which of the following is true about the element $_{33}As$
(A) It is the 5th period element (B) It is P-block element
(C) It belongs to 16th group (D) It is the member of VIA group

26 Which of the following is the correct order of ionisation energy
(A) B < Be < C < O < N (B) O < C < B < N < Be
(C) Be < B < C < N < O (D) B < Be < O < N < C

27 In halogens, which of the following increases from iodine to fluorine?
(A) Size (B) Electronegativity
(C) The ionization energy of the element (D) Reciprocal of size

28 Correct order of solubility of the compound is
(A) $Na_2SO_4 < K_2SO_4 < Rb_2SO_4$ (B) $Rb_2SO_4 < K_2SO_4 < Na_2SO_4$
(C) CsF < CsCl < CsBr (D) CsBr < CsCl < CsF

29 Which of the following reaction are endothermic in nature.
(A) $F + e^- \longrightarrow F^-$ (B) $O^- + e^- \longrightarrow O^{--}$ (C) $Ar + e^- \longrightarrow Ar^-$ (D) $Be + e^- \longrightarrow Be^-$

30 Ionisation energy of atoms A and B are 350 and 250 kcal mol^{-1} respectively. The electron affinities of these atoms are 70 kcal mol^{-1} and 90 kcal mol^{-1} respectively then
(A) Electron cloud is more attracted by A (B) Electron cloud is more attracted by B.
(C) Electronegativity of A is more than B (D) Electronegativity of A is less than B

31 Which of the following order is **<u>correct</u>** :
(A) $O^{2-} < F^- < Na^+ < Mg^{2+}$ increasing $Z_{effective}$
(B) $Mg^{++} < Na^+ < O^{--} < F^-$ increasing size
(C) $O^{2-} < F^- < Na^+ < Mg^{2+}$ increasing I.E.
(D) $O^{2-} < F^- < Na^+ < Mg^{+2}$ increasing E.A.

32 Which of the following is (are) true order

(A) $B^+ < B < B^-$ size (B) $I < Br < Cl < F$ Electron affinity

(C) $O^{--} < O^- < O^+$ $Z_{effective}$ (D) Na < Al < Mg < Si Ionisation potential

33 In which of the following arrangements, the order is not correct according to the property indicated against it:

(A) increasing size : $Cu^{2+} < Cu^+ < Cu$ (B) increasing IE_1 : B < C < N < O

(C) increasing EA_1 : $I < Br < Cl < F$ (D) increasing IE_1 : Li < Na < K < Rb

34 Which of the following reaction $\Delta H > 0$ (endothermic)

(A) $Ne(g) + e \rightarrow Ne^-(g)$ (B) $Na(g) \rightarrow Na^+(g) + e^-$

(C) $O^-(g) + e^- \rightarrow O^{--}(g)$ (D) $Mg^{++}(g) + e \rightarrow Mg^+(g)$

35 **Assertion :** Electron affinity value of the 3rd period element is more than 2nd period element.
Reason : Due to smaller size of the 2nd period, its electron density increases which eases the addition of electron.

(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 correct explanation of A.

(C) A is true but R is false (D) Both A and R are false.

36 **Assertion** : 'He' has lowest ionisation energy among all the elements.

Reason : Addition of extra electrons even in fully filled orbitals releases energy.

(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 correct explanation of A.

(C) A is true but R is false (D) Both A and R are false.

37 A particular atom (not ion) having atomic number between 22 to 30 has magnetic moment equal to 1.73 B.M. Then find the atomic number of the element which is just below it in the periodic table.

38 If ionization potential of an element (hydrogen like) is 217.6 volt then find the first excitation potential of the atom in volts

39 A particular d-block element 'A' of 4th period has zero magnetic moment when it is in A^+ state. Then find the atomic number of the element in the periodic table which is just below this element.

40 Electronegativity value on Mullikan scale for two different elements are given as 7 and 1.4 respectively. If bond is formed between then calculate the percentage ionic character of the bond between them. [$EN_P = EN_M / 2.8$, use Hanny Smith formula, % ionic character = $16\Delta + 3.5\Delta^2$]

41 6 g of Mg (s) atoms (atomic mass = 24.0 amu) is converted to Mg^{++} (g). Then find the energy required in kJ mol^{-1} for this process, if the first and second ionization energies of Mg are 740 and 1440 kJ mol^{-1} respectively and enthalpy of sublimation is 100 kg mol^{-1}.

