SOLVED EXAMPLES

Ex. 1 Following are the valence shell electronic configurations of some elements.

(i) $3s^2\ 3p^5$ **(ii)** $3d^{10}\ 4s^2$ **(iii)** $2s^2\ 3p^6\ 4s^1$ **(iv)** $1s^2\ 2s^2$

Find out the blocks to which they belong in the periodic table ?

Ans. **(i)** p-block **(ii)** d-block **(iii)** s-block **(iv)** s-block

Sol. The block of the elements depend on the type of sub-shell which receive the last electron. In case of **(i)** it enters in 3p-subshell, **(ii)**z it enters 3d-subshell, **(iii)** it enters 4s-subshell and **(iv)** it enters 2s-subshell.

Ex. 2. A M^{2+} ion derived from a metal in the first transition metal series has four electrons in 3d subshell. What element might M be ?

Ans. Chromium

Sol. Electron configuration of M^{2+} is : $[Ar]^{18}\ 4s^0\ 3d^4$

$\therefore$ Electron configuration of M is : $[Ar]^{18}\ 4s^1\ 3d^5$ (and not $4s^2\ 3d^4$)

So total number of electrons = 24.

Hence, metal M is chromium (Cr).

Ex. 3 Find out the group of the element having the electronic configuration, $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$.

Ans. As last electron enters in d-subshell, therefore this belongs to d-block. For d-block element the group number is equal to the number of valence shell electrons + number of electrons in (n-1) d-subshell. So, group number = 6 + 2 = 8.

Ex. 4 Arrange the following ions in the increasing order of their size : Be^{2+} , Cl^-, S^{2-} , Na^+ , Mg^{2+} , Br^- ?

Ans. $Be^{2+} < Mg^{2+} < Na^+ < Cl^- < S^{2-} < Br^-$

Sol. Be^{2+} is smaller than Mg^{2+} as Be^{2+} has one shell where as Mg^{2+} has two shells.

Mg^{2+} and Na^+ are isoelectronic species : Ionic radius $\propto$ 1/nuclear charge.

Cl^- and S^{2-} are isoelectronic species : Ionic radius $\propto$ 1/nuclear charge.

Cl^- is smaller than Br^- as Cl^- has three shells where as Br^- has four shells.

Ex. 5 In Column-I, there are given electronic configurations of some elements. Match these with the correct metals given in Column-II :

	Column-I		Column-II
(A)	$ns^2,\ np^5$	**(p)**	Chromium
(B)	$(n-1)\ d^{10}\ ,\ ns^1$	**(q)**	Copper
(C)	$(n-1)\ d^5\ ,\ ns^1$	**(r)**	Krypton
(D)	$(n-1)\ d^{10}\ ,\ ns^2\ ,\ np^6$	**(s)**	Bromine

Ans. **(A)** $\rightarrow$ (s) ; **(B)** $\rightarrow$ (q) ; **(C)** $\rightarrow$ (p) ; **(D)** $\rightarrow$ (r).

Sol. **(A)** ns^2np^5 is general valence shell electron configuration of halogens. So this configuration belongs to bromine.

(B) $(n-1)\ d^{1\text{-}10}\ ns^{1\text{-}2}$; This is electron configuration of d-block elements. As it contains $(n-1)\ d^{10}ns^1$ configuration it belongs to copper.

(C) $(n-1)\ d^{1\text{-}10}\ ns^{1\text{-}2}$; This is electron configuration of d-block elements. As it contains $(n-1)\ d^5\ ns^1$ configuration it belongs to chromium.

(D) Noble gases has valence shell electron configuration $ns^2\ np^6$, so it belongs to krypton.

Ex. 6 Match the metals given in Column-II with their type given in Column-I :

	Column-I		Column-II
(A)	Metalloid	**(p)**	Sulphur
(B)	Radioactive	**(q)**	Gold
(C)	Transition metal	**(r)**	Arsenic
(D)	Chalcogen	**(s)**	Uranium

Ans. **(A)** → (r) ; **(B)** → (s) ; **(C)** → (q) ; **(D)** → (p)

Sol. **(A)** Arsenic is a metalloid because it behaves as metal (forming cation, As^{3+} -$AsCl_3$) as well as nonmetal (forming anion, As^{3-} -AsH_3).

(B) Uranium is a radioactive element.

(C) Those elements which in their neutral atoms or in most common oxidation state have partially filled d-orbitals are called as transition elements. Gold in its +3 oxidation state has electron configuration $[Xe]^{54}$, $5d^8 6s^0$.

(D) 16^{th} group elements like oxygen and sulphur are ore forming elements and therefore are called as chalcogens.

Ex. 7 Match the metals given in Column-II with their type given in Column-I :

	Column-I		Column-II
(A)	Representative element	**(p)**	Cerium
(B)	Lanthanide	**(q)**	Aluminium
(C)	Coinage metal	**(r)**	Thorium
(D)	Actinide	**(s)**	Gold

Ans. **(A)** → (q) ; **(B)** → (p) ; **(C)** → (s) ; **(D)** → (r)

Sol. **(A)** s-block and p-block elements are collectively called as representative elements. As in aluminium last electron enters in p-subshell ($[Ne]^{10}3s^2 3p^1$).

(B) Lanthanide series follows lanthanum (atomic number 57) and starts from cerium (atomic number 58) to lutetium (atomic number 71), fourteen 4f- series elements.

(C) Group 11- transition elements copper, silver & gold are known as coinage metals (used for making the coins).

(D) Actinides series follows actinium (atomic number 89) and starts from thorium (atomic number 90) to lawrencium (atomic number 103), fourteen 5f- series elements.

Ex. 8 The (IE_1) and the (IE_2) in kJ mol^{-1} of a few elements designated by Roman numerals are shown below:

	I	II	III
IE_1	403	549	1142
IE_2	2640	1060	2080

Which of the above elements is likely to be a

(a) non-metal

(b) alkali metal

(c) alkaline earth metal ?

Ans. **(a)** non-metal(III) – Due to highest ionisation energy, (IE_1) and (IE_2).

(b) alkali metal (I) – Due to lowest ionisation energy, (IE_1) and there is quite high jump in (IE_2) due to inert gas configuration.

(c) alkaline earth metal (II) – There is little difference in (IE_1) and (IE_2) and the value of (IE_1) is slightly greater than(I) due to stable configuration(ns^2).

Ex. 9 Ionisation energy and electron affinity of fluorine are respectively 17.42 and 3.45 eV. Calculate electronegativity of fluorine atom.

Sol. According to Mulliken's electronegativity $(\chi_M) = \dfrac{\text{Ionisation energy} + \text{Electron affinity}}{2}$

$$= \frac{17.42 + 3.45}{2} = 10.435$$

Therefore, electronegativity on Pauling's scale $(\chi_P) = \dfrac{10.435}{2.8} = 3.726$ **Ans.** $\chi_P = 3.726$

Ex. 10 Why the electron gain enthalpy values of alkaline earth metals are lower (i.e. less negative) or positive ?

Sol. The general valence shell electron configuration of alkaline earth metals is ns^2 (stable configuration). The extra electron must enter np subshell, which is effectively shielding by the two ns electrons and the inner electrons. Consequently, the alkaline earth metals have little or no tendency to pick up an extra electron

Ex. 11 Match the particulars given in Column-I with the process/metal / species given in Column-II.

	Column-I		Column-II
(A)	Isoelectronic species	**(p)**	$A^+(g) + \text{energy} \rightarrow A^{++}(g) + e^-(g)$
(B)	Half filled orbital	**(q)**	Ar, K^+, Ca^{++}
(C)	Second ionisation energy	**(r)**	Lutetium
(D)	Inner transition element	**(s)**	Antimony

Ans. **(A)** → (q) ; **(B)** → (s) ; **(C)** → (p) ; **(D)** → (r)

Sol. **(A)** Species having same number of electrons but different nuclear charge are called isoelectronic species. Ar, K^+ & Ca^{++} have same number of electrons i.e. 18 but 18, 19 & 20 number of protons respectively.

(B) np^3, $(n–1)\,d^5$ and $(n–2)\,f^7$ represent half filled orbitals. Antimony has $([Kr]^{36}\,4d^{10}5s^2 5p^3)$.

(C) The energy required to remove an electron from an univalent cation(g) is called second ionisation energy.

(D) 4f and 5f- series elements are called inner transition elements because they have three outer most shells incomplete.

Ex. 12 The Column-I has certain details about the elements of s-, p- and d-block elements. Match those with the group number of the elements listed in Column-II.

Column-I (element / elements)	Column-II (group number)
(A) An element whose fourth shell contains two p-electrons	**(p)** 8^{th} group
(B) An element whose valence shell contains one unpaired p-electron	**(q)** 12^{th} group
(C) An element which receives last electron in $(n-1)$ d-subshell	**(r)** 14^{th} group
(D) An element with the ground-state electron configuration $[Ar]4s^2 3d^{10}$	**(s)** 17^{th} group

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

Sol. **(A)** $[Ar]3d^{10}4s^24p^2$: Fourth shell contains two electron in 4p-sub shell i.e., $4p^2$. Therefore, group number $= 10 + 4 = 14$.

(B) Halogens (i.e. group number 17) have valence shell electronic configuration ns^2np^5 and there is one unpaired electron in p-subshell i.e., 

(C) The element in which last electron enters in d-subshell belongs to d-block. For d-block elements the group number = number of electrons in valence shell + number of electrons in (n – 1) d-subshell.

Group number 8. Valence shell electronic configuration is $ns^2(n-1)d^6$. Therefore, group number $= 2 + 6 = 8$.

