UNIT : 11 CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

Important Points

- Modern Periodic law: The physical and chemical properties of elements are periodic function of their atomic numbers .

  The chemical properties of elements are governed by the number of electrons in the outermost orbital of atom. Elements with similar electronic a configuration posses similar properties.

- Modern Periodic Table: The two terms used to describe the periodic table are – period and group.

  - Period: The horizontal rows of the periodic table are known as periods. Each period starts with filling up of a new quantum shell and continues till the p-orbital of the same shell is filled up. There are seven periods in the modern periodic table.

  - NUMBER OF ELEMENTS IN THE DIFFERENT PERIODS

Period Number	Orbital's being filled up	Number of elements
1	1s	2
2	2s 2p	8
3	3s 3p	8
4	4s 3d 4p	18
5	5s 4d 5p	18
6	6s 4f 5d 6p	32
7	7s 5f 6d 7p	Incomplete

Group: The vertical columns of the periodic table are known as groups. There 18 groups; which are numbered 1to 18 according to IUPAC recommendations. Elements of same group have same electronic configuration.

GP-1 → Alkalimetals
GP-2 → Alkaline Earthmetals
Electronic configurations

S		
1s	1	2
2s	Li	Be
3s	Na	Mg
4s	K	Ca
5s	Rb	Sr
6s	Cs	Ba
7s	Fr	Ra

H

Electro Configuration : $(n-1)d^{1-10}ns^{1-2}$

D — Inner Transition Metal

	3	4	5	6	7	8	9	10	11	12
3d	Sc	Ti	V	Cr	Ma	Fe	Ce	Ni	Cu	Zn
4d	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd
5d	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg
6d	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Uuu	Uub

Electronic Configuration ns^2np^{1-6}
GP-16 → Chalcogens
GP-17 → Halogeus

p	13	14	15	16	17	18
						He
2p	B	C	N	O	F	Ne
3p	Al	Si	P	S	Cl	Ar
4p	Ga	Ge	As	Se	Br	Kr
5p	In	Sn	Sb	Te	I	Xe
6p	Tl	Pb	Bi	Po	At	Rn
7p	-	Uuq	-	Uuh	-	-

Electronic Configuration : $(n-2)f^{1-14}(n-1)d^{0-1}ns^2$ Inner Transition elements

f-section

4f Lenthenoids	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
5f Actinoids	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Effective Nuclear charge: In a poly electronic atom, the internal electrons repel the electrons of the outermost orbit. This result in decrease of the nuclear attraction of the electrons in the outermost orbit .This part of nuclear charge is known as effective nuclear charge.

Z^* Effective Nuclear charge

Z Nuclear charge

σ shielding constant

$Z^* = Z - \sigma$

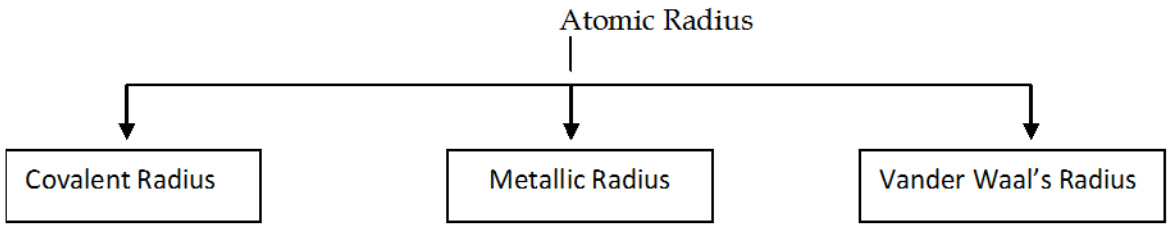
Electrons in orbital's -→ Of shells--→	σ per electron in n	Orbit (n-1)	(n-2),(n-3) .....
s or p orbital	0.35	0.85	1
d or f orbital	0.35	1	1

NOTE: For 1s electron, σ =0.30 (in case of two electron system.)

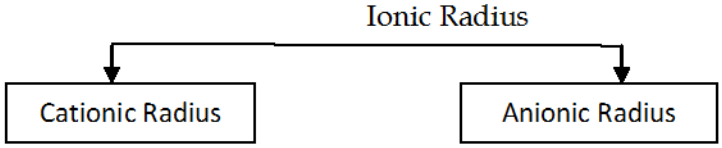
For H-atom (Z=1), there is no screening, being one electron system.

σ = 0 and $Z^* = Z = 1$

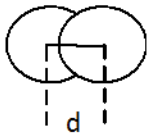
Element	Z	n	Value of σ for (Z- 1) electrons				Total	$Z^*=Z-\sigma$
			n	(n-1)	(n-2)	(n-3)		
Be	4	2	0.35	2×0.85			1.95	1.95
N	7	2	4× 0.35	2×0.85			3.10	3.90
K	19	4	0	8×0.85	8×1	2×1	16.8	2.20



ii) Ionic Radius can be expressed in two ways



1) Covalent Radius :

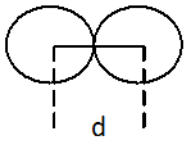


Covalent Radii = d/2

Covalent radius is equal to half the internuclear distance between two identical atoms joined by a single covalent bond.

2) Metallic Radius:

Metallic Radius is equal to half the shortest internuclear distance between two atoms in metallic crystal.



r = d/2

3) Vander waals Radius:

r = d/2

Vander waal's > metallic > Covalent

ii) Ionic Radius: Distance between the nucleus and the limit of electron cloud scattered around the nucleus.

Cationic Radii: Ionic radii of a cation As the positive charge increases the size (cationic radii) decreases.

Eg. $M^{3+} < M^{2+} < M^{1+} < M$

Size " (1/ amount of positive charge) or (1/ effective nuclear charge)

Anionic Radii: Ionic radii of an anion. As the negative charge increases (anionic radii) increases.

Eg. $X^{3-} > X^{2-} > X^{1-} > X$

Note: Anionic radii > Atomic radii > Cation Radii

iii) Size of isoelectronic species : Isoelectronic species are the species which have same nuclear of electrons but different nuclear charge

$_8O^{-2} > _9F^{-} > _{11}Na^{+} > _{12}Mg\ 2^{+}$

Size of isoelectronic species 1/ No. Of protons (nuclear charge)

Unit of atomic radius and ionic radii in nm ,^{0}A ,pm

1nm = 10^{-9}m

$1^0A = 10^{-10}m = 10^{-8}cm$

$1pm = 10^{-12}m = 10^{-10}cm$

Ionization Enthalpy: The minimum amount of energy required to remove the most loosely bound electron from an isolated gaseous atom. It is always an endothermic process. Its unit is KJ mole-1

$A_{(g)} \xrightarrow{1st\ I.E} A^+ + e^-$

$A^{2+}_{(g)} \xrightarrow{2nd\ I.E} A^{2+} + e^-$

$A^{2+}_{(g)} \xrightarrow{3rd\ I.E} A^{3+} + e^-$

$\Delta_i H_1 < \Delta_i H_2 < \Delta_i H_3$

Electron gain enthalpy: It is the energy released, when an isolated gaseous atom gains an electron. It may be an endothermic or exothermic process.