42 The electron affinity of a hypothetical element 'A' is 3 eV per atom. How much energy in kcal is released when 10g of 'A' is completely converted to A^- ion in a gaseous state?
(1 eV = 23 kcal mol^{-1}, Molar mass of A = 30 g)

43 The electron affinity of a hypothetical element 'A' is 3 eV per atom. How much energy in kcal is released when 20 g of 'A' is completely converted to A^- ion in a gaseous state?
(1 eV = 23 kcal mol^{-1}, Molar mass of A = 30 g)

44 If 0.5 moles of gaseous non-metallic X^- anions(having positive electron affinity) requires 806.4 kJ energy to get completely converted into gaseous X^+ ions. Calculate Pauling's electronegativity of the element X. Use Avogadro's No. = 6×10^{23} and 1eV = 1.6×10^{-19} J.

[use the fact that, Paulings negativity = $\frac{\text{Mullikan's Electronegativity}}{2.8}$ and Mullikan's electronegativity = $\frac{IE + EA}{2}$]

45 The correct order of E.N. is

(A) F > Cl < Br > I (B) F > O > N > C (C) S < O < Se < Te (D) All

46 What is the position of the element in the periodic table satisfying the electronic configuration of M^{+2} is $(n-1)\,d^2$ for n = 4

(A) 3rd period and 3rd group (B) 4th period and 4th group

(C) 3rd period and 2nd group (D) 4th period and 3rd group

47 What is the position of the element in the periodic table satisfying the electronic configuration $(n-1)\,d^1\,ns^2$ for n = 4

(A) 3rd period and 3rd group (B) 4th period and 4th group

(C) 3rd period and 2nd group (D) 4th period and 3rd group

48 Magnetic moment of $_{25}Mn^{x+}$ is $\sqrt{35}$ then the value of x is
(A) 1 (B) 2 (C) 3 (D) 4

49 Magnetic moment of $_{30}Zn^{2+}$ ion is same as
(A) $_{29}Cu^{1+}$ (B) $_{21}Sc^{3+}$ (C) $_{28}Ni^{4+}$ (D) A and B both

50 The correct order of magnitude of ionic radii of ions is :
(A) $O^- < O < O^{2-}$ (B) $Mg > Mg^+ > Mg^{+2}$ (C) $F^- > Cl^- > Br^-$ (D) $Na^+ < Mg^{2+} < Al^{3+}$

51 Which one of the following arrangements represents the correct order of electron gain enthalpy of the given atomic species ?
(A) Cl > F > Br > I (B) F > Cl > Br > I (C) Cl < F < Br < I (D) I < F < Br < Cl

52 Identify the least stable ion amongst the following :
(A) Ne^- (B) F^- (C) B^- (D) C^-

53 Tick the correct order of second ionisation enthalpy in the following :
(A) Be < C < B < Li (B) C > Be > B > Li (C) Li > C > B > Be (D) Be > C > Li > Be

54 Identify the element of third period whose successive I.E.s are given below

Element	IE_1	IE_2	IE_3
X	1521	2666	3931
Y	513	4562	6920
Z	738	1451	7733

	X	Y	Z		X	Y	Z
(A)	Na	Mg	Ar	(B)	Al	S	Ar
(C)	Ar	Na	Mg	(D)	Al	Na	Mg

55 Which of the following species has the highest negative value of electron gain enthalpy ?
(A) F (B) Cl (C) Br (D) O

56 Which of the following oxide strongly basic in character :
(A) CO_2 (B) SO_2 (C) Na_2O (D) All of these

57 An element has magnetic moment $4\sqrt{3}$ B.M, has set of quantum numbers for two consequitive unpaired higer energy electron as n = 3, ℓ = 2, m = –1, s = $+\frac{1}{2}$ and n = 3, ℓ = 2, m = –2 , s = $+\frac{1}{2}$, What are the possible quantum number of next highter energy unpaired electron.

(A) n = 3, ℓ = 2, m = 0, s = $+\frac{1}{2}$ (B) n = 3, ℓ = 2, m = +1, s = $+\frac{1}{2}$
(C) n = 4, ℓ = 0, m = 0, s = $+\frac{1}{2}$ (D) n = 3, ℓ = 2, m = +2, s = $+\frac{1}{2}$

58 Which is/are amphoteric oxides ?
(A) BeO (B) Al_2O_3 (C) ZnO (D) MgO

59 The factors that influence the ionisation energies are :
(A) the size of the atom (B) the charge on the nucleus
(C) How effectively the inner electron shell screen the nuclear charge
(D) Stability of electronic configuration

60 Which of the following is/are neutral oxide(s) :
(A) SO_3 (B) GeO (C) CO (D) NO

61 **S_1 :** The number of elements in each period is twice the number of atomic orbitals available in the energy level that is being filled.
S_2 : In modern periodic table each block contains a number of columns equal to the number of electrons that can occupy that sub-shell.
S_3 : As isotopes of an element have different mass number so their first ionisation energies will also be different.
S_4 : The element with atomic number 55 is likely to have the same outer valence shell configuration as the element with atomic number 11.
(A) T T F F (B) T T F T (C) F F T F (D) F F T T