Like wise, group 12 is $ns^2(n-1)d^{10}$. Therefore, group number $= 2 + 10 = 12$.

So in group 8 and 12 last electron enters in d-subshell.

(D) For electronic configuration. $[Ar]4s^23d^{10}$ the group number $= 2 + 10 = 12$.

Ex. 13 Match the type of elements / characteristic of the elements listed in Column-I with the correct element listed in Column-II.

	Column-I		**Column-II**
(A)	Highest 1^{st} ionisation energy	**(p)**	Technitium
(B)	Highest electronegativity	**(q)**	Lithium
(C)	Synthetic element	**(r)**	Helium
(D)	Strongest reducing agent	**(s)**	Fluorine

Ans. **(A)** $\rightarrow$ (r) ; **(B)** $\rightarrow$ (s) ; **(C)** $\rightarrow$ (p) ; **(D)** $\rightarrow$ (q).

Sol. **(A)** Helium has highest 1^{st} ionisation energy amongst all the elements of periodic table because of ns^2 valence electron configuration and its small size of atom.

(B) Fluorine has highest electronegativity i.e. 4.0 on Pauling scale on account of its small size.

(C) Technitium is a man made element.

(D) Lithium is a strongest reducing agent because of its highest negative value of E° due to its higher hydration energy on account of its small size of atom.

Exercise # 1 [Single Correct Choice Type Questions]

1. Which of the following is/are drawback of Mendeleev's periodic table :
(A) Position of Hydrogen was uncertain.
(B) No separate positions were given to isotopes of an element.
(C) The order of increasing atomic mass was not strictly followed.
(D) All of these

2. The period number in the long form of the periodic table is equal to :
(A) magnetic quantum number of any element of the period.
(B) atomic number of any element of the period.
(C) maximum Principal quantum number of any element of the period.
(D) maximum Azimuthal quantum number of any element of the period.

3. Which one of the following statements related to the modern periodic table is **incorrect** :
(A) The p-block has 6 columns, because a maximum of 6 electrons can occupy all the orbitals in a p-subshell.
(B) The d-block has 8 columns, because a maximum of 8 electrons can occupy all the orbitals in a d-subshell.
(C) Each block contains a number of columns equal to the number of electrons that can occupy that subshell.
(D) The block indicates value of Azimuthal quantum number (ℓ) for the last subshell that received electrons in building up the electronic configuration.

4. Which is correct match ?
(A) Eka silicon-Ge **(B)** Eka aluminium-Ga **(C)** Both **(A)** and **(B)** **(D)** None of these

5. The elements in which electrons are progressively filled in 4f-orbital are called :
(A) actinoids **(B)** transition elements
(C) lanthanoids **(D)** halogens

6. Atomic number of Ag is 47. In the same group, the atomic numbers of elements placed above and below Ag in Long form of periodic table will be :
(A) 29, 65 **(B)** 39, 79 **(C)** 29, 79 **(D)** 39, 65

7. Element with electronic configuration as [Ar] $3d^5 4s^1$ is placed in ___ in Modern periodic table :
(A) IA (1^{st} group), s-block **(B)** IB (7^{th} group), d-block
(C) VIB (8^{th} group), d-block **(D)** VIB (6^{th} group), d-block

8. In modern periodic table, the element with atomic number Z = 118 will be :
(A) Uuo ; Ununoctium ; alkaline earth metal **(B)** Uno ; Unniloctium ; transition metal
(C) Uno ; Unniloctium ; alkali metal **(D)** Uuo ; Ununoctium ; noble gas

9. Which of the following is not an actinoid :
(A) Curium ($Z = 96$) **(B)** Californium ($Z = 98$) **(C)** Uranium ($Z = 92$) **(D)** Terbium ($Z = 65$)

10. Which of the following statements is not correct regarding hydrogen :
(A) It resembles halogens in some properties.
(B) It resembles alkali metals in some properties.
(C) It can be placed in 17^{th} group of Modern periodic table.
(D) It cannot be placed in 1^{st} group of Modern periodic table.

11. The order of screening effect of electrons of s, p, d and f orbitals of a given shell of an atom on its outer shell electrons is
(A) s > p > d > f **(B)** f > d > p > s **(C)** p < d < s > f **(D)** f > p > s > d

12. Which of the following is/are generally true regarding effective nuclear charge (Z_{eff}) :
(A) It increases on moving left to right in a period.
(B) It remains almost constant on moving top to bottom in a group.
(C) For isoelectronic species, as Z increases, Z_{eff} decreases.
(D) Both **(A)** and **(B)**.

13. Which of the following is the correct order of size of the given species :
(A) $I > I^- > I^+$ **(B)** $I^+ > I^- > I$ **(C)** $I > I^+ > I^-$ **(D)** $I^- > I > I^+$

14. Match the correct atomic radius with the element :

S.No.	Element	Code	Atomic radius (pm)
(i)	Be	(p)	74
(ii)	C	(q)	88
(iii)	O	(r)	111
(iv)	B	(s)	77
(v)	N	(t)	66

(A) (i) – r, (ii) – q, (iii) – t, (iv) – s, (v) – p **(B)** (i) – t, (ii) – s, (iii) – r, (iv) – p, (v) – q
(C) (i) – r, (ii) – s, (iii) – t, (iv) – q, (v) – p **(D)** (i) – t, (ii) – p, (iii) – r, (iv) – s, (v) – q

15. Select correct statement(s) about radius of an atom :
(A) Values of Vander waal's radii are larger than those of covalent radii because the Vander waal's forces are much weaker than the forces operating between atoms in a covalently bonded molecule.
(B) The metallic radii are smaller than the Vander waal's radii, since the bonding forces in the metallic crystal lattice are much stronger than the Vander waal's forces.
(C) Both **(A)** & **(B)**
(D) None of these

16. Which of the following order of atomic / ionic radius is not correct ?
(A) $F < Cl < Br < I$ **(B)** $Y^{3+} > Sr^{2+} > Rb^+$ **(C)** $Nb \approx Ta$ **(D)** $Li > Be > B$

17. The size of isoelectronic species F^-, Ne and Na^+ is affected by :
(A) nuclear charge (Z)
(B) valence principal quantum number (n)
(C) electron-electron interaction in the outer orbitals
(D) none of the factors because their size is the same.

18. Which of the following order of radii is correct :
(A) $Li < Be < Mg$ **(B)** $H^+ < Li^+ < H^-$ **(C)** $O < F < Ne$ **(D)** $Li < Na < K < Cs < Rb$

19. Which one of the following statements is incorrect in relation to ionisation enthalpy ?
(A) Ionization enthalpy increases for each successive electron.
(B) The greatest increase in ionization enthalpy is experienced on removal of electron from core of noble gas configuration.
(C) End of valence electrons is marked by a big jump in ionization enthalpy.
(D) Removal of electron from orbitals bearing lower n value is easier than from orbitals having higher n value.

20. The ionization enthalpy will be highest when the electron is to be removed from ..... if other factors are equal
(A) s-orbital **(B)** p-orbital **(C)** d-orbital **(D)** f-orbital

21. Which represents alkali metals (i.e. 1st group metals) based on $(IE)_1$ and $(IE)_2$ values (in kJ/mol) ?

		$(IE)_1$	$(IE)_2$			$(IE)_1$	$(IE)_2$
(A)	X	500	1000	**(B)**	Y	600	2000
(C)	Z	550	7500	**(D)**	M	700	1400

22. Which of the following relation is correct with respect to first (I) and second (II) ionization enthalpies of potassium and calcium ?

(A) $I_{Ca} > II_K$ **(B)** $I_K > I_{Ca}$ **(C)** $II_{Ca} > II_K$ **(D)** $II_K > II_{Ca}$

23. The first ionisation enthalpies (in eV) of N & O are respectively given by :

(A) 14.6, 13.6 **(B)** 13.6, 14.6 **(C)** 13.6, 13.6 **(D)** 14.6, 14.6

24. The first ionisation enthalpies of Na, Mg, Al and Si are in the order :

(A) Na < Mg > Al < Si **(B)** Na > Mg > Al > Si

(C) Na < Mg < Al < Si **(D)** Na > Mg > Al < Si

25. Among halogens, the correct order of amount of energy released in electron gain (electron gain enthalpy) is :

(A) F > Cl > Br > I **(B)** F < Cl < Br < I **(C)** F < Cl > Br > I **(D)** Cl > Br > F > I

26. The order of electron gain enthalpy (magnitude) of O, S and Se is :

(A) O > S > Se **(B)** S > Se > O **(C)** Se > S > O **(D)** S > O > Se

27. Which of the following statements is/are correct ?

(A) Electron gain enthalpy may be positive for some elements.

(B) Second electron gain enthalpy always remains positive for all the elements.

(C) $\Delta_{eg}H(K^+) = -IE(K)$

(D) All of these

28. Which of the following will have the most negative electron gain enthalpy and which the least negative ?

F, P, S, Cl.

(A) P, Cl **(B)** Cl, F **(C)** Cl, S **(D)** Cl, P

29. Electronic configurations of four elements A, B, C and D are given below :

(i) $1s^2 2s^2 2p^6$ (ii) $1s^2 2s^2 2p^4$ (iii) $1s^2 2s^2 2p^6 3s^1$ (iv) $1s^2 2s^2 2p^5$

Which of the following is the correct order of increasing tendency to gain electron :

(A) (i) < (iii) < (ii) < (iv) **(B)** (i) < (ii) < (iii) < (iv) **(C)** (iv) < (ii) < (iii) < (i) **(D)** (iv) < (i) < (ii) < (iii)

30. If x, y and z are electronegativity on Mulliken scale, ionisation potential (in V) and electron affinity (+, in eV) respectively, then the electron affinity in the terms of electronegativity and ionisation potential will be :

(A) $z = \frac{x+y}{2}$ **(B)** $y = \frac{x+z}{2}$ **(C)** $x = \frac{z-y}{2}$ **(D)** $z = 2x - y$

31 The electronegativity values of C,N,O and F on Pauling scale :

(A) decrease from carbon to fluorine.