$X_{(g)} + e^- \xrightarrow{\Delta eg\ H1} X^-_{(g)}$

$X^-_{(g)} + e^- \xrightarrow{\Delta eg\ H2} X^{2-}_{(g)} + e^- \xrightarrow{\Delta eg\ H3} X^{3-}$

Unit of ionic enthalpy and $\ddot{A}_{ig}$ H : The units are ev mole^{-1} / KJ mole^{-1} / Kcal mole^{-1}

1 ev mole^{-1} = 93.6 KJ mole^{-1}

1 ev mole^{-1} = 23.06 Kcal mole^{-1}

Electro negativity: It is the relative tendency of an atom to attract electron towards itself in a covalent bond. Three different scales are used in measurement (i) Pauling (ii) Mulliken (iii) Alfred - Roche, Pauling Scale is most widely used.

Factors affecting electro negativity are I.E , E.A, & shielding

(i) I.E, E.A, & electro negativity ∞ 1/ atomic size

(ii) I.E, E.A, & electro negativity ∞ effective nuclear charge

(iii) I.E, E.A, & electro negativity ∞ 1/ shielding

Screening effect: The decreases in force of attractions by the electrons of shells present in between the nucleus & valence electron

Lattice Enthalpy: It is the energy evolved when one gram molecule of the crystal is formed from gaseous ions.

Valency & oxidation No:

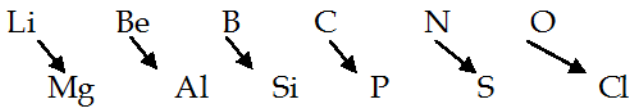
Valency is the combining capacity of an element. Valency remain constant in a group. It is dependent on the number of valence electrons. Valency increases from 1 to 4 & then decreases from 4 to 1 (Applicable to representative elements). Valency of noble gases is zero.

Oxidation No:

Oxidation no. It is the charge possessed by an atom in a molecule. The oxidation number of s-block elements is +1 in alkali metals & +2 in alkaline metals. d-block elements exhibit variable oxidation numb. And p-block elements possess positive well as well as negative oxidation number.

Diagonal Relationship:

The similarity in properties between the first members of second period with their diagonally opposite element of third period is known as diagonal relationship. Diagonal relationship is prominent between



Reason: These elements have similar atomic radii & polarising power. ie. Charge/size ratio is similar.

Trend of different properties across the period

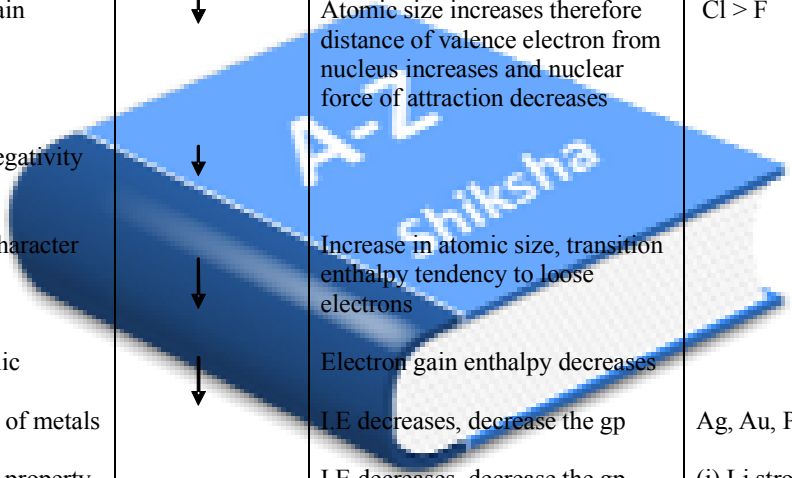
↓ Increases ↑ Decreases

Trends in different properties across the period

Property	Trend	Reason	Exception
1) Atomic Number effective	↑	Increases in number of protons in the nucleus of atoms	
2) Effective nuclear Charge	↑		Decreases sharply from gp 17-18
3) Atomic radii	↓	The Principal quantum remains constant Effective nuclear charge increases	In transition metal size increases from 1st member to 2nd but size of 2nd & 3rd are almost equal
4) Ionisation enthalpy	↓	The nuclear force of attraction on outer most electrons increases	(i) Be > B (ii) N >O (iii)Mg>A(liv) In transition element show small variation member but I.E of 3rd member is higher than 2nd member
5) Electron gain enthalpy	↑	Atomic size decreases Effective nuclear charge increases. Hence nuclear force of attraction increases.	Cl > F
7) Electron negativity	increases		
8) Metallic Character	decreases	Ionisation enthalpy decrease in atomic size, electronegativity increases	
9) Non metallic character	↓ Decreases	Electron gain enthalpy decreases	
10) Reactivity of metals	↑	I.E increases,	Ag, Au, P+
11) Reducing property of metals	↑	I.E increases, Tendency to donate electrons decreases	
12) Reactivity of non-metals	↑	Electro negativity increases	
13) Oxidising property of non metals	↑	Electro negativity increases	
14) M.P & B.P of metals	↑	Lattice enthalpy increases	
15) M.P & B.P of non-metals	↑		

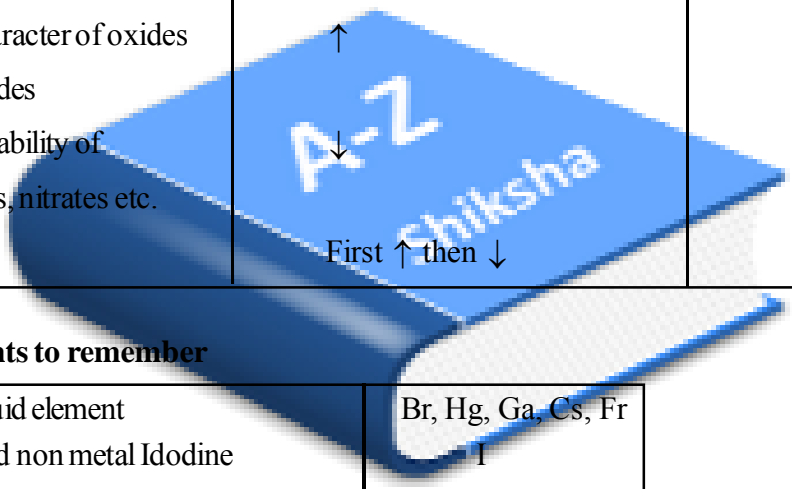
Trends in different properties down the group