62 S_1 : Among K^+, Mg^{2+} and Al^{3+} ions Al^{3+} is the smallest one
S_2 : The negative value of electron gain enthalpy of Cl > F because there is weak electron-electron repulsion in the bigger 3-p sub-shell of Cl as compared to compact 2p-subshell of F.
S_3 : Formation of S^{2-} and Ar^-, both require the absorption of energy.
S_4 : The following set of elements does not represent the correct order of electron affinity values S > Se > Te > O.
(A) T T T F (B) F F F T (C) F F T T (D) T T T T

63 S_1 : Number of lines in line spectrum of hydrogen depends on amount of hydrogen gas taken.
S_2 : Values of de-Broglie wavelength of electron in hydrogen atom also quantised.
S_3 : Ionisation energy of Ga is higher than Al.
S_4 : Different types of orientation in space for ' f ' orbital is 5.
(A) T T T T (B) F F F F (C) T F F T (D) F T T F

64 Among the following groupings which represents the collection of isoelectronic species ?
(A) NO, CN^-, N_2, O_2^- (B) NO^+, C_2^{2-}, O_2^-, CO (C) N_2, C_2^{2-}, CO, NO (D) CO, NO^+, CN^-, C_2^{2-}

65 Which of the following statements is/are true about the modern form of periodic table :
(A) properties of the elements are the periodic function of their atomic number.
(B) There are 7 periods. (C) There are 8 groups
(D) It has separate positions for the isotopes.

66 The gaseous HX molecule has a measured dipole moment of 4.0 D, which indicates that it is a very polar molecule. The separation between the nuclei in this molecule is 2.67×10^{-8} cm then the percentage ionic character in HX molecule :
(A) 78% (B) 31.25% (C) 50.25% (D) None of these

67 **STATEMENT - 1 :** For two ions of the same size and charge, one with an $(n-1)d^x ns^0$, electronic configuration will be more polarizing than a cation with an $(n-1)s^2\,(n-1)p^6 ns^o$, electronic configuration.
STATEMENT - 2 : Compounds of Hg^{2+} ions having an ionic radius of 116 pm are more covalent in character than those of Ca^{2+} ions with almost identical size (114 pm) and the same charge.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

68

	Column – I		**Column – II**
(A)	$Na_2O \xrightarrow{>400^\circ C}$	(p)	One of the products is diamagnetic.
(B)	$Ca(HCO_3)_2 \xrightarrow{\Delta}$	(q)	One of the products is acidic oxide.
(C)	$NaNO_3 \xrightarrow{800^\circ C}$	(r)	One of the products is oxygen.
(D)	$Ba(NO_3)_2 \xrightarrow{\Delta}$	(s)	One of the products is a basic oxide.

69 Which is not correctly matched ?
(1) Basic strength of oxides $Cs_2O < Rb_2O < K_2O < Na_2O < Li_2O$
(2) Stability of peroxides $Na_2O_2 < K_2O_2 < Rb_2O_2 < Cs_2O_2$
(3) Stability of bicarbonates $LiHCO_3 < NaHCO_3 < KHCO_3 < RbHCO_3 < CsHCO_3$
(4) Melting point NaF < NaCl < NaBr < NaI
(A) 1 and 4 (B) 1 and 3 (C) 1 and 2 (D) 2 and 3

70

Column A	**Column B**
(i) $Br^- + BrO_3^- \rightarrow Br_2$	(a) disproportioation
(ii) $S_2O_3^{2-} \rightarrow SO_2 + S$	(b) Comproportiontion
(iii) $Cl^- + Cr_2O_7^{2-} \rightarrow CrO_2Cl_2$	(c) Metal displacement
	(d) Non-metal displacement
	(e) Not a redox reaction

(A) (i) – (b) ; (ii) – (a) ; (iii) – (e) (B) (i) – (a) ; (ii) – (b) ; (iii) – (e)
(C) (i) – (a) ; (ii) – (c) ; (iii) – (e) (D) (i) – (b) ; (ii) – (a) ; (iii) – (d)

71 **STATEMENT - 1 :** Solubilities of alkali metal fluorides and carbonates increase down the group.
STATEMENT - 2 : Hydration energies of alkali metal halides decrease down the group with increase in size of cations.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

72 Which of the following statements is correct :
(A) Hydration energy of alkali metal ions increases down the group
(B) Solubility of sulphates of II A group decreases down the group
(C) Li does not form nitride on burning in air
(D) except Li_2CO_3 all the carbonates of alkali metals decompose on heating