(B) increase from carbon to fluorine.

(C) increase upto oxygen and then decrease upto fluorine.

(D) decrease from carbon to nitrogen and then increase continuously.

32. The correct order of electronegativity on Pauling scale is :

(A) F > Cl > O > S **(B)** Li > Na > K > Rb > Cs

(C) Be < B < N < C **(D)** Both **(A)** and **(B)**

33. Which of the following is affected by the stable electron configuration of an atom ?
(a) Electronegativity (b) Ionisation enthalpy (c) Electron gain enthalpy
Correct answer is :
(A) only electronegativity **(B)** only ionisation enthalpy
(C) only electron gain enthalpy and ionisation enthalpy **(D)** all of the above

34. Correct order of electronegativity of N, P, C and Si on Pauling scale is :
(A) N > P > C > Si **(B)** C > Si > N > P **(C)** N < P < C < Si **(D)** N > C > P > Si

35. The electronegativity values of the elements are useful in predicting :
(A) bond energy of a molecule. **(B)** polarity of a molecule.
(C) nature of an oxide. **(D)** all of these

36. Identify the incorrect order of acidic strengths of CO_2, CuO, CaO, H_2O :
(A) $CuO < CaO < H_2O < CO_2$ **(B)** $H_2O < CuO < CaO < CO_2$
(C) $CaO < H_2O < CuO < CO_2$ **(D)** All of these

37. Select the correct order(s) of acidic/basic strength :
(A) $NaOH < Mg(OH)_2 < Al(OH)_3$; basic strength **(B)** $H_2S > H_2Se > H_2Te$; acidic strength
(C) $H_2SO_3 < H_2SO_4$; acidic strength **(D)** Both **(B)** and **(C)**

38. The order of basic character of given oxides is :
(A) $Na_2O > MgO > CuO > SiO_2$ **(B)** $MgO > SiO_2 > CuO > Na_2O$
(C) $SiO_2 > MgO > CuO > Na_2O$ **(D)** $CuO > Na_2O > MgO > SiO_2$

39 An element X having configuration ns^2np^1 occurs in a short period of Modern periodic table. The formula and nature of its oxide is :
(A) XO_3, amphoteric **(B)** XO_3, acidic **(C)** X_2O_3, amphoteric **(D)** X_2O_3, basic

40. In which of the following elements, + 3 oxidation state is more stable than + 5 ?
(A) P **(B)** As **(C)** N **(D)** Bi

41. Which of following does not exists :
(A) TlI_3 **(B)** PbF_4 **(C)** Both **(A)** and **(B)** **(D)** None of these

42. Which of the following is correct order of stability :
(A) $Tl^{3+} > Bi^{3+}$ **(B)** $PbO_2 > PbO$ **(C)** $BiI_5 < BiF_5$ **(D)** $Sn^{2+} = Ge^{2+}$

43. Thallium shows different oxidation states because :
(A) of its high reactivity **(B)** of inert pair of electrons
(C) of its amphoteric nature **(D)** its is a transition metal

44. An element has atomic number is 29. It belongs to :
(A) 4^{th} period, group 11 **(B)** 5^{th} period, group 10
(C) 4^{th} period, group II B **(D)** 5^{th} period, IB group

45. The oxidation state of nitrogen varies from:
(A) –3 to + 5 **(B)** 0 to +5 **(C)** –3 to 1 **(D)** +3 to +5

46. When H_2SO_3 is converted into H_2SO_4 the change in the oxidation state of sulphur is from-
(A) 0 to + 2 **(B)** +2 to + 4 **(C)** +4 to +2 **(D)** +4 to + 6

47. The halogen that shows same oxidation state in all its compounds with other elements is-
(A) I_2 **(B)** F_2 **(C)** Cl_2 **(D)** Br_2

48. Which of the following contains atomic number of only -sblock
(A) 55,12,18,53 **(B)** 13,33,54,83 **(C)** 3, 20,55,87 **(D)** 22,33,55,66

49. What is the atomic number of last member of the seventh period of the extended form of periodic table?
(A) 116 **(B)** 118 **(C)** 120 **(D)** 122

50. The oxidation number and covalency of suphur in the sulphur molecule (S_8) are respectively :
(A) 0 and 2 **(B)** + 6 and 8 **(C)** 0 and 8 **(D)** +6 and 2

51. The oxidation number that iron does not exhibit in its common compounds or in its elemental state is :
(A) 0 **(B)** +1 **(C)** +2 **(D)** +3

52. Most stable oxidation state of gold is :
(A) + 1 **(B)** +3 **(C)** +2 **(D)** zero

53. The most stable oxidation state of chromium is -
(A) +5 **(B)** +3 **(C)** +2 **(D)** +4

54. Which can have both +ve and –ve oxidation states?
(A) F **(B)** I **(C)** Na **(D)** He

55. Conversion of $PbSO_4$ to PbS the oxidation number of sulphur in PbS is-
(A) –2 **(B)** + 6 **(C)** +4 **(D)** –1

56. Oxidation state of oxygen in H_2O_2 is-
(A) –2 **(B)** –1 **(C)**+1 **(D)** +2

57. The oxidation number of phosphorus in $Mg_2P_2O_7$ is
(A) +5 **(B)** –5 **(C)** +6 **(D)** –7

58. Which metal exhibits more than one oxidation states?
(A) Na **(B)** Mg **(C)** Al **(D)** Fe

59. The atomic number of an element which can not show the oxidation state of +3 is :
(A) 13 **(B)** 32 **(C)** 33 **(D)**17

60. The most common oxidation state of an element is –2. The number of electrons present in its outer most shell is :
(A) 2 **(B)** 4 **(C)** 6 **(D)** 8

61. Which of the following element shows only –1 oxidation number in combined state :
(A) F **(B)** Cl **(C)** Br **(D)** I

62. Oxidation number of S in S_2Cl_2 is
(A) + 1 **(B)** + 6 **(C)** 0 **(D)** – 1

63. In the conversion of Br_2 to BrO_3^-, the oxidation state of bromine changes from-
(A) 0 to + 5 **(B)** – 1 to + 5 **(C)** 0 to –3 **(D)** +2 to +5

64 Which of the following is true about the element $_{33}As$ according to Modern periodic table :
(A) It is a 5th period element. **(B)** It is a p-block element.
(C) It belongs to 16th group. **(D)** It is one among typical elements.

65. Li resembles Mg due to diagonal relationship, which is attributed to :
(A) similar atomic and ionic size **(B)** similar electronegativity
(C) similar ionization enthalpy **(D)** Both **(A)** and **(B)**

66. Which of the following is correct order of increasing Z_{eff} :
(A) $S^{2-} < Cl^- < K^+ < Ca^{2+}$ **(B)** $S^{2-} > Cl^- > K^+ > Ca^{2+}$
(C) $Cl^- < S^{2-} < K^+ < Ca^{2+}$ **(D)** $S^{2-} < Cl^- < Ca^{2+} < K^+$

67. When the following five anions are arranged in order of decreasing ionic radius, the correct sequence is :
(A) Se^{2-}, I^-, Br^-, O^{2-}, F^- **(B)** I^- , Se^{2-}, Br^- , F^-, O^{2-}
(C) Se^{2-}, I^-, Br^-, F^-, O^{2-} **(D)** I^-, Se^{2-}, Br^-, O^{2-}, F^-

68. The group in Modern periodic table, in which all the elements do not have same number of electrons in their valence shell is :
(A) 13th **(B)** 11th **(C)** 9th **(D)** zero

69. The first element of a group differs in many ways from the other heavier members of the group. This is due to :
(A) small size **(B)** high electronegativity and high ionisation potential
(C) unavailability of d-orbitals **(D)** all of the above

70. Screening effect is not observed in :
(A) He^+ **(B)** Li^{2+} **(C)** Be^{3+} **(D)** In all cases

71. The radii of N, N^{3-}, O and O^{2-} are in the order :
(A) $N^{3-} > O^{2-} > O > N$ **(B)** $O^{2-} > N^{3-} > N > O^{2-} > O$
(C) $N^{3-} > O^{2-} > N > O$ **(D)** $N > O > O^{2-} > N^{3-}$

72. In which of the following compounds, manganese shows maximum radius ?
(A) MnO_2 **(B)** $KMnO_4$ **(C)** MnO **(D)** $K_3[Mn(CN)_6]$

73. The statement that is **not** correct for periodic classification of elements in Modern periodic table is :
(A) The properties of elements are periodic function of their atomic numbers.
(B) Non-metallic elements are less in number than metallic elements.
(C) For transition elements, the 3d-orbitals are filled with electrons after 3p-orbitals and before 4s-orbitals.
(D) The first ionisation enthalpies of elements generally increase with increase in atomic number as we go along a period.