Property	Trend	Reason	Exception
1) Atomic Number effective	↑	Increases in number of protons in the nucleus of atoms	
2) Effective nuclear Charge	↑		
3) Atomic radii	↑	The Principal quantum number increases Effective nuclear charge is almost constant Nuclear force of attraction decreases	In transition metal size increases from 1st member to 2nd but size of 2nd & 3rd are almost equal
4) Transition enthalpy	↓	The Principal quantum number increases The nuclear force of attraction on valence electrons decreases	(i) Tl > In (ii) Pb > Sn (iii) In transition element decreases from 1st to 2nd member but I.E of 3rd member is higher than 2nd member
5) Electron gain enthalpy	↓	Atomic size increases therefore distance of valence electron from nucleus increases and nuclear force of attraction decreases	Cl > F
7) Electron negativity	↓		
8) Metallic Character	↓	Increase in atomic size, transition enthalpy tendency to loose electrons	
9) Non metallic character	↓	Electron gain enthalpy decreases	
10)Reactivity of metals		I.E decreases, decrease the gp	Ag, Au, P+
11) Reducing property of metals	↑	I.E decreases, decrease the gp Tendency to donate electrons	(i) Li strongest (ii) Au, Hg, Tl, Bi, W, Re & Pb are less stronger than Ag, Cd, In, Sb, Mo, Tc & Sn
12) Reactivity of non-metals	↓	Electro negativity decreases< gp decreases	
13) Oxidising property of non metals	↓	Tendency to loose electrons	
14) M.P & B.P of metals	↓	Lattice enthalpy decreses	
15) M.P & B.P of non-metals	↑	Molecular solids	



Quick glance of properties across the period & down the group

	Property	Across the Period	Down the Group
(1)	Effective nuclear charge	↑	↑
(2)	Atomic Size	↓	Constant
(3)	Ionisation Enthalpy	↑	↓
(4)	Electron gain Enthalpy	↑	↓
(5)	Electronegativity	↑	↓
(6)	Metallic property	↓	↑
(7)	Oxidising Agent	↑	↓
(8)	Reducing Agent	↓	↑
(9)	Basic character of oxides & hydroxides	↓	↑
(10)	Acidic character of oxides & hydroxides	↑	↓
(11)	Thermal stability of carbonates, nitrates etc.	↓	↑
(12)	Density	First ↑ then ↓	



Important points to remember

(1)	Liquid element	Br, Hg, Ga, Cs, Fr
(2)	Solid non metal Idodine	I
(3)	Lightest Metal	Li
(4)	Heaviest & Highest O.S.	Os
(5)	Hardest element	W
(6)	Metalloids	B, Si, As, Te
(7)	Lowest electronegativity	Cs
(8)	Highest electronegativity	F
(9)	Highest ΔiH	He
(10)	Lowest ΔiH	Cs
(11)	Highest ΔegH	Cl
(12)	Highest electronegativity	F
(13)	Strongest oxidising agest F	
(13)	Strongest Reducing agent	Li
(14)	Most reactive liquid metal	Cs

M.C.Q.

1. The most electronegative element possess the electronic configuration

   a) $ns^2\ np^2$ b) $ns^2\ np^4$ c) $ns^2\ np^5$ d) $ns^2\ np^3$

2. The maximum number of electrons in d– orbital of an element with atomic number 46 is

   a) 10 b) 18 c) 20 d) 19

3. The ionisation enthalpy of Cs is 375.6KJmol^{-1}< what is the energy required to convert [at mass of Cs = 133] 2.66mg of gaseous Cs completely to Cs^+

   a) 7.512 J b) 7.512 KJ c) 7512.2 J d) 18782 J

4. The atomic number of elements M, N, & P are x, x–1, x–3. If P is a halogen atom then the type of bond between N & P is

   a) Covalent b) Ionic c) Coordinate d) Metallic

5. In the above question (Question 4) the formula of M & P is

   a) MP b) M_2P c) MP_2 d) M_2P_3

6. The elements X. Y. & Z have 2, 3 & 4 electrons in the outermost orbital respectively. The element which form most basic oxide is

   a) X b) Y c) Z d) None of the above

7. Elements A, B, C & D belong to the 17th group. If the atomic numbers are y, y–x, y + 4x + 4 & y + 2x + 2 (x = 8) > the element which is violet solid is

   a) C b) A c) B d) D

8. An element X belongs to Gp16 & 5th period. Its atomic number is

   a) 34 b) 50 c) 52 d) 85

9. The position of an element with atomic number 114 is

   a) Period 6 gp 14 b) Period 6 gp 16 c) Period 5 gp 18 d) Period 7 gp 14

10. The total no. of electrons in the outermost orbital in element A, B, C, D are 2, 1, 4, & 6 respectively. The elements which belongs to chalcogens is

    a) B b) C c) D d) A

11. The ionic radii of isoelectronic species are found to be 171pm, 136pm & 140pm respectively. The isoelectronic species are _____

    a) N^{3-} , O^{2-} , F^- b) F^- , O^{2-} , N^{3-} c) O^{2-} , N^{3-} , F^- d) N^{3-} , F^- , O^{2-}

12. The size of Mo is very similar to W due to_____

    a) Shielding effect b) Actinide contraction

    c) Poor Shielding by 4f electrons d) Poor shielding by 4d electrons

13. Choose the correct order ionization energy

    a) N > O > F b) F > O > N c) N > O < F d) O > F > N

14. The order of ionization energy of K, Ca, & Ba are

a) K > Ca > Ba b) Ca > Ba > K c) Ba > K > Ca d) K > Ba > Ca

15. The element with zero electron gain enthalpy is

a) Argon b) Lithium c) Calcium d) Fluorine

16. Pick the iso electronic species from the following

I. NH_3 II. NH^-_2

III. CH^+_3 IV. H_3O^+

a) ii, iii, iv b) i , ii , iv c) i , ii , iii , iv d) i & iv

17. The element with atomic number 44 belongs

a) d–Block b) p–Block c) s–Block d) f–Block

18. In the third period there are only eight elements because

a) It is a short period b) The 3d orbitals are absent

c) The d orbitals are absent

d) When n=3, the maximum number of electrons which can be accommodated are eight

19. Choose the correct electronic configuration which has the highest difference between first & second ionisation enthalpies.