73 **STATEMENT-1 :** Value of 'ℓ' varies from 0 to n – 1.
STATEMENT-2 : n^{th} shell contains n – 1 subshell each subshell is assigned one value as it has different shape.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

74 Arrange the following in the increasing order as stated below :
(i) Ca^{2+}, S^{2-}, $K^+ \longrightarrow Z_{eff}$
(ii) K^+, Na^+, $Rb^+ \longrightarrow Z_{eff}$
(iii) Ca^{2+}, Mg^{2+}, $Sr^{2+} \longrightarrow$ Size
(iv) Na, Be, Mg, K $\longrightarrow$ Size
(v) Arrange the following set of quantum numbers in the increasing order of their energy.

(a) n = 4, ℓ = 1, m = 0, s = $-\frac{1}{2}$, (b) n = 3, ℓ = 2, m = –1, s = $\frac{1}{2}$,

(c) n = 3, ℓ = 2, m = 1, s = $-\frac{1}{2}$ (d) n = 4, ℓ = 0, m = 0, s = $\frac{1}{2}$

75 Explain the radii of Ar is greater than the radii of chlorine.

76 The first ionisation energy of carbon atom is greater than that of boron atom, whereas reverse is true for the second ionisation energy. Explain.

77 The elements with atomic numbers 117 and 120 are yet to be discovered. In which family/group would you place these elements when discovered ? Give their expected electronic configuration of the outermost shells and IUPAC names.

78 Arrange the following in order of increasing radii :
(i) I, I^+, I^- (ii) C, N, Si, Na (iii) O^{2-}, F^-, Ne, Mg^{2+} (iv) Fe, Fe^{2+}, Fe^{3+}

79 Explain the following :
(i) There are only 14 lanthanides and only 14 actinides.
(ii) Why argon (at Mass 39.94) has been placed before potassium (at. mass 39.10) in the periodic table ?

80 First and second ionisation energy of Mg(g) are 720 kJ/mol and 1440 kJ/mol respectively. Calculate the % of Mg^+ ions if one gram of Mg(g) absorbs **50 kJ of energy.** (At. mass of Mg is 24 amu.)

81 Which of the following is the **<u>correct</u>** order of ionisation energy :
(1) $Be^+ > Be$ (2) $Be > Be^+$ (3) C > Be (4) B > Be
(A) 2, 3 (B) 3, 4 (C) 1, 3 (D) None of these

82 Which is correct order for the properties specified?
(A) $NaBr > MgBr_2 > AlBr_3$ (melting point)
(B) K > Mg > Al > B (metallic character)
(C) Li < B < Be < C < O < N < F < Ne (first ionisation enthalpy)
(D) Li > Na > K > Rb > Cs (chemical reactivity)

83 **S_1 :** First electron gain ethalpy of inert gas is positive.
S_2 : Electronegativity of halogen decreases down the group.
S_3 : $(I.E._3)_{Mg} > (I.E._3)_{Al}$
S_4 : $r_{S^{2-}} < r_{Cl^-}$
(A) T T T F (B) T T F F (C) F T T F (D) T T T T

84 The first (ΔH_1) and second (ΔH_2) ionisation enthalpies (in kJ mol^{-1}) and the (ΔH_{eg}) electron gain enthalpy (in kJ mol^{-1}) of a few elements are given below:

	Elements	ΔH_1	ΔH_2	$\Delta_{eg}H$
(i)	P	520	7300	- 60
(ii)	Q	419	3051	- 48
(iii)	R	1681	3374	- 328
(iv)	S	1008	1846	- 295
(v)	T	2372	5251	+ 48
(iv)	U	738	1451	- 40

Based on the above information match the following columns

Column I	**Column II**
(A) The least reactive element	(p) R
(B) The most reactive metal is	(q) S
(C) The most reactive non-metal is	(r) T
(D) The least reactive non-metal	(s) Q

85 The gaseous mettalic chloride ($MC\ell$ type) molecule has a measured dipole moment of 9.0 D, which indicates that it is a very polar molecule. The separation between the nuclei in this molecule is 2.25×10^{-8} cm. Calculate the percentage ionic character in KCl molecule. [1.6×10^{-19} , C = 4.8×10^{-10} esu]
[1.6×10^{-19} , C = 4.8×10^{-10} esu]

86 Arrange the following in the order given below :
(a) Increasing polarising power : Na^+, Ca^{2+}, Mg^{2+} and Al^{3+}
(b) Increasing dipole moment : PCl_5 , $BeCl_2$, $[IClBr]^-$
(c) Increasing bond length (NO), $(NO)^+$, $(NO)^-$
(d) Increasing bond energy H_2^+ , He_2^+ , H_2