74. Values of IE_1, IE_2 and IE_3 of an element are 9.3, 18.2 and 553.8 eV. What information(s) do these data convey?
(A) The element has two electrons in the valence shell.
(B) The element belongs to 14th group of Modern periodic table.
(C) Both **(A)** and **(B)**
(D) None of these

75. Which of the following is the correct order of ionisation enthalpy ?
(1) $Be^+ > Be$ (2) $Be > Be^+$ (3) $C > Be$ (4) $B > Be$
(A) 2, 3 **(B)** 3, 4 **(C)** 1, 3 **(D)** 1, 4

76. Considering the elements B, Al, Mg, and K, the correct order of their metallic character is :

(A) B > Al > Mg > K **(B)** Al > Mg > B > K

(C) Mg > Al > K > B **(D)** K > Mg > Al > B

77. The formation of the oxide ion, $O^{2-}(g)$, from oxygen atom requires first an exothermic and then an endothermic step as shown below :

$O(g) + e^- \longrightarrow O^-(g)\ ;\ \Delta_{eg}H = -141\ kJmol^{-1}$

$O^-(g) + e^- \longrightarrow O^{2-}(g)\ ;\ \Delta_{eg}H = +780\ kJmol^{-1}$

Thus process of formation of O^{2-} in gas phase is unfavourable even though O^{2-} is isoelectronic with neon. It is due to the fact that :

(A) oxygen is more electronegative.

(B) addition of electron in oxygen results in larger size of the ion.

(C) electron repulsion outweighs the stability gained by achieving noble gas configuration.

(D) O^- ion has comparatively smaller size than oxygen atom.

78. Aqueous solutions of two compounds $M_1 - O - H$ and $M_2 - O - H$ are prepared in two different beakers. If, the electronegativity of $M_1 = 3.4$, $M_2 = 1.2$, O = 3.5 and H = 2.1, then the nature of two solutions will be respectively:

(A) acidic, basic **(B)** acidic, acidic **(C)** basic, acidic **(D)** basic, basic.

79. Which of the following statement is incorrect ?

(A) The tendency to attract bonded pair of electron in case of hybrid orbitals follow the order : $sp > sp^2 > sp^3$

(B) Alkali metals generally have negative value of electron gain enthalpy.

(C) $Cs^+(g)$ releases more energy upon gain of an electron than Cl(g).

(D) The electronegativity values for 2p-series elements is less than that for 3p-series elements on account of small size and high inter electronic repulsions.

80. The ground state electronic configurations of some elements, A, B, C, D, and E (these symbols represent the some of the known elements given in the Modern periodic table) are as follows :

A : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$

B : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$

C : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

D : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

E : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6$.

Match the electronic configurations of the elements with the properties given below and select the correct sequence by choosing the correct codes given.

(i) Element forms a cation which is isoelectronic with P^{3-}.

(ii) Element which in its compounds can show a maximum oxidation state of +6 and also forms coloured compounds in this oxidation state.

(iii) Element has largest atomic radius and highest first ionisation enthalpy in the respective period.

(iv) Element which has intermediate value of electronegativity and its oxide forms salts with strong acids and bases.

(A) B C E A **(B)** B D E C **(C)** B C D E **(D)** A B C D

81. Fluorine has the highest electronegativity among the $ns^2\ np^5$ group on the Pauling scale, but the electron affinity of fluorine is less than that of chlorine because :

(A) the atomic number of fluorine is less than that of chlorine.

(B) fluorine being the first member of the family behaves in an unusual manner.

(C) chlorine can accommodate an electron better than fluorine by utilising its vacant 3d–orbital.

(D) small size, high electron density and an increased electron repulsion makes addition of an electron to fluorine less favourable than that in the case of chlorine in isolated stage.

82. Which of the following statement is incorrect ?

(A) Oxide of aluminium (Al_2O_3), and arsenic (As_2O_3) are amphoteric.

(B) Oxide of chlorine (Cl_2O_7) is less acidic than oxide of nitrogen (N_2O_5).

(C) Oxide of carbon (CO_2) is more acidic than oxide of silicon (SiO_2).

(D) The correct increasing order of basic character of various oxides is $H_2O < CuO < MgO < CaO$.

83. Considering the elements F, Cl, O and N, the correct order of their chemical reactivity in terms of oxidizing property is :

(A) F > Cl > O > N **(B)** F > O > Cl > N **(C)** Cl > F > O > N **(D)** O > F > N > Cl

84. Strontium metaphosphate is

(A) $Sr(PO_3)_2$ **(B)** $SrHPO_3$ **(C)** $Sr_3(PO_4)_2$ **(D)** $Sr_2P_2O_7$

85. Nickel (II) pyroselenate is

(A) $Ni_2Se_2O_7$ **(B)** $NiSe_2O_7$ **(C)** $Ni_2Se_2O_5$ **(D)** $NiSe_2O_5$

86. The formula of sodium tungstate is Na_2WO_4 and that of lead phosphate is $Pb_3(PO_4)_2$. What is the formula for lead tungstate ?

(A) $PbWO_4$ **(B)** $Pb_2(WO_4)_3$ **(C)** $Pb_3(WO_4)_2$ **(D)** $Pb_3(WO_4)_4$

87. Mercurous azide is

(A) $Hg_2(N_3)_2$ **(B)** HgN_3 **(C)** Hg_2N_3 **(D)** $Hg(N_3)_2$

88. $Fe[Fe(CN)_6]$ is :

(A) ferroferrocyanide **(B)** Ferriferricyanide

(C) ferroferricyanide **(D)** ferriferrocyanide

89. Ethyl methyl ether , $CH_3–O–C_2H_5$, is used as an anaesthetic . Formula for corresponding thioether would be :

(A) $CH_3—S—C_2H_5$ **(B)** $CH_3—O—S—C_2H_5$

(C) $C_2H_5—O—CH_3$ **(D)** $C_2H_5—O—CH_2SH$

90. Hydracid which contains nitrogen is :

(A) HN_3 **(B)** HNO_3 **(C)** HNO_2 **(D)** NH_3

91. Anhydride of $HClO_4$ is :

(A) Cl_2O_7 **(B)** ClO_3 **(C)** Cl_2O_5 **(D)** ClO_2

92. Correct name of the compound $NaCrO_2$ will be

(A) Sodium metachromate **(B)** Sodium metachromite

(C) Sodium orthochromate **(D)** Sodium orthochromite

93. Which of the following acids cannot be simply converted into other acids by addition or removal of water ?
(A) H_3PO_4 **(B)** HPO_3 **(C)** H_3PO_3 **(D)** H_3PO_2

94. Of the following pairs, the one containing examples of metalloid elements is :
(A) B and Al **(B)** Ga and Ge **(C)** Al and Si **(D)** As and Sb

95. Which of the following is the wrong statement ?
(A) All the actinide elements are radioactive. **(B)** Alkali and alkaline earth metals are s-block elements.
(C) Pnicogens and halogens are p-block elements. **(D)** The first member of the lanthanide series is lanthanum.

96. Atomic number of 15, 33, 51 represents the following family :
(A) carbon family **(B)** nitrogen family **(C)** oxygen family **(D)** None of these

97. The places that were left empty by Mendeleev in his periodic table were for :
(A) aluminium and silicon **(B)** gallium and germanium
(C) arsenic and antimony **(D)** molybdenum and tungsten

98. The elements which exhibit both vertical and horizontal similarities are :
(A) inert gas elements **(B)** representative elements
(C) transition elements **(D)** none of these

99. According to Modern periodic table, Chalcogens are elements of :
(A) group 16 **(B)** p-block
(C) ns^2np^4 configuration **(D)** all of these

100. Which set does not shows correct matching according to Modern periodic table :
(A) Cr = [Ar] $3d^5\ 4s^1$; element belongs to 6^{th} group.
(B) Fe^{2+} = [Ar] $3d^6$; element belongs to 8^{th} group.
(C) Sc^{3+} = [Ne] $3s^2\ 3p^6$; element belongs to zero/eighteen group.
(D) All of the above.

101. In a given energy level, the order of penetration effect of different orbitals is :
(A) f < p < d < s **(B)** s < p < d < f **(C)** f < d < p < s **(D)** s = p = d = f

102. **Statement-1 :** Generally in a period in Modern periodic table, noble gas has the largest atomic radius.
Statement-2 : In case of noble gases, Vander waal's radius is defined and there are large inter-electronic repulsions.
(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. (E) Statement-1 and Statement-2 both are False.

103. **Statement-1 :** Br^- and As^{3-} are isoelectronic but the ionic radius of As^{3-} is greater than that of Br^-.
Statement-2 : The magnitude of effective nuclear charge on the outermost shell electrons in As^{3-} is lesser than that in Br^-.
(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. (E) Statement-1 and Statement-2 both are False.

104. Which of the following statement is wrong for the d-block elements :
(A) General electronic configuration for them is $(n-1)d^{1-10}ns^{0-2}$.
(B) They generally exhibit variable valency.
(C) Last electron enters in (n – 1)d subshell in them.
(D) They are placed from 3^{rd} to 6^{th} period in modern periodic table.

105. In which element shielding effect is not possible ?
(A) H **(B)** Be **(C)** B **(D)** N

106. Which of the following gaseous atoms has highest value of ionisation enthalpy ?
(A) P **(B)** Si **(C)** Mg **(D)** Al

107. The second ionization enthalpies of elements are always higher than their first ionization enthalpies because:
(A) cation formed always have stable half filled or completely filled valence shell electron configuration.
(B) it is easier to remove electron from cation.
(C) ionization is an endothermic process.
(D) the cation is smaller than its parent atom.