a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$ b) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$

c) $1s^2\ 2s^2\ 2p^4$ d) $1s^2\ 2s^2\ 2p^3$

20. The set of quantum numbers for unpaired electron of an element with atomic number 84 are

a) N= 6 , l = 1 , m = $^+_-$ 1 , $m_s = ^+_-1/2$ b) N= 5 , l = 3 , m = 0 , $m_s = ^+_-1/2$

c) N= 6 , l = 0 , m = 0 , $m_s = ^+_-1/2$ d) N= 6 , l = 3 , m = 2 , $m_s = ^+_-1/2$

21. The elements with highest ionization enthalpy in a period are

a) Alkaline earth metals b) Halogens

c) Noble gases d) Lanthanides

22. Choose the species which is not isoelectronic

a) Bo_3^{3-} b) Co_3^{2-} c) No_3^- d) So_3^{2-}

23. The formation of Mg^{2+} is as follows

I. $Mg_{(g)} \rightarrow Mg^+_{(g)} + e^-$ $-737\ KJ\ mol^{-1}$

II. $Mg^+_{(g)} \rightarrow Mg^{2+}_{(g)} + e^-$ $-1450\ KJ\ mol^{-1}$

The energy required in the second steps is higher because

a) Mg^+ is more electropositive b) Mg^+ has larger size than Mg

c) Mg^+ tends to loose only one electron d) Mg^+ has smaller size than Mg

24. The first 2nd and 3rd ionization enthalpies of gallium are 579KJmol^{-1} ,1979KJmol^{-1} & 2962 KJmol^{-1} even though the iii I.P is highest Ga^{3+} is the most stable because

a) The energy loss is maximum resulting greater stability

b) The size of Ga^{3+} is smallest

c) Ga^{3+} is most reactive

d) It attains a stable configuration

25. The electronic configuration of M^{3+} is [Kr] $4d^{10}$ Its position in the periodic table is

a) Period 4 gp 8 b) Period 5 gp 13 c) Period 4 gp 18 d) Period 5 gp 16

26. The electronic which will exhibit maximum no. of oxidation states

a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$ b) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^5$

c) [Xe] $4f^{14}\ 5d^6\ 6s^2$ d) [Ar] $4s^2\ 4p^4$

27. Choose the incorrect order w.r.t properly indicated

a) Electro negativity F > Cl > Br b) Electron affinity Cl > F > Br

c) Oxidizing power $F_2 > Cl_2 > Br_2$ d) Bond enthalpy $F_2 > Cl_2 > Br_2$

28. Choose the correct statement

a) As shielding effect increases electro negativity decreases

b) As shielding effect increases electro negativity increases

c) As ionization potential increases metallic property increases

d) As +ve charge on species increases ionic radii increases

29. The electronic configuration which contain metals, non metals & metalloid is_____

a) ns^1 & ns^2 b) ns^2 , $ns^{2(n-1)d\ (1-10)}$

c) $ns^2\ np^6$ & ns d) $ns^2\ np^4$ & $ns^2\ np^5$

30. The group in which all the three physical states (solid ,liquid, gas) are observed is

a) gp 17 b) gp 14 c) gp 18 d) gp 15

31. The element which exhibits highest oxidation number is

a) Mn b) Os c) Fr d) I

32. Four elements A, B, C & D. D is non reactive gas. C is a highly reactive gas, B is a solid & forms oxide, A is high reactive solid & used to prepare Lasagne's solution. Choose the correct sequence of possible atomic no. of elements

a) 12, 18, 9, 11 b) 11, 36, 9, 20 c) 20, 36, 11, 9 d) 9, 18, 11, 20

33. The element with highest electronic affinity belongs to

a) Period 1 gp b) Period 3 gp 17 c) Period 2 gp 17 d) Period 2 gp 16

34. The atomic no. of B = atomic of A+18 , Statements A & B to

a) Same pd & same gp b) Same pd but different gp

c) Different pd but same gp d) Different pd and different gp

35. Element B occupies 3rd pd & gp 16

Element C occupies 4 pd & gp 3

The molecular formula of compound formed between B & C is

a) B_3C_2 b) C_2B_3 c) CB_2 d) B_2C

36. Choose the correct statement w.r.t oxidising property of F

a) It is the strongest oxidising agent because it has highest electron gain enthalpy

b) It is the strongest oxidising agent due to its small size

c) It is the strongest oxidising agent because it has maximum electron negativity

d) It is the strongest oxidising agent due to high lattice enthalpy

37. The name of the scientist who discovered the element Unu & its accepted IUPAC nameis—

a) Mendeleev &Mendelinium b) Seaborg & Seaborgium

c) Mendeleev &Dubinium d) G.T.Seaborg & Mendelinium

38. Which of the following property does not indicate the periodicity of elements

a) Ionization potential b) Neutron/ proton Ratio

c) Bonding behaviour d) Electron negativity

39. Properties of Li are similar to Mg because

a) The size of Li & Mg are different b) The size by charge ratio is similar

c) The charges are same d) Both are reactive

40. From the given set of quantum numbers for the last electron of the atom, choose the element which is a non metal. The set of Quantum numbers of A, B, C & D are given below

A – n = 2 , l = 1 , m = 0 , $^{+}$-1 B – n = 4 , l = 0 , m = 0

C – n = 5 , l = 2 , m = $^{+}$-2 D – n = 6 , l = 3 , m = 0

a) D b) C c) B d) A

41. Be shows diagonal relationship with

a) Mg b) Al c) B d) Na

42. Which of the following ions are not isoelectronic with Ar

a) Na^+ b) Ca^{+2} c) Cl^- d) K^+

43. The ionisation potential of N > O because

a) Ionisation potential increases with decrease in size

b) N posses stable half filled p–orbital

c) The screening effect in N > O

d) O is more electropositive than N

44. The physical properties of chromium is most closely related to

a) Niobium b) Tungsten c) Titanium d) Calcium

45. The electronic configuration of an element of chalcogen family is

a) [Ar] $3d^{10}$ $4s^2$ $4p^1$ b) [Ar] $3d^{10}$ $4s^2$ $4p^4$

c) [Ar] $3d^{10}$ $4s^2$ $4p^{3n}$ d) [Ar] $3d^{10}$ $4s^2$ $4p^2$

46. Choose the incorrect statement

a) An element with high electronegativity always has high electron affinity

b) Electron gain enthalpy is the property of an isolated atom

c) Electronegativity is the property of a bonded atom

d) Both electronegativity & electron affinity are equally proportional to nuclear charge & inversely proportional to atomic size