87 **STATEMENT-1 :** 'He' has lowest ionisation energy among all the elements.
STATEMENT-2 : Addition of extra electrons even in fully filled orbitals releases energy
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

88 Identify incorrect order of bond angles
(A) Cl_2O > F_2O and F_2O < H_2O
(B) AsI_3 > $AsBr_3$ > $AsCl_3$
(C) NO_2^+ > NO_2^-
(D) $H_b\hat{B}H_b$ > $H_t\hat{B}H_t$; where H_t is terminal Hydrogen of B_2H_6 and H_b is the bridging Hydrogen of B_2H_6

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Column I	**Column II**
(A) SO_2, NO_3^-, CO_3^{2-}	(p) Semi-metals
(B) B, Si, Ge, As, Sb	(q) Isoelectronic species
(C) He, Ne, Ar, Kr, Xe	(r) Van der waal's radii
(D) M(g) + energy $\rightarrow$ $M^+(g) + e^-$	(s) Ionisation energy

90 The electron gain enthalpies of halogens are as given below.
F = – 332, Cl = – 349, Br = – 324, I = – 295 kJ mol^{-1}.
The less negative value for F as compared to that of Cl is due to :
(A) Strong electron-electron repulsions in the compact 2–p sub shell of F.
(B) Strong electron -electron repulsions in the bigger 3–p sub shell of Cl
(C) Smaller electronegativity value of F than Cl
(D) (A) & (B) both

91 Consider the following four statements
(1) Ionisation energy of Gallium is greater than $A\ell$.
(2) Equivalent weight of $KMnO_4$ in neutral medium is $\frac{M}{3}$.
(3) First ionisation energy of Phosphorus is more than sulphur.
(4) Lattice energy of Al_2O_3 is less than $MgCl_2$

(A) TTTF (B) TFTF (C) FFTT (D) TTFF

92 Consider the following four statements
(1) Solubility of AgF is more than AgI.
(2) Oxide and Hydroxide of berelium are amphoteric in nature.
(3) Reducing power of ionic hydride of metal decreases down the group.
(4) Equivalent weight of H_2O_2 in acidic and basic medium are $\frac{M}{2}$

93 The correct order of radii is

(A) N < Be < B (B) $F^- < O^{2-} < N^{3-}$ (C) Na < Li < K (D) $Fe^{3+} < Fe^{2+} < Fe^{+4}$

94 The correct order of electron affinity, when first electron is added into isolated gaseous atom is _____

(A) He > N > F > Be (B) Ar > Ne > He > H (C) Cl > F > Br > I (D) O > S > Se > Te

95 Which of the following electronic configurations indicates the biggest jump between the second and third ionization energy values?

(A) $1s^2\,2s^2\,2p^2$ (B) $1s^2\,2s^2\,2p^6\,3s^1$ (C) $1s^1\,2s^2\,2p^6\,3s^2$ (D) $1s^2\,2s^2\,2p^1$

96 **Statement-1 :** In a period noble gases has largest atomic radius.
Statement-2 : In case of noble gases vander waal radius is defined.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

97 **Statement-1 :** IIIrd period elements has greater electron gain enthalpy than IInd period elements.
Statement-2 : IIIrd period elements has 3d-orbitals.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

98

Column-I **Electronic configuration**	**Column-II** **Periodic Properties (Compare between given electronic configuration only)**
(A) $1s^2$	(p) Positive electron gain enthalpy
(B) $1s^2\,2s^2\,2p^5$	(q) Highest ionisation energy
(C) $1s^2\,2s^1$	(r) Lowest ionisation energy
(D) $1s^2\,2s^2\,2p^6$	(s) Highest electron gain enthalpy

ANSWER KEY

1 (D)

Sol. $C^+ – 1s^2\ 2s^2\ 2p^1$
$N^+ – 1s^2\ 2s^2\ 2p^2$
$O^+ – 1s^2\ 2s^2\ 2p^3$
$F^+ – 1s^2\ 2s^2\ 2p^4$
clearly 2nd I.E. has order O > F > N > C.

2 (B)

Sol. As electronegativity difference between bonded element increases % ionic character increase.