108. A large difference between the third and fourth ionization energies indicates the presence of :
(A) 4 valence electrons in an atom **(B)** 5 valence electrons in an atom
(C) 3 valence electrons in an atom **(D)** 2 valence electrons in an atom

109. Which of the following is the correct order of ionisation enthalpy ?
(A) $Te^{2-} < I^- < Cs^+ < Ba^{2+}$ **(B)** $I^- < Te^{2-} < Cs^+ < Ba^{2+}$
(C) $Te^{2-} < Cs^+ < I^- < Ba^{2+}$ **(D)** $Ba^{2+} < Cs^+ < I^- < Te^{2-}$

110. The correct order of electron gain enthalpy (most endothermic first and most exothermic last) is :
(A) Be < B < C < N **(B)** Be < N < B < C **(C)** N < Be < C < B **(D)** N < C < B < Be

111. For magnitude of electron gain enthalpy of chalcogens and halogens, which of the following options is correct ?
(A) Br > F **(B)** S > F **(C)** O < Cl **(D)** S < Se

112. The lanthanide contraction refers to :
(A) radius of the series. **(B)** valence electrons of the series.
(C) the density of the series. **(D)** electronegativity of the series.

113. Select correct statement(s) :
(A) Across a transition series (from Cr to Cu), there is only a small change in atomic radius from one element to another due to very small change in effective nuclear charge.
(B) The rate of decrease in the size across the lanthanide series is less than the across the first transition series.
(C) Both are correct statements.
(D) None of the statement is correct.

114. Which is/are true statement(s) ?
(A) Larger is the value of ionisation enthalpy, easier is the formation of cation.
(B) Larger is the value of electron gain enthalpy, easier is the formation of anion.
(C) Larger is the value of ionisation energy as well as electron affinity, smaller is the Mulliken electronegativity of atom.
(D) Larger is the Z_{eff}, larger is the size of atom.

115. Which of following ions do not exist together in aqueous solution :
(A) Pb^{2+}, F^- **(B)** Tl^{3+}, I^-
(C) Both **(A)** and **(B)** **(D)** None of these

116. Increasing order of acidic character is :
(A) $SO_3 > N_2O_5 > CO_2 > SiO_2$ **(B)** $SO_3 < N_2O_5 < CO_2 < SiO_2$
(C) $SO_3 < N_2O_5 > CO_2 < SiO_2$ **(D)** $SO_3 > N_2O_5 > CO_2 < SiO_2$

117. Amphoteric behaviour is shown by the oxides of :
(A) Al and Ca **(B)** Pb and N **(C)** Be and B **(D)** Sn and Zn

118. Which one of the following statements is correct ?
(A) The elements having large negative values of electron gain enthalpy generally act as strong oxidising agents.
(B) The elements having low values of ionisation enthalpies act as strong reducing agents.
(C) The formation of $S^{2-}(g)$ from S(g) is an endothermic process.
(D) All of these.

Exercise # 2 Part # I [Multiple Correct Choice Type Questions]

1. An element belongs to 3rd period and group-13 of the Modern periodic table. Which of the following properties will be shown by the element ?
(A) Good conductor of electricity **(B)** Liquid, metallic
(C) Solid, metallic **(D)** Solid, non-metallic

2. Which of the following orders is(are) correct for size :
(A) $Al \approx Ga$ **(B)** $Te^{2-} > I^- > Cs^+ > Ba^{2+}$
(C) $Cr^{3+} < Cr^{6+}$ **(D)** $Pd \approx Pt$

3. Which of the following statements is/are correct ?
(A) The second ionization enthalpy of oxygen element is greater than that of fluorine element.
(B) The third ionization enthalpy of phosphorus is greater than that of aluminium.
(C) The first ionization enthalpy of aluminium is slightly greater than that of gallium.
(D) The second ionization enthalpy of copper is greater than that of zinc.

4. Which of the following elements will gain one electron more readily in comparison to other elements of their group
(A) S(g) **(B)** Na(g) **(C)** O(g) **(D)** Cl (g)

5. Which of the following sequences contain atomic numbers of only representative elements ?
(A) 3, 33, 53, 87 **(B)** 2, 10, 22, 36 **(C)** 7, 17, 25, 37, 48 **(D)** 9, 35, 51, 88

6. Ionic radii vary in :
(A) inverse proportion to the effective nuclear charge.
(B) inverse proportion to the square of effective nuclear charge.
(C) direct proportion to the screening effect.
(D) direct proportion to the square of screening effect.

7. Those elements impart colour to the flame on heating in it, the atoms of which require low energy for the ionisation (i.e. absorb energy in the visible region of spectrum). The elements of which of the following groups in Modern periodic table will impart colour to the flame ?
(A) 2 **(B)** 13 **(C)** 1 **(D)** 17

8. 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 IE_1 : $B < Al < Ga < In < Tl$ **(D)** increasing IE_1 : $Li < Na < K < Rb$

9. Ionisation energy of atoms A and B are 350 and 250 $kCalmol^{-1}$ respectively. The electron affinities of these atoms are 70 and 90 $kCalmol^{-1}$ respectively. Then :
(A) electron cloud is more attracted by A
(B) electron cloud is more attracted by B.
(C) on Mulliken scale, electronegativity of A is more than B
(D) on Mulliken scale, electronegativity of A is less than B

10. Which of the following has/have no unit ?
(A) Electronegativity **(B)** Electron gain enthalpy
(C) Ionisation enthalpy **(D)** Metallic character

11. Poor shielding of nuclear charge by d or f- orbital electrons is responsible for which of the following facts ?
(A) Atomic radius of Nb (4d-series) is comparable to that of Ta (5d-series)
(B) The Ist ionisation enthalpy of copper is less than that of zinc
(C) The value of electron gain enthalpy is more negative for sulphur than for oxygen.
(D) The Ist ionisation energy for gold is greater than that of silver.

12. Which of the following is/are true order(s) ?

(A) $B^+ < B < B^-$ Size

(B) $I < Br < Cl < F$ Electron gain enthalpy

(C) $O^{--} < O^- < O^+$ Z_{eff}

(D) $Na < Al < Mg < Si$ Ionisation potential

13. Which of the following statements is/are correct ?

(A) Helium has the highest first ionisation enthalpy in the Modern periodic table.

(B) Sulphur has less negative electron gain enthalpy than oxygen.

(C) Mercury and bromine are liquids at room temperature.

(D) In any period of Modern periodic table, atomic radius of alkali metal is the highest.

14. A, B and C are oxides of elements X, Y and Z respectively. X, Y and Z are in the same period of the Modern periodic table. A gives an aqueous solution which turns blue litmus red. B reacts with both strong acids and strong alkalies. C gives an aqueous solution which is strongly alkaline.

Which of the following statement is/are true ?

(A) All the three elements are metals.

(B) The Pauling electronegativities decrease from X to Y to Z.

(C) The atomic radius increases in the order X < Y < Z.

(D) X, Y and Z could be phosphorus, aluminium and sodium respectively.

15. Which of the following acids are ortho-acids

(A) H_3PO_4 **(B)** H_3BO_3 **(C)** $H_4Si_2O_7$ **(D)** H_5IO_6

16. Prefix pyro-is attached to the names

(A) As_2O_3 **(B)** $S_2O_7^{2-}$ **(C)** Sb_2O_5 **(D)** $H_4As_2O_7$

17. Identify the meta -acids

(A) $HMnO_4$ **(B)** H_2SnO_3 **(C)** $HClO_3$ **(D)** HPO_3

18. Names of which of the following acids end in -ic acid?

(A) H_2SO_4 **(B)** $HClO_4$ **(C)** H_2SO_3 **(D)** HNO_2

19. Names of which of the following end in -ous acid ?

(A) HNO_2 **(B)** H_2CO_3 **(C)** H_2SO_3 **(D)** HBO_2

20. Select the endothermic step(s) :

(A) $S^-(g) + e^- \longrightarrow S^{2-}(g)$

(B) $Ne(g) + e^- \longrightarrow Ne^-(g)$

(C) $N(g) + e^- \longrightarrow N^-(g)$

(D) $AI^{2+}(g) \longrightarrow AI^{3+}(g) + e^-$

21. Select the incorrect statement(s).

(A) IE_1 of nitrogen atom is less than IE_1 of oxygen atom.

(B) Electron gain enthalpy of oxygen is less negative than selenium.

(C) Electronegativity on Pauling scale is 2.8 times the electronegativity on Mulliken scale.

(D) Cr^{6+} is smaller than Cr^{3+}.

22. Which is/are incorrect order for the properties specified ?

(A) I > Br > Cl > F (oxidising character)

(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)

23. Which are correct match :-

(A) O < C < S < Se — Atomic size

(B) Na < Al < Mg < Si — I^{st} I.P

(C) MgO < SrO < Cs_2O < K_2O — Basic character

(D) $P_4O_{10} > SO_3 > Cl_2O_7$ - Acidic character

24. Which are correct match :-

(A) O > F > N > C — IInd I.P.

(B) $S^{-2} > Cl^- > K^+ > Ca^{+2}$ — Ionic radius

(C) N > C > P > Si— E. N.

(D) F > Na > Ne — I^{st} I.P.

25. Which of the following statement is/are not correct:-

(A) I.P. increases down the group

(B) IP of s–block elements is less than corresponding d– block elements

(C) If ΔIP > 16 eV higher oxidation state is more stable

(D) IP of halogen elements is maximum in their respective period

26. Out of the following statements which is/are correct :-

(A) H is an element of minimum atomic radius

(B) He is an element of highest I.P.

(C) Cl is an element of highest EA

(D) Li is an element of lowest I.P.