47. Choose the oxide which is most basic CuO, MgO, Al_2O_3 & K_2O

a) K_2O b) MgO c) CuO d) Al_2O_3

48. An element with atomic number 19 will most readily react with the element whose atomic number is

a) 18 b) 21 c) 20 d) 17

49. If graph is drawn between electron enthalpy & atomic number from 1 to 60, which of the following statement will be true

a) Alkali metals are at the maxima & noble gases at the minimum

b) Alkali metals are at the minimum & noble gases at the maxima

c) Transition elements at maxima

d) Maxima & minima are not observed

50. In a period with increase in atomic number, the metallic character of an element

a) Decrease across pd & increases in gp

b) increase across pd & decreases in gp

c) increase across pd & increases in gp

d) Decrease across pd & decreases in gp

51. In element P with electronic configuration [Ar] $4s^1$ will combine with an element of _____ configuration to form a highly soluble ionic solid with high melting point

a) [Ar]$4s^2$ b) [Ne]$3s^2$ $3p^3$ c) [Ne] $3s^2$ $3p^5$ d) [Ar] $4s^2 3d^2$

52. In group 14 the lower oxidation state becomes more stable down the group. The reason is

a) Inert pair effect b) Decreases in ionisation potential

c) Metallic character increases d) Decrease in electron affinity

53. Choose the correct option. Hint T=true F = False

I. In the second period atomic radii of Be is 90pm, F is 64pm, & that of Ne is 160pm

II. Atomic radii decreases from Li to Ne

III. The increase in size of Ne is due to presence of vanderwaals force of attraction & presence of covalent bond

IV. In Ne there is absence of covalent bond therefore the radii is vanderwaals radii

V. The order of radii is Metallic > Covalent > Vanderwaals

a) TTFTF b) TTTFF c) TFFTT d) TFFFT

54. Choose correct option

I. Ionisation enthalpy $\propto$ 1/shielding effect

II. Ionisation enthalpy $\propto$ Chemical reactivity

III. Ionisation enthalpy $\propto$ 1/Metallic character

IV. Ionisation enthalpy $\propto$ Effective nuclear charge

a) TFFT b) FFTT c) TTTF d) TFTT

55. Choose the correct option

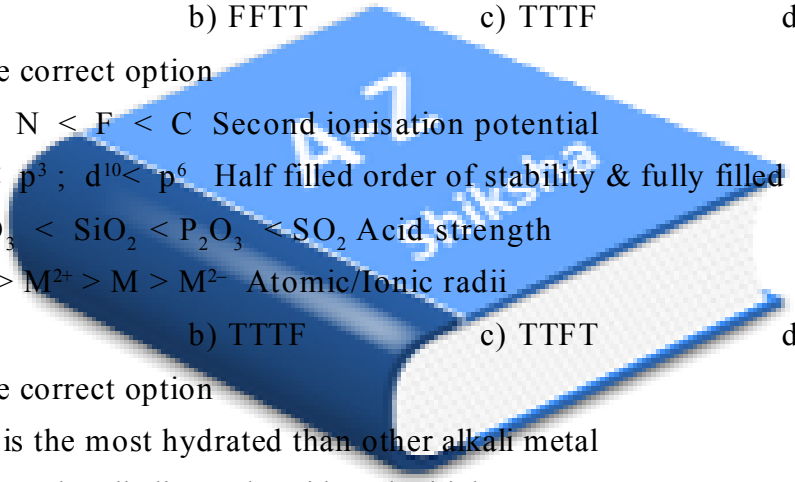
I. C < N < F < C Second ionisation potential

II. $d^5 < p^3$; $d^{10} < p^6$ Half filled order of stability & fully filled orbital's

III. $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$ Acid strength

IV. $M^{3+} > M^{2+} > M > M^{2-}$ Atomic/Ionic radii

a) TFTT b) TTTF c) TTFT d) TTTT



56. Choose the correct option

I. Cs^+ is the most hydrated than other alkali metal

II. Among the alkali metals, Li has the highest M.P

III. Li is the strongest reducing agent because of low ionisation enthalpy

IV. Li is the strongest reducing agent because the high ionisation potential is compensated by high hydration enthalpy

V. Li is resemble to Al

a) FTFTF b) TTFTF c) FFFTF d) TTTFF

57. Choose the correct option

I. NaCl < NaI < NaF < NaBr Ionic character

II. Si < P < C < N Electronegativity

III. $BeCl_2 < MgCl_2 < CaCl_2 < BaCl_2$ Ionic character

IV. $Al^{3+} < Mg^{2+} < Na^+$ Ionic mobility

a) FTTF b) TFFT c) FTTT d) FFTT

58. Choose the correct option

I. Transition metals are characterised by variable oxidation state

II. Elements of IB & IIB are transition elements

III. Elements of gp1 exhibit only +1 O.S

IV. Group 17 contains only gases

a) TTFF b) TFTF c) TTTF d) TTTT

59. Choose the correct option

I. The ionisation enthalpy of Be > B

II. d–Block elements are known as representative elements

III. Palladium is the only element of fifth period that has no electron in fifth energy level

IV. The second ionisation enthalpy of Al is greater than that of Mg

V. Among Li, Be, B ,C N ; Li has least value of electron gain enthalpy

a) TFTFT b) TFFTT c) TFFFT d) TFTTT

60. Choose the correct option

I. The last electron in case of inner transition elements goes to f–orbital

II. The electron affinity is highest for fluorine

III. Metallic radius is smaller than covalent radii

IV. Ar has lesser ionisation enthalpy than K

a) TFFT b) TFFF c) TTTF d) TTFF

61. Choose the correct option

I. All halogens exhibit variable oxidation state

II. s–Block elements do not exhibit variable oxidation state

III. the most stable oxidation state of Bi is +3

IV. N exhibits –3, +3 & +5 oxidation state

a) TFTT b) TFFT c) FTTT d) FTTF

62. Choose the correct option

I. O.S of 'O' in OF_2 is –2

II. Ionisation enthalpy is the minimum amount of energy required to remove an electron from an atom

III. Screening effect : it is the attraction of electron towards the nuclear

IV. Half filled orbitals are more stable half fully filled orbitals

a) TTTT b) FFFF c) TTFT d) TFFT

Match the following

63. Set A

1. Strongest reductant
2. Fully filled d–orbital
3. Noble metal
4. Actinide

Set B

p) silver
q) Berkelium
r) Copper
s) Iodide ion
t) Sodium ion

a) 1–s, 2–r, 3–p, 4–q b) 1–t, 2–r, 3–p, 4–q c) 1–s, 2–t, 3–q, 4–p d) 1–t, 2–s, 3–q, 4–p