3 (D)

Sol. Al – [Ne] $3s^2\ 3p^1$, Mg – [Ne] $3s^2$
clearly the $I.E_3$ of Al is more than $I.E_2$ of Mg due to more number of protons in the nucleus.
Al – [Ne] $3s^2\ 3p^1$, Mg – [Ne] $3s^2$

4 (D)

Sol. $_{30}Zn – 1s^2$, $2s^2\ 2p^6$, $3s^2\ 3p^6$, $3d^{10}$, $4s^2$
$\sigma = 0.35 \times 1 + 18 \times 0.85 + 10 \times 1 = 25.65$
$\Rightarrow \quad Z_{eff} = 30 – 25.65$

5	(A)	**6**	(A)	**7**	(C)
8	(D)	**9**	(A)		

10 (D)

Sol. $_{47}Ag – [Kr]\ 5S^1\ 3d^{10}$

11	(B)	**12**	(B)	**13**	(B)
14	(C)	**15**	(B)	**16**	(B)
17	(B)	**18**	(A)	**19**	(A)

20 (C)

21 (D)

Sol. Valence shell configuration
Ion
Si^+ – $2s^1$
P^+ – $2p^2$
S^+ – sp^3
Cl^+ – sp^4
Clearly S^+ has half filled orbital.

22	(B)	**23**	(C)	**24**	(B)
25	(B)	**26**	(A)	**27**	(B)(C)(D)

28 (B)(D) CsBr < CsCl < CsF

Sol. More is the size difference more is the solubility.

29 (B)(C)(D)

Sol. ΔH_{eg} for 2nd, 13th and 18th group are positive and ΔH_{eg_2} for all the atom is positive.

30 (A)(C)

31 (A)(C)(D)

Sol. For isoelectronic species Zeff increases with the increase of atomic number.

32	(A)(C)(D)	**33**	(B)(C)(D)	**34**	(A)(B)(C)

35 (C)

Sol. I.E. of 3rd period is more than II this is due to the high electron density of 2nd period element which makes it difficult the addition of electron in its outermost shell.

36 (D)

37 **Ans.** 47

Sol. As magnetic moment = $\sqrt{n(n+2)}$ = 1.73

$\Rightarrow$ n = 1

since atom has only one unpaired electron hence it must be $_{29}Cu$.

Hence element below it in periodic table has atomic number 29 + 18 = 47.

38 **Ans. 163**

39 **Ans.** 47

Sol. In the d-block element only Cu^+ has no unpaired electron and it will have zero magnetic moment.

Hence the element has atomic number z = 29. and the element just below it has atomic number = 29 + 18 = 47

40 **Ans.** 46%

Sol. E.N. on pauling scale = $\frac{7}{2.8}$ = 2.5

E.N. on pauling scale for 2nd element = $\frac{1.4}{2.8}$ = 0.5

Electronegativity difference Δ = 2.5 – 0.5 = 2

$\therefore$ % ionic character = $16\Delta + 3.5\,\Delta^2 = 16 \times 2 + 3.5 \times 2^2 = 32 + 14 = 46\%$

41 **Ans.** 570

Sol. Total energy required to convert

$\frac{6}{24} = \frac{1}{4}$ mole of Mg(s) into Mg^{++}

$E = \frac{1}{4}(100 + 740 + 1440) = \frac{2280}{4} = 570$ kJ/mol

42 **Ans.** 23 kcal

Sol. $A + e \longrightarrow A^- + 3$ eV

30 3 × 23 kcal

$\therefore$ energy released for conversion of 10 g gaseous A into A^- ions = $\frac{3\times23}{30} \times 10$ **= 23 kcal**

43 **Ans.** 46 kcal

Sol. $A + e \longrightarrow A^- + 3$ eV

30 3 × 23 kcal

$\therefore$ energy released for conversion of 10 g gaseous A into A^- ions = $\frac{3\times23}{30} \times 20$ **= 46 kcal**

44 **Ans.** 3

Sol. Let $X \longrightarrow X^+ e^-$ $\therefore$ IE (energy absorbed) = a eV per atom

and $X + e^- \longrightarrow X^-$ $\therefore$ EA (energy released) = – b eV per atom

Now $\frac{N}{2}$ Of X^- lose two electrons to give $\frac{N}{2}$ X^+

$\therefore$ $X^- \longrightarrow X + e^-$ $\therefore$ energy absorbed = + b

$X \longrightarrow X^+ + e^-$ $\therefore$ energy absorbed = + a

$\therefore$ $a \times \frac{N}{2} + b \times \frac{N}{2} = \frac{806.4\times1000}{1.6\times10^{-19}}$ eV

or (a + b) = $\frac{806.4\times1000\times2}{1.6\times10^{-19}\times6\times10^{23}} = \frac{806.4\times2}{1.6\times60} = 16.8$

or (a + b) i.e. $\frac{IE+EA}{2} = \frac{16.8}{2} = 8.4$

$\therefore$ Mulliken's electronegativity = 8.4

Paulings negativity = $\frac{8.4}{2.8} = 3.0$

45 (B) **46** (B)

47 (D)

Sol. When n = 4, the configuration will be$[Ar]^{18}\,3d^1\,4s^2$ and thus period is fourth and group no. is third.