27. AB is predominantly ionic as A^+ B^- if :-

(A) $(IP)_A < (IP)_B$ **(B)** $(EA)_A < (EA)_B$ **(C)** $(EN)_A < (EN)_B$ **(D)** Size of A < size of B

28. The properties which are common to the elements belonging to groups 1 and 17 of periodic tables are-

(A) Electropositive character increases down the group

(B) Reactivity decreases from top to bottom

(C) Atomic radii increases as atomic number increases

(D) Electronegativity decreases on moving down a group

29. The number of which subatomic particle is same in case of chlorine atom and chloride ion :

(A) Electron **(B)** Proton **(C)** Neutrons **(D)** All of the above

30. Which of the following show amphoteric behaviour :

(A) $Zn(OH)_2$ **(B)** BeO **(C)** Al_2O_3 **(D)** $Pb(OH)_2$

31. Fluorine is stronger oxidizing agent than chlorine in aqueous solution. This can be attributed to the property :

(A) Heat of dissociation

(B) Electron affinity

(C) Ionization potential

(D) Heat of hydration

32. Electron affinify of the elements or ions shown correct :

(A) $S > O^-$ **(B)** $O > S^-$ **(C)** $O^- > S^-$ **(D)** $N^- > S$

33. Ionization energy of an element is :

(A) Equal in magnitude but opposite in sign to the electron gain enthalpy of the cation of the element

(B) Same as electron affinity of the element

(C) Energy required to remove one valence electron from an isolated gaseous atom in its ground state

(D) Equal in magnitude but opposite in sign to the electron gain enthalpy of the anion of the element

34. Select equations having endothermic step :

(A) $S^{-}(g) \longrightarrow S^{2-}(g)$

(B) $Na^{+}(g) + Cl^{-}(g) \longrightarrow NaCl(s)$

(C) $N(g) \longrightarrow N^{-}(g)$

(D) $Al^{2+}(g) \longrightarrow Al^{3+}(g)$

35. Consider the following ionization steps :

$$M(g) \longrightarrow M^{+}(g) + e^{-} ; \Delta H = 100 \text{ eV}$$

$$M(g) \longrightarrow M^{2+}(g) + 2e^{-} ; \Delta H = 250 \text{ eV}$$

select correct statement(s) :

(A) $I.E._1$ of M(g) is 100 eV **(B)** $I.E._1$ of $M^{+}(g)$ is 150 eV

(C) $I.E._2$ of M(g) is 250 eV **(D)** $I.E._2$ of M (g) is 150 eV

36. Which of the following statements are correct :

(A) F is the most electronegative and Cs is the most electropositive element.

(B) The electronegativity of halogens decreases from F to I

(C) The electron affinity of Cl is higher than that of F though their electronegativities are in the reverse order

(D) The electron affinity of noble gases is almost zero.

37. Diagonal relationships are shown by :

(A) Be and Al **(B)** Li and Mg **(C)** Mg and Al **(D)** B and P

Part # II [Assertion & Reason Type Questions]

Each question has 5 choices (A), (B), (C), (D) and (E) out of which only one is correct.

(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.

(E) Statement-1 and Statement-2 both are False.

1. **Statement-1 :** The atomic radii of the elements of the oxygen family are smaller than the atomic radii of the corresponding elements of the nitrogen family.
Statement-2 : The members of the oxygen family are more electronegative because they have lower values of nuclear charge, than those of the nitrogen family.

2. **Statement-1 :** In general, for an element, $IE_1 < IE_2 < IE_3$ ..... .
Statement-2 : After the removal of each successive electron, remaining electrons are held more tightly by the nucleus. So removal of next electron becomes difficult.

3. **Statement-1 :** Generally, ionisation enthalpy increases from left to right in a period in Modern periodic table.
Statement-2 : When successive electrons are added to the orbitals in the same principal quantum level, the shielding effect of inner core of electrons does not increase very much to compensate for the increased attraction of the electron to the nucleus.

4. **Statement-1 :** The 4f- and 5f- inner transition series of elements are placed separately at the bottom of the Modern periodic table.
Statement-2 : (i) Position of f-block elements prevents the undue expansion of the Modern periodic table i.e., maintains its structure.
(ii) Position of f-block elements preserves the principle of classification by keeping elements with similar properties in a single column.

5. **Statement-1 :** Boron has a smaller first ionisation enthalpy than beryllium.
Statement-2 : The penetration of a 2s electron to the nucleus is more than the 2p electron, hence 2p electron is more shielded by the inner core of electrons than the 2s electrons.

6. **Statement-1 :** NO is an acidic oxide while CrO_3 is a basic oxide.
Statement-2 : Oxides of metals are generally basic and oxides of non-metals are generally acidic.

7. **Statement-1 :** The decreasing order of acidic character of CO_2, N_2O_5 , SiO_2 and SO_3 is $SO_3 > N_2O_5 > CO_2 > SiO_2$.
Statement-2 : Acidic character of oxides increases on moving top to bottom in a group and decreases on moving left to right in a period in Modern periodic table.

8. **Statement-1 :** Electron gain enthalpy values of the 3rd period p-block elements of the Modern periodic table are generally more negative than the 2nd period element of the same group.
Statement-2 : Due to smaller atomic size of the 2nd period element, its electron density is high which eases the addition of electron.

9. **Statement-1 :** Metallic character of first group metals of Modern periodic table increases down the group.
Statement-2 : On moving top to bottom in first group in Modern periodic table, value of ionisation enthalpy continuously decreases.

10. **Statement-1 :** Electron gain enthalpy always becomes less negative as we go down a group in Modern periodic table.
Statement-2 : Size of the atom increases on going down the group in Modern periodic table and the added electron would be farther from the nucleus.

11 **Statement -1** : Size of anion is larger than their parent atom.
Statement -2 : Zeff of anion is greater than that of their parent atom.

12. **Statement -1** : Atomic radius of inert gases is largest in the period
Statement -2 : Effective nuclear charge of inert gases is minimum

13. **Statement -1** : 2^{nd} IP of alkali metals is maximum in the period.
Statement -2 : Alkali metals has smallest atomic size in the period.

14. **Statement -1** : First ionization energy of nitrogen is lower than oxygen.
Statement -2 : Across the period effective nuclear charge decreases.

15. **Statement -1** : Two successive ionisation energies of Argon are 56.8 eV and 36.8 eV respectively.
Statement -2 : Zeff of Ar ($3s^23p^6$) is greater than Ar^+ ($3s^23p^5$).

16. **Statement -1** : The third period contains only 8 elements and not 18 like 4th period.
Statement -2 : In III period filling starts from $3s^1$ and complete at $3p^6$ whereas in IV period it starts from $4s^1$ and complete after $3d^{10}$ and $4s^2$.

17. **Statement -1** : Electron affinity of fluorine is greater than chlorine.
Statement -2 : Ionisation potential of fluorine is less than chlorine.

Exercise # 3 Part # I [Matrix Match Type Questions]

1. Match the electronic configurations of the elements given in **column-(I)** with their correct characteristic**(s)** (i.e. properties for given configuration) given in **column-(II)**.

Column-I	Column-II
(A) $1s^2$	**(p)** Element shows highest negative oxidation state.
(B) $1s^2\ 2s^2\ 2p^5$	**(q)** Element shows highest first ionisation enthalpy.
(C) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$	**(r)** Element shows highest electronegativity on Pauling scale.
(D) $1s^2\ 2s^2\ 2p^2$	**(s)** Element shows maximum electron gain enthalpy (most exothermic).

2. Match Column–I (atomic number of elements) withColumn–II (position of element in periodic table) and select the correct answer using the codes given below :

Column-I	Column-II
(A) 19	**(p)** p-block
(B) 22	**(q)** f-block
(C) 32	**(r)** d-block
(D) 64	**(s)** s-block

3.

Column-I	Column-II
(A) Increasing ionisation potential	**(p)** N > O > F
(B) Increasing electronegativity	**(q)** N < O < F
(C) Decreasing Zeff	**(r)** O < N < F
(D) Decreasing electron affinity	**(s)** O > C > N

4. Match Column–I (Elements) withColumn–II (configuration of elements) and select the correct answer using the codes given below :

Column-I	Column-II
(A) The third alkali metal	**(p)** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
(B) The second transition element	**(q)** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6$
(C) The fourth noble gas element	**(r)** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2\ 4s^2$
(D) The second helogen element	**(s)** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$

5.

Column-I	Column-II
(A) Increasing atomic size	**(p)** Cl < O < F
(B) Decreasing atomic radius	**(q)** Li < Be < B
(C) Increasing electronegativity	**(r)** Si < Al < Mg
(D) Increasing effective nuclear charge	**(s)** N > O > F

6.

Column-I	Column-II
(A) Metalloid	**(p)** Selenium
(B) Radioactive	**(q)** Silver
(C) Transition	**(r)** Arsenic
(D) Chalcogen	**(s)** Uranium

Part # II [Comprehension Type Questions]

Comprehension # 1

Ionization energies of five elements in kcal/mol are given below :

Atom	I	II	III
P	300	549	920
Q	99	734	1100
R	118	1091	1652
S	176	347	1848
T	497	947	1500

1. Which element is a noble gas ?
(A) P **(B)** T **(C)** R **(D)** S

2. Which element form stable unipositive ion :
(A) P **(B)** Q **(C)** R **(D)** S

3. The element having most stable oxidation state +2 is :
(A) Q **(B)** R **(C)** S **(D)** T

4. Which is a non-metal (excluding noble gas) :
(A) P **(B)** Q **(C)** R **(D)** S

5. If Q reacts with fluorine and oxygen, the molecular formula of fluoride and oxide will be respectively :
(A) QF_3, Q_2O_3 **(B)** QF, Q_2O **(C)** QF_2, QO **(D)** None of these

6. Which of the following pair represents elements of same group :
(A) Q, R **(B)** P, Q **(C)** P, S **(D)** Q, S

Comprehension # 2

Four elements P,Q,R & S have ground state electronic configuration as :

$P \rightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$ $Q \rightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

$R \rightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^3$ $S \rightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^1$

1. Which of the following option represent the correct order of true (T) and False (F) Statement:

I. size of P< size of Q II. size of R < size of S

III. size of P < size of R (appreciable difference) IV. size of Q < size of S (appreciable difference)

(A) TTTT **(B)** TTTF **(C)** FFTT **(D)** TTFF

2. Order of IE_1 values among the following is :
(A) P > R > S > Q **(B)** P < R < S < Q **(C)** R > S > P > Q **(D)** P > S > R > Q

Comprehension # 3

In the modern periodic table, elements are arranged in order of increasing atomic numbers which is related to the electronic configuration. Depending upon the type of orbitals receiving the last electron, the elements in the periodic table have been divided into four blocks, viz, s, p, d and f. The modern periodic table consists of 7 periods and 18 groups. Each period begins with the filling of a new energy shell. In accordance with the Arfbau principle, the seven periods (1 to 7) have 2, 8, 8, 18, 18, 32 and 32 elements respectively. The seventh period is still incomplete. To avoid the periodic table being too long, the two series of f-block elements, called lanthanoids and actinoids are placed at the bottom of the main body of the periodic table.