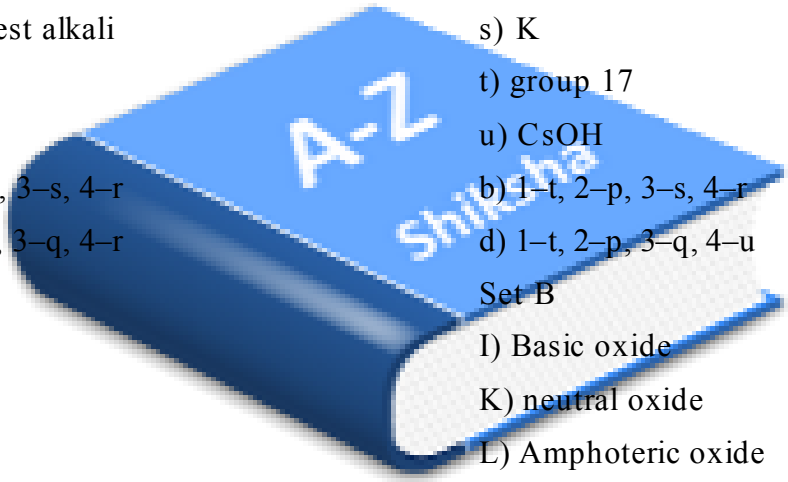
64. Set A

1. Liquid non metal
2. Metal stored in paraffin
3. Most electropositive metal
4. Strongest alkali

Set B

p) Lightest metal
q) Cs
r) KOH
s) K
t) group 17
u) CsOH

a) 1–s, 2–q, 3–s, 4–r b) 1–t, 2–p, 3–s, 4–r
c) 1–t, 2–q, 3–q, 4–r d) 1–t, 2–p, 3–q, 4–u



65. Set A

1. CO
2. CO_2
3. K_2O
4. Al_2O_3
5. SiO_2

Set B

I) Basic oxide
K) neutral oxide
L) Amphoteric oxide
M) acidic oxide
O) Neutral

a) 1–K, 2 & 5– M, 3–J, 4–L b) 1, 2 & 5– M, 3–J, 4–L
c) 1–K, 2 – M, 3–L, 4–J d) 1–J, 2 & 5– M, 3–K, 4–L

66. Set A

1. Osmium
2. Lead
3. Tungsten
4. Caesium

Set B

p) Hardest metal electric
q) poor conductor of current
r) largest size
s) most reactive solid matter
t) highest oxidation state

a) 1–t, 2–q, 3–p, 4–s b) 1–t, 2–q, 3–p, 4–r
c) 1–t, 2–s, 3–q, 4–t d) 1–t, 2–q, 3–s, 4–r

67. Set A — Set B

1. Diagonal relationship — q)attraction towards nucleus
2. Shielding effect — r) charge on the nucleus available for other electrons
3. Effective nuclear charge — s) similar polarising power
   t) Ionisation enthalpy decreases

a) 1–s, 2–t, 3–r b) 1–t, 2–s, 3–r c) 1–r, 2–s, 3–t d) 1–s, 2–r, 3–t

68. Set A — Set B

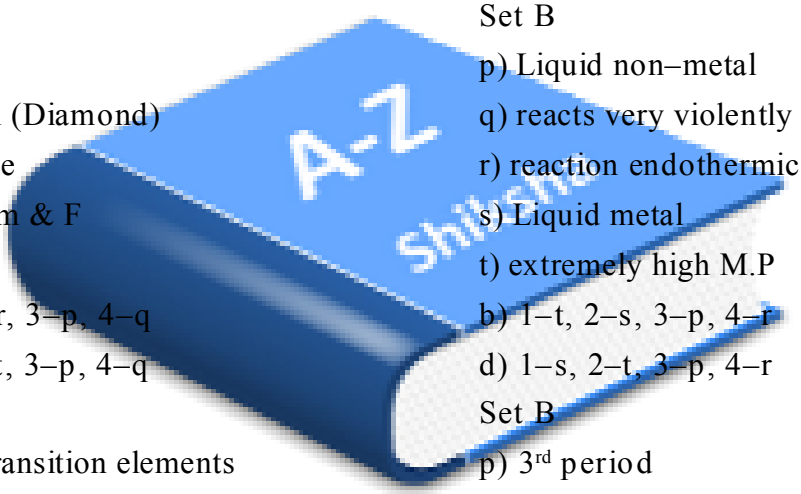
1. Br — p) Chalcogen
2. Ba — q) alkali metal
3. Se — r) alkaline earth metal
4. Rb — s) Halogen

a) 1–p, 2–r, 3–s, 4–q b) 1–s, 2–r, 3–p, 4–q
c) 1–s, 2–r, 3–q, 4–p d) 1–s, 2–p, 3–r, 4–q

69. Set A — Set B

1. Hg — p) Liquid non–metal
2. Carbon (Diamond) — q) reacts very violently
3. Bromine — r) reaction endothermic
4. Caesium & F — s) Liquid metal
   t) extremely high M.P

a) 1–s, 2–r, 3–p, 4–q b) 1–t, 2–s, 3–p, 4–r
c) 1–s, 2–t, 3–p, 4–q d) 1–s, 2–t, 3–p, 4–r



70. Set A — Set B

1. Inner transition elements — p) 3rd period
2. Transition — q) s & p Block
3. Typical element — r) d–Block
4. Representative element — s) f–Block
   t) p–Block

a) 1–r, 2–s, 3–p, 4–q b) 1–s, 2–r, 3–p, 4–q
c) 1–q, 2–r, 3–s, 4–t d) 1–s, 2–r, 3–t, 4–q

71. Set A

1. Be < Al — p) noble gases
2. Aufbau principle — q) p–Block
3. $ns^2\ np^{1-5}$ — r) Diagonal relationship
4. $ns^2 np^6$ — s) Block deciding rule

a) 1–r, 2–s, 3–q, 4–p b) 1–s, 2–r, 3–p, 4–q
c) 1–q, 2–r, 3–q, 4–p d) 1–r, 2–q, 3–s, 4–p