48 (B)

Sol. 25^{Mn} – [Ar] $3d^5 4s^2$

Given $\sqrt{n(n+2)} = \sqrt{35}$

$\Rightarrow$ n = 5

Hence to have '5' unpaired electrons Mn must be in '+2' state.

49 (D)

Sol. $\mu = \sqrt{n(n+2)}$ B.M. (n = unpaired electron)

n = 0 in Zn^{+2}

Cu^+ and Sc^{+3} both have zero unpaired electron.

50 (B) **51** (A) **52** (A)
53 (A)

54 (C)

Sol. X : Na its $(IE)_2$ is very high
Y : Mg its $(IE)_3$ is very high
Z : Ar its $(IE)_1$ is very high

55 (B)

56 (C)

57 (A)(B)(D)

Sol. See the magnetic moment it contain six unpaired electrons. out off six for two electron, quantum numbers written and others are written in four options.

58 (A)(B)(C) **59** (A)(B)(C)(D) **60** (C)(D)
61 (B)

62 (A)

Sol.

	S > Se > Fe > O	
$\Delta_{eg}H$ electron gain enthalpy	–200 > –195 > –190 > –141	It is correct order

63 (D)

64 (D)

Sol.

Substance	CO	NO^+	CN^-	C_2^{2-}	N_2	NO	O_2^-
No. of electrons	14	14	14	14	14	15	17

65 (A)(B)

66 (B)

Sol. Dipole moment of compound would have been completely ionic

$= (4.8 \times 10^{-10}\ \text{esu})(2.67 \times 10^{-8}\ \text{cm}) = 12.8\ \text{D}$

so % ionic character $= \frac{4.0}{12.8} \times 100\% = 31.25\ \%$

67 (B)

Sol. Transition metal ions have pseudo inert gas configuration which have higher polarising power due to poor shielding of d-electrons. Alkali metal and alkaline earth metal ions have less polarising power due to inert gas configuration (more shielding effect of s-and p-electrons as compared to d-electrons).

68 **Ans.** [A — p,s] ; [B — p,q] ; [C — p,r,s] ; [D — q,r,s].

Sol. (A) $Na_2O \xrightarrow{>400^\circ C} Na_2O_2 + Na$

(B) $Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3(s) + CO_2(g) + H_2O(\ell)$

(C) $4\ NaNO_3 \xrightarrow{800^\circ C} 2\ Na_2O + 5\ O_2 + 2\ N_2$.

(D) $2\ Ba(NO_3)_2 \xrightarrow{\Delta} 2\ BaO + 4\ NO_2 + O_2$.

NO_2 also acts as reducing agent reduces ozone to O_2 and MnO_4^- to Mn^{2+} (acidic medium).

$2NO_2 + O_3 \longrightarrow N_2O_5 + O_2$.

69 (A)

Sol. Basic strength increases down the group

$Cs_2O > Rb_2O > K_2O > Na_2O > Li_2O$

L.E. a $\frac{1}{\gamma_+ + \gamma_-}$

more is L.E. more is melting point

$\therefore$ NaF > NaCl > NaBr > NaI

70 (A)

71 (B)

Sol. Both statements are correct but S_2 is not correct explanation of S_1 .

Statement - 1 : The reason for this is that their lattice energies change is more than the hydration energies on descending the group.

Statement - 2 : Hydration energy $\propto \frac{1}{\text{size of cation}}$

72 (B)

Sol. (A) Hydration energy of decreases down the group as the size of the ion increases

(B) Solubility $BaSO_4$ < ..... < $BeSO_4$

(C) Li form Li_3N

(D) Li_2CO_3 decompose on heating

73 (C)

Sol. n^{th} shell contains n subshell.

74

Sol. (i) Ca^{2+} , S^2, K^+ are iso electronic species.

$z_{eff} = z - \sigma$ σ is cost

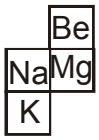
as $z\uparrow$, $z_{eff}\uparrow$

$\Rightarrow$ $Ca^{2+} > K^+ > S^{2-}$

(ii) K^+ , Na^+ Rb^+
As z_{eff} remains almost constant hence if will have constant z_{eff}.

(iii) number of shell is increasing
$Sr^{2+} > Ca^{2+} > Mg^{2+}$

(iv)



Be < Mg < Na < K.