Now answer the following five questions :

1. The element with atomic number 57 belongs to :

(A) s-block **(B)** p-block **(C)** d-block **(D)** f-block

2. The last element of the p-block in 6th period is represented by the outermost electronic configuration :

(A) $7s^2 7p^6$ **(B)** $5f^{14} 6d^{10} 7s^2 7p^0$ **(C)** $4f^{14} 5d^{10} 6s^2 6p^6$ **(D)** $4f^{14} 5d^{10} 6s^2 6p^4$

3. Which of the elements, whose atomic numbers are given below, cannot be accommodated in the present set up of the long form of the periodic table ?

(A) 107 **(B)** 118 **(C)** 126 **(D)** 102

4. The electronic configuration of the element which is just above the element with atomic number 43 in the same group is _____:

(A) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$ **(B)** $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^3 4p^6$

(C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$ **(D)** $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7 4s^2$

5. The elements with atomic numbers 35, 53 and 85 are all _____ :

(A) noble gases **(B)** halogens **(C)** heavy metals **(D)** light metals

Comprehension # 4

It is not possible to measure the atomic radius precisely since the electron cloud surrounding the atom does not have a sharp boundary. One practical approach to estimate the size of an atom of a non-metallic element is to measure the distance between two atoms when they are bound together by a single bond in a covalent molecule and then dividing by two. For metals we define the term "metallic radius" which is taken as half the internuclear distance separating the metal cores in the metallic crystal. The van der waal's radius represents the over all size of the atoms which includes its valence shell in a non bonded situation. It is the half of the distance between two similar atoms in separate molecules in a solid. The atomic radius decreases across a period and increases down the group. Same trends are observed in case of ionic radius. Ionic radius of the species having same number of electrons depends on the number of protons in their nuclei. Sometimes, atomic and ionic radii give unexpected trends due to poor shielding of nuclear charge by d- and f-orbital electrons.

Now answer the following three questions :

1. Which of the following relations is correct, if considered for the same element :

(A) $r_{Vanderwaal} > r_{Covalent} > r_{Metallic}$ **(B)** $r_{Covalent} > r_{Metallic} > r_{Vanderwaal}$

(C) $r_{Vanderwaal} > r_{Metallic} > r_{Covalent}$ **(D)** $r_{Metallic} > r_{Covalent} > r_{Vanderwaal}$

2. K^+, Cl^- , Ca^{2+} , S^{2-} ions are isoelectronic. The decreasing order of their size is :

(A) $Ca^{2+} > K^+ > Cl^- > S^{2-}$ **(B)** $S^{2-} > Cl^- > K^+ > Ca^{2+}$

(C) $K^+ > Cl^- > Ca^{2+} > S^{2-}$ **(D)** $S^{2-} > Cl^- > Ca^{2+} > K^+$

3. Select the INCORRECT option regarding atomic/ionic sizes :

(A) $Zn > Cu$ **(B)** $Pb^{2+} > Pb^{4+}$ **(C)** $Zr \approx Hf$ **(D)** $N^{3-} < Al^{3+}$

Comprehension # 5

The periodicity is related to the electronic configuration. That is, all chemical and physical properties are a manifestation of the electronic configuration of the elements.

The atomic and ionic radii generally decrease in a period from left to right. As a consequence, the ionization enthalpies generally increase and electron gain enthalpies become more negative across a period. In other words, the ionization enthalpy of the extreme left element in a period is the least and the electron gain enthalpy of the element on the extreme right is the highest negative. This results into high chemical reactivity at the two extremes and the lowest in the centre. Similarly down the group, the increase in atomic and ionic radii result in gradual decrease in ionization enthalpies and a regular decrease (with exception in some third period elements) in electron gain enthalpies in the case of main group elements.

The loss and gain of electrons can be co-related with the reducing and oxidising behaviour, and also with metallic and non-metallic character respectively, of the elements.

1. The correct order of the metallic character is :

(A) Al > Mg > Na > Si

(B) Na > Mg < Al > Si

(C) Na > Mg > Al > Si

(D) Al > Mg > Si > Na

2. Considering the elements B, C, N, F, and Si, the correct order of their non-metallic character is :

(A) B > C > Si > N > F

(B) Si > C > B > N > F

(C) F > N > C > B > Si

(D) F > N > C > Si > B

3. Which of the following statement is correct ?

(A) Ionisation enthalpies of elements decrease along a period and increase along a group in Modern periodic table.

(B) In the 3rd period of Modern periodic table, the two most reactive elements are sodium and fluorine.

(C) Fluorine has the least negative electron gain enthalpy among all halogens.

(D) Ionisation enthalpy of Pb is greater than that of Sn.

Exercise # 4 [Subjective Type Questions]

1. Describe the term penetration as it applies to electronic configuration. The properties of which one of the following elements are most modified by penetration, and the properties of which one are least modified : Zn, Ca, Br, H ?

2. Why the size of atom decreases from scandium to vanadium, remains almost unaltered from chromium to copper but increases from copper to zinc ?

3. Why is the decrease in size between Li and Be more pronounced than that between Na and Mg or K and Ca?

4. Why the I^{st} ionisation enthalpy of potassium is less than that of copper but the reverse is true for II^{nd} ionisation enthalpy ?

5. The ionisation enthalpies of the coinage metals fall in the order Cu > Ag < Au. Why ?

6. With reference to Modern periodic table, identify :
(a) an element that is in group III A (group 13) and 3^{rd} period.
(b) the second transition element of fourth period.
(c) the group which accommodates lanthanides and actinides.
(d) the elements of 15^{th} group which show metallic as well as non-metallic behaviour.

7. An element belonging to 3d series of Modern periodic table has spin magnetic moment = 5.92 B.M. in +3 oxidation state. Determine the atomic number and name of the element. Also determine the period, block and group of the element in Modern periodic table.

8. Inspite of both O^{2-} and F^- having stable electronic configuration of Neon, the formation of $F^-(g)$ from F(g) is exothermic where as that of $O^{2-}(g)$ from O(g) is endothermic. Why ?

9. First and second ionisation enthalpies of Mg 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. (Given : Atomic mass of Mg = 24 amu.)

10. The second ionization enthalpies (in $kJmol^{-1}$) of some elements of 4th period of Modern periodic table are :

Ca	Sc	Ti	V	Cr	Mn
1145	1235	1310	1365	1592	1509

Account for the trend in values.

11. The electron gain enthalpy of a hypothetical element 'A' is –3 eV per atom. How much energy in kCal is released when 10 g of 'A' are completely converted to A^- ions in gaseous state ?
(Take : 1 eV per atom = 23 kCal mol^{-1}, Molar mass of A = 30 g)

12. For the gaseous reaction $K + F \rightarrow K^+ + F^-$, ΔH was calculated to be 18.4 kCal/mol under conditions where the cations and anions were prevented from combining with each other. The ionization enthalpy of K is 4.3 eV/atom. What is the electron gain enthalpy of F (in eV) ? (Take : 1 eV/atom = 23 kCal/mol)

13. In Modern periodic table, the increasing order of reactivity among group 1 elements is Li < Na < K < Rb < Cs whereas that among group 17 elements is F > Cl > Br > I. Explain.

14. "CO is acid anhydride of Formic acid (HCOOH) and N_2O is acid anhydride of Hyponitrous acid ($H_2N_2O_2$)". State whether true or false. Comment.

15. The acidic strength of hydrohalic acids (HX) increases on moving down the group in Modern periodic table, while it decreases for perhalic acids (HXO_4). Explain.

16. Which of the following compounds are found to exist ?

BiF_5, PbO_2, $SnCl_2$, Tl_2O_3, PbI_4, As_2O_3

17. If 0.5 mole of gaseous non-metallic X^- anions requires 806.4 kJ energy to get completely converted into gaseous X^+ ions, then calculate Pauling's electronegativity of the element X. Assume that element X has negative value of electron gain enthalpy. Use Avogadro's No. = 6×10^{23} and 1eV = 1.6×10^{-19} J.

Hint : [Pauling's electronegativity = $\frac{\text{Mulliken's Electronegativity}}{2.8}$]

18. Electronegativity values on Mulliken scale for two different elements are given as 7 and 1.4 respectively. If bond is formed between them, then calculate the percentage ionic character of the bond between them, using Hanny Smith formula.