72. Set A (Atomic no.) Set B (Position of element)

1. 100 p) d–Block
2. 50 q) s–Block
3. 40 r) lanthanides
4. 11 s) Actinides

a) 1–t, 2–s, 3–p, 4–q b) 1–r, 2–s, 3–p, 4–q

c) 1–t, 2–p, 3–s, 4–q d) 1–r, 2–s, 3–q, 4–p

73. The position of element A, B, C & D are

Element	Period	Group
A	4	2
B	3	13
C	3	16
D	4	16

74. The molecular formula of the oxide of each element in its highest state are

a) AO_2, B_3O_2, CO, DO b) AO, B_2O_3, CO, DO

c) A_2O, B_2O_3, CO_2, DO_2 d) AO, B_2O_3, CO_3, DO_3

75. With reference of above question the oxide which is (i) most ionic (ii) amphoteric (iii) highest M.P (iv) reacts most readily acid only

a) AO,BO,AO,AO b) AO,CO,BO,AO

c) BO, AO, AO, DO d) DO, AO, BO, CO

Assertion reason type

75–85 are assertion reason type for each question select the correct choice from the following

a) Statement 1 is true, statement 2 is true & is correct explanation for statement 1

b) Statement 1 is true, statement 2 is true but is not correct explanation for statement 1

c) Statement 1 is true, statement 2 is false

d) Statement 1 is false, statement 2 is true

75.

1. F atom has lesser electron affinity than atom
2. The size of F is very small therefore electron electron repulsion is high

76.

1. The size of X^+,X & O^- are identical
2. The removal of electron decreases the size while addition of e^- increases the size.This is primarily due to decreases increases in electronic repulsion

77.

1. In group 14 +2oxidation state of Pb is more stable than +4 oxidation state
2. The size of atom increase from carbon to Lead

78.

1. The electro negativity of Ne is 1.6
2. Ne belongs to group 18

79.

1. The solubility of sulphates of alkaline earth metals in water decreases down the group
2. Lattice enthalpy decreases with increases atomic size but hydration enthalpy of Na^{+2} ion decreases in group 2

80.

1. There are 14 elements in the lanthanide series and 14 elements in the actinide series
2. All the elements of actinide series are radioactive.

81.

1. The ionisation enthalpy of Be is lesser than B
2. Ionisation enthalpy normally decreases down the group

82.

1. Transition element exhibits variable oxidation states.
2. Electronic configuration of transition elements is $ns^{2(n-1)10}$

83.

1. The boiling point of hydrogen compounds of group 16 is into the order of $H_2O > H_2S < H_2se < H_2Te$
2. The bond enthalpy between hydrogen and the element decreases down the group. H_2O exhibits H–bond

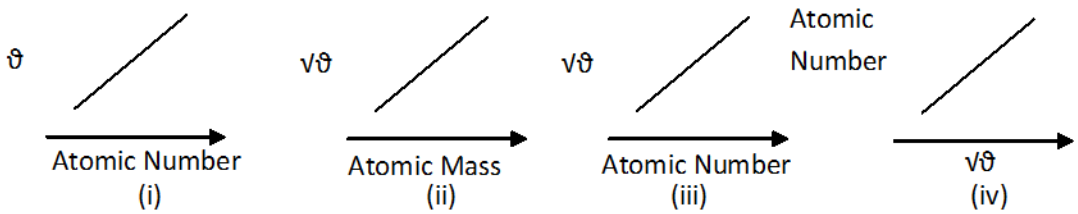
84.

1. F_2 is highly reactive
2. The bond enthalpy of F_2 is exceptionally high

85.

1. The d–Block elements are also known as transition elements
2. They form colored compounds and complexes.

86.

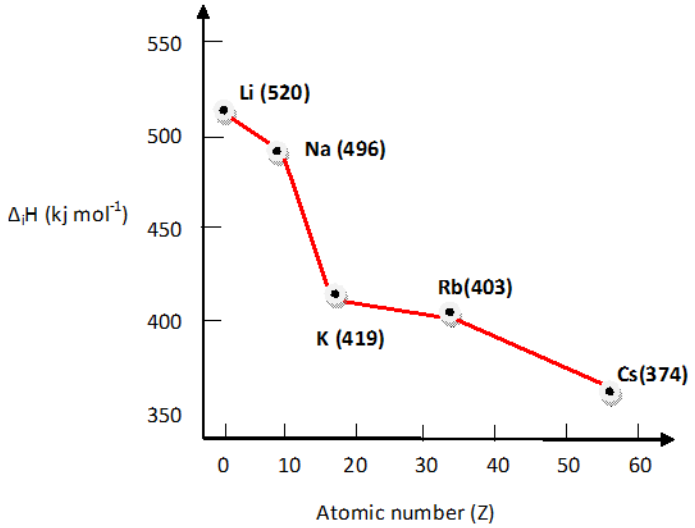


a) (ii) b) (iii) c) (i) d) (iv)

87. Z= 34 & Z=37. What is the other name elements are known on basis of given atomic number respective?

a) Representative, Halogen
b) Tranter, Chalcogen
c) Halogen transition
d) Chalcogen & representative

88.



Relation between first ionization enthalpies of alkali metals elements and their atomic number Value of 1st ionization enthalpy of Be will be_____

a) Below Cs
b) Between Li & Na
c) Above Li
d) Below Li but above K

89. The Correct decreasing order of atomic size among the following species is:

a) $Ca^{2+} > K^{+} > Ar > Cl^{-} > S^{2-}$
b) $K^{+} > Ca^{2+} > Cl^{-} > Ar > S^{2-}$
c) $S^{2-} > Cl^{-} > Ar > K^{+} > Ca^{2+}$
d) $S^{2-} > Ar > Cl^{-} > Ca^{2+} > K^{+}$

90. Arrange Ce^{3+}, La^{3+}, Pm^{3+} and Yb^{3+} in increasing order of their size:

a) $Yb^{3+} < Pm^{3+} < Ce^{3+} < La^{3+}$
b) $Ce^{3+} < Yb^{3+} < Pm^{3+} < La^{3+}$
c) $Yb^{3+} < Pm^{3+} < La^{3+} < Ce^{3+}$
d) $Pm^{3+} < La^{3+} < Ce^{3+} < Yb^{3+}$

91. Which of the following reaction require maximum energy.

a) $F \rightarrow F^{-}$
b) $H \rightarrow H^{-}$
c) $Cl \rightarrow Cl^{-}$
d) $O \rightarrow O^{2-}$

92. Given below is the E.C. Which of the following is not the correct E.C.

a) [Xe] $6s^1$
b) [Xe] $4f^{14}\ 5d^1\ 6s^2$
c) [Ar] $3d^{10}\ 4s^2\ 4p^5$
d) [Ar] $3d^7 4s^2$