(v) (a) Energy order is decided by n + ℓ value if n + ℓ values are same the greater is the value of n greater will be the energy .
a > b ~ c > d.
(b) energy order of the filling of electrons is
3p < 4s < 3d < 4p < 5s
Clearly at the energy level of n = 4 4s, 3d and 4p are fiiled which has 9 orbitals total which can accomodate 18 electrons.

75

Sol. In chlorine, the radii means the atomic or covalent radii which is actually half the intermolecular distance between 2 atoms whereas in Argon the radii means the Vanderwaals radii as Argon is not a diatomic molecule. Vanderwaals radii is actually half the distance between adjacent molecule. So Vanderwaal's radii being larger than atomic radii, Argon, has got a larger radii than chlorine.

76

Sol. The electronic configurations of carbon and boron are as follows :

C : $1s^2, 2s^2, 2p_x^1\ 2p_y^1$

B : $1s^2, 2s^2\ 2p_x^1$

Due to higher nuclear charge in carbon, the force of attraction towards valency electron in more in carbon atom and hence the first ionisation energy is greater than boron atom. After loss of one electron, the monovalent cations have the configuration as follows.

77

Sol.

Atomic Number	**Name**	**Symbol**	**Electronic Configuration**	**Group/family**
117	Ununseptium	Uus	$7s^27p^5$	17/Halogen
120	Unbinilium	Ubn	$8s^2$	2^{nd}/Alkaline earth metals

78

Sol. (i) $I^+ < I < I^-$

z/e $\frac{53}{52}$ $\frac{53}{53}$ $\frac{53}{54}$ z/e decreases, hence size increases.

(ii) N < C < Si < Na
(iii) $Mg^{2+} < Ne < F^- < O^{2-}$
(iv) $Fe^{3+} < Fe^{2+} < Fe$

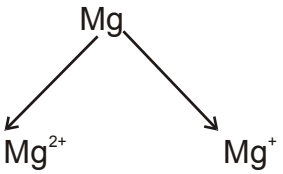
79

Sol. (i) In lanthanides and actinides, the differentiating electron enters to (n – 2)f – subshell.
The maximum capacity of f–subshell is of 14 electrons. Thus, there are only 14 lanthanides ($4f^{1-14}$) and only 14 actinides ($5f^{1-14}$). **[2.5]**

(ii) In modern periodic table, elements have been placed in order of their increasing atomic numbers. The atomic number of argon is 18 and that of potassium is 19. Thus, argon has been placed before potassium. **[2.5]**

80

Sol. 1g ≡ 1/24 moles



$\frac{1}{24} - x$ x

$$x \times 720 + \left(\frac{1}{24} - x\right)(720 + 1440)$$

$$= 50$$

$$720\,x + \frac{2160}{24} - 2160\,x = 50$$

$\Rightarrow$ $1440\,x = 90 - 40 = 50$

$\Rightarrow$ $x = \frac{90}{1440} = \frac{1}{60}$

$\therefore$ % of $Mg^{+} = \frac{x}{1/24} \times 100 = \frac{24}{16} \times 100 \simeq 67\ \%$

81 (C)

82 (A)(B)(C)

83 (A)

84 **Ans.** A- r, B-s, C-p, D-r

85 **Ans.** **83.33%**

Sol. Dipole moment of compound would have been completely ionic
= $(4.8 \times 10^{-10}$ esu$)(2.25 \times 10^{-8}$ cm$) = 4.8 \times 2.25$ D

so % ionic character = $\frac{9}{4.8 \times 2.25} \times 100\% = 83.33\ \%$

86

Sol. (a) $Na^{+} < Ca^{2+} < Mg^{2+} < Al^{3+}$
(b) $BeCl_2 = PCl_5 < [IClBr]^{-}$
(c) $(NO)^{-} > (NO) > (NO)^{+}$ [bond length]
(d) $H_2 > H_2^{+} > He_2^{+}$ [bond energy]

87 (D)

88 (D)

89

Sol. **(A – q), (B – p), (C – r), (D – s),**
(A) Have same number of electrons – So isoelectronic species
(B) Has metallic as well as non-metallic properties-semi metal

(C) Exist as mono atomic molecules & are held together by weak vander Waal's forces-so radius is defined as van der Waal's radius

(D) Energy required to remove an electron from valence shell of a gaseous atom is called I.E.

(E) Energy released when an extra electron is added to valence shell of an isolated gaseous atom to form an anion is called electron affinity

90 (A) **91** (A) **93** (B) **94** (C)

95 (C)

Sol. In $1s^2\ 2s^2\ p^6\ 3s^2$ after loosing two e^- it will aquire inert gas configuration. So the jum in I.E. is high.
$1s^2\ 2s^2\ p^6\ 3s^2$

96 (A)

97 (B)

98

Ans. (A) p, q (B) s (C) r (D) p