93. The electro negativity of the following elements increases in order of:

a) C, N, Si, P
b) N, Si, C, P
c) Si, P, C, N
d) P, Si, N, C

94. The electronic configuration of element A is $1s^2, 2s^2, 2p^6 3s^2$ while that of element B is $1s^2, 2s^2\ 2p^5$. The formula of the compound is :

a) AB
b) A_2B
c) AB_2
d) A_2B_6

95. Choose the option in which the order is not in accordance to the property indicated.

(a) $Al^{3+} \langle Mg^{2+} \langle Na^{+} \langle F^{-}$ (Increasing ionic size)

(b) B⟨C⟨N⟨O (Increasing first ionisation enthalpy)

(c) I⟨Br⟨F⟨Cl (Incresing negative electron gain enthalpy)

(d) Li⟨Na⟨K⟨Rb (Increasing metallic radius)

96. Choose the wrong order

(a) $NH_3 \langle PH_3 \langle A_5H_3$ (Acidic)

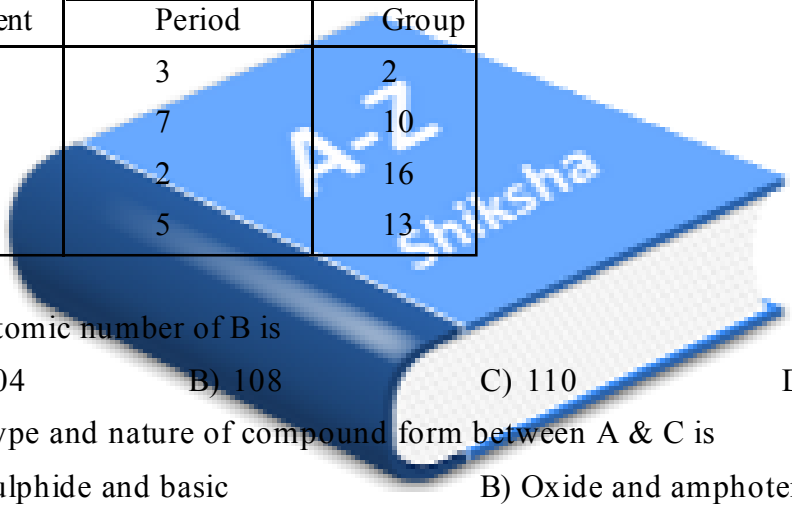
(b) Li⟨Be⟨B⟨C ΔiHi

(c) $Al_2O_3 \langle MgO \langle Na_2O \langle K_2O$ (Basic)

(d) $Li^{+} \langle Na^{+} \langle K^{+} \langle CS^{+}$ (Ionic Radius)

97.

Element	Position in perodic table	
	Period	Group
A	3	2
B	7	10
C	2	16
D	5	13



I. the atomic number of B is

A) 104 B) 108 C) 110 D) 105

II. the type and nature of compound form between A & C is

A) Sulphide and basic B) Oxide and amphoteric

C) Sulphide and neutral D) Oxide and basic

III. Element D is

A) Metal B) Metalloid C) Non–metal D) Liquid

(a) 1-B, 2-C, 3-A (b) 1-D, 2-A, 3-C (c) 1-C, 2-D, 3-B (d) 1-A, 2-D, 3-A

98. The properties of elements are given below

Element	**Property**
B	Liquid and forms strongest alkali
C	Non–metal and shining crystal
D	A metal used as catalyst with exceptional electronic configuration

I. The element B is

A) Cs B) Ga C) Fr D) Na

II. the element D is

A) Pt B) Ni C) Pd D) Mo

III. The element C is

A) Br B) I C) Ga D) Carbon

(a) 1-A, 2-D, 3-B (b) 1-D, 2-A, 3-C (c) 1-A, 2-D, 3-A (d) 1-A, 2-C, 3-B

99. For the elements having atomic number 7,15,33, 51 and 83

I. The atomic number of the element/elements in which EX_3 (X=Helogen) is most stable

A) 15 & 33 B) 33 & 51 C) 51 D) 83

II. The atomic number of the element whic form more than two oxides

A) 7 B) 33 C) 15 D) 53

III. The atomic number of the element which is store under the water

A) 15 B) 33 C) 51 D) 83

(a) 1-D, 2-A, 3-A (b) 1-A, 2-C, 3-A (c) 1-C, 2-D, 3-B (d) 1-B, 2-A, 3-A

100. Read the passage carefully and answered the following questions

Shielding effect is the ability of the inner electrons to shield the outer most electrons from the nuclear force of attaratioon the shielding constant ó can be calculated by the equation:

$Z^* = Z - \sigma$ where Z^* = effective nuclear charge

Z = Nuclear charge

σ = Shielding constant

The rules according to sleter are given below in the table

Electrons in the orbitals of shells →	σ per electron of orbit		
	n	n-1	(n-2), n-3 etc
s or p orbital	0.35	0.85	1.0
d or f orbital	0.35	1.00	1.0

The electrons of an atom are classified as (1s), (2s 2p), (3s,3p), (3d), (4s,4p,4d), (4f).....

Electrons on the right contribute nothing to the shielding constant

I. The shielding constant for an p-electron of -7N is _____

A) 3.10 B) 3.45 C) 2.45 D) 2.4

II. The shielding constant for a 3d electron of 30Zn is

A) 21.5 B) 20.8 C) 21.85 D) 21.15

III. The effective nuclear charge 19K is _____ if σ =16.8

A) 1.9 B) 2.20 C) 2.22 D) 3.90

(a) 1-B, 2-A, 3-C (b) 1-C, 2-D, 3-A (c) 1-A, 2-C, 3-B (d) 1-B, 2-B, 3-B

ANSWER KEY

1	c	18	b	35	b	52	a	69	c	86	b
2	c	19	a	36	c	53	a	70	b	87	d
3	a	20	a	37	d	54	d	71	a	88	c
4	b	21	c	38	b	55	b	72	a	89	c
5	c	22	d	39	b	56	a	73	d	90	a
6	a	23	d	40	d	57	c	74	a	91	d
7	a	24	d	41	b	58	c	75	a	92	b
8	c	25	b	42	a	59	d	76	d	93	c
9	d	26	c	43	b	60	b	77	b	94	c
10	b	27	d	44	c	61	c	78	d	95	b
11	d	28	a	45	b	62	b	79	a	96	b
12	c	29	d	46	a	63	a	80	b	97	c
13	c	30	a	47	a	64	d	81	d	98	d
14	b	31	b	48	d	65	a	82	b	99	a
15	a	32	c	49	b	66	b	83	a	100	c
16	b	33	b	50	a	67	a	84	c		
17	a	34	c	51	c	68	b	85	b