19. Write the chemical formula of following compounds/ions

(1) ferric sulphate	(2) Magnesium phosphite	(3) Nickel dithiosulphate
(4) Cadmium nitrite	(5) Calcium metaborate	(6) Mercuric iodide
(7) Nickel bisulphate	(8) Arsenous oxide	(9) Lead formate
(10) Aluminium acetate	(11) Sodium dichromate	(12) Potassium cyanide
(13) Cuprous sulphide	(14) Metaphosphate ion	(15) Hydrogen peroxide
(16) Ammonium hyponitrite	(17) Aluminium hydrogenphosphite	

20. Give the chemical formulae for

(a) Potassium pyrosulphite	(b) potassium hydrogenpyrophosphite
(c) Barium permanganate	(d) Scandium trihydrogenpyrosilicate
(e) Sodium strontium aluminium pyrosilicate	(f) Vanadium (III) Phosphate

21. Give the formulae for

(a) Magnesium Nitride	(b) Barium fluoride	(c) Iron (III) sulphide
(d) Strontium hydride	(e) indium (I) chloride	(f) Rubidium super oxide
(g) Caesium lodide	(h) Calcium phosphide	(i) Stannous chloride
(j) Potassium ozonide	(k) chromium (III) oxide	(l) Mercurous chloride
(m) Potassium peroxide	(n) Xenon tetraoxide	

22. Which of the following formulae are wrong ? Write the correct possibilities?

(1) NO_2	**(2)** AlO_2	**(3)** CO_2	**(4)** SiI_2	**(5)** SnO	**(6)** PbO_2
(7) FeO	**(8)** MnO_2	**(9)** V_2O_5	**(10)** K_3I	**(11)** Cr_2O_7	**(12)** BiF_5
(13) PbO_2	**(14)** Ti_2O_5	**(15)** CuF_4	**(16)** AgF_3	**(17)** ZnS	**(18)** K_2O
(19) K_2O_2	**(20)** K_2O_5	**(21)** K_2Se	**(22)** KSe_3	**(23)** KI_3	**(24)** KI
(25) $Ni(CN)_2$	**(26)** FeO_4	**(27)** HeO_4	**(28)** HeS	**(29)** H_2S	**(30)** BiO_2
(31) SnS_2	**(32)** SnS	**(33)** Sn_2S_3	**(34)** YCl_3	**(35)** CdF_3	**(36)** XeF_7
(37) FeO_2	**(38)** CrO_3	**(39)** KO_2	**(40)** AgCl	**(41)** SiH_4	**(42)** $ZrCl_3$
(43) Fe_2O_3	**(44)** $NiCl_5$	**(45)** KO_3	**(46)** XeO_4	**(47)** $Rb(CN)_3$	

23. Name of the following

(a) XeF_6	(b) SCl_2	(c) SO_2	(d) SO_3	(e) NO_2	(f) N_2O_5
(g) N_2O_4	(h) XeO_4	(i) Li_3N	(j) RbN_3	(k) MnO_2	(l) BaO_2
(m) Tl_2O_3	(n) CsO_3	(o) $Zn(CN)_2$	(p) LiH	(q) CH_4	(r) NaAu
(s) UO_2	(t) PbH_4				

24. Give the formulae for

(a) Tantallum (III) nitride	(b) Gold (III) fluoride	(c) Iron (II) iodide
(d) Barium azide	(e) strontium nitride	(f) Caesium peroxide
(g) Xenon trioxide	(h) Radium silicide	(i) Lithium hydride
(j) Beryllium telluride	(k) Potassium ozonide	(l) Chromium (III) sulphide
(m) Bismuth (III) oxide	(n) Gallium selenide	(o) Aluminium arsenide

25. Group the elements, whose atomic numbers are given below, into various blocks in Modern periodic table :
19, 25, 31, 38, 42, 54, 64, 105

26. What is the name given to the elements which represent the properties of lower elements of their respective group in Modern periodic table ? These elements belong to which period in Modern periodic table ?

27. A particular atom having atomic number between 22 to 30 has spin magnetic moment equal to 1.73 B.M. Then find the atomic number of the element which is just below it in the Modern periodic table.

28. Compare the screening effect of a d-electron with a f-and a p-electron.

29. Arrange the following in order of atomic/ionic radius :
(i) N^{3-}, P^{3-}, As^{3-} (ii) Cr, Mn, Fe (iii) Cu, Zn

30. Why the I^{st} ionisation enthalpy of nitrogen is higher than oxygen and opposite is true for second ionisation enthalpy ?

31. Compare qualitatively the first and second ionization potentials of copper and zinc. Explain the observation.

32. The alkali metals (IA) and coinage metals (IB) seem to have the same outer electronic configuration ns^1 (n = principal quantum number of outermost shell), but group (IB) elements are more stable than group (IA) elements. Explain.

33. Na^+ has higher value of ionisation enthalpy than Ne, though both have same electronic configuration. Explain.

34. Give the variation of :
(a) Ionisation enthalpy in Group 14 of Modern periodic table.
(b) Pauling's electronegativity in Group 13 of Modern periodic table.

35. The ionisation enthalpies of atoms A and B are 400 and 300 $kCalmol^{-1}$ respectively. The electron affinities of these atoms are 80 and 90 $kCalmol^{-1}$ respectively. Determine which of the atoms have higher electronegativity on Pauling scale. (Take : $23.1 \times 5.6 = 130$).

36. Calculate the % ionic character in AB molecule according to Hanny Smith formula, if bond enthalpy (in kCal/mol) of
AB molecule is 6 units.
AA molecule is 4 units.
BB molecule is 1 unit.
Take : $0.104 \times 2 = 0.2$.

37. Electrons of which subshell do not participate in bonding due to inert pair effect ?

38. Arrange the following in correct order of reducing capacity :
Ge^{2+} , Sn^{2+}, Pb^{2+}

Exercise # 5 Part # I [Previous Year Questions] [AIEEE/JEE-MAIN]

1. Which one of the following ions has the highest value of ionic radius ? **[AIEEE-2004]**

(1) Li^+ **(2)** B^{3+} **(3)** O^{2-} **(4)** F^-

2. The formation of the oxide ion $O^{2-}_{(g)}$ requires first an exothermic and then an endothermic step as shown below :

$$O_{(g)} + e^- = O^-_{(g)} ; \Delta H° = -142 \text{ kJmol}^{-1}$$
$$O^-_{(g)} + e^- = O^{2-}_{(g)} ; \Delta H° = 844 \text{ kJmol}^{-1}$$ **[AIEEE-2004]**

This is because :

(1) oxygen is more electronegative.

(2) oxygen has high electron affinity.

(3) O^- ion will tend to resist the addition of another electron.

(4) O^- ion has comparatively larger size than oxygen atom.

3. Among Al_2O_3, SiO_2, P_2O_3 and SO_2 the correct order of acid strength is : **[AIEEE-2004]**

(1) $SO_2 < P_2O_3 < SiO_2 < Al_2O_3$ **(2)** $SiO_2 < SO_2 < Al_2O_3 < P_2O_3$

(3) $Al_2O_3 < SiO_2 < SO_2 < P_2O_3$ **(4)** $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

4. Which of the following oxides is amphoteric in nature ? **[AIEEE-2005]**

(1) CaO **(2)** CO_2 **(3)** SiO_2 **(4)** SnO_2

5. In which of the following arrangements the order is NOT according to the property indicated against it ?

(1) $Al^{3+} < Mg^{2+} < Na^+ < F^-$ – increasing ionic size **[AIEEE-2005]**

(2) B < C < N < O – increasing first ionisation enthalpy

(3) I < Br < F < Cl – increasing electron gain enthalpy (with negative sign)

(4) Li < Na < K < Rb – increasing metallic radius

6. Which of the following factors may be regarded as the main cause of lanthanide contraction ?

(1) Greater shielding of 5d electrons by 4f electrons. **[AIEEE 2005]**

(2) Poorer shielding of 5d electron by 4f electrons.

(3) Effective shielding of one of 4f electrons by another in the sub-shell.

(4) Poor shielding of one of 4f electron by another in the sub-shell.

7. The lanthanide contraction is responsible for the fact that : **[AIEEE-2005]**

(1) Zr and Y have about the same radius **(2)** Zr and Nb have similar oxidation state

(3) Zr and Hf have about the same radius **(4)** Zr and Zn have same oxidation state.

8. The increasing order of the first ionization enthalpies of the elements B, P, S and F (lowest first) is : **[AIEEE-2006]**

(1) F < S < P < B **(2)** P < S < B < F **(3)** B < P < S < F **(4)** B < S < P < F

9. Which of the following statements is true ? **[AIEEE-2006]**

(1) H_3PO_3 is a stronger acid than H_2SO_3. **(2)** In aqueous medium, HF is a stronger acid than HCl.

(3) $HClO_4$ is a weaker acid than $HClO_3$. **(4)** HNO_3 is a stronger acid than HNO_2.

10. Lanthanoid contraction is caused due to : **[AIEEE-2006]**

(1) the appreciable shielding on outer electrons by $4f$ electrons from the nuclear charge

(2) the appreciable shielding on outer electrons by $5f$ electrons from the nuclear charge

(3) the same effective nuclear charge from Ce to Lu

(4) the imperfect shielding on outer electrons by 4f electrons from the nuclear charge

11. The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence. **[AIEEE-2007]**

(1) $SiX_2 << GeX_2 << SnX_2 << PbX_2$ **(2)** $PbX_2 << SnX_2 << GeX_2 << SiX_2$

(3) $GeX_2 << SiX_2 << SnX_2 << PbX_2$ **(4)** $SiX_2 << GeX_2 << PbX_2 << SnX_2$

12. The set representing the correct order of ionic radius is : **[AIEEE-2009]**

(1) $Na^+ > Li^+ > Mg^{2+} > Be^{2+}$ **(2)** $Li^+ > Na^+ > Mg^{2+} > Be^{2+}$

(3) $Mg^{2+} > Be^{2+} > Li^+ > Na^+$ **(4)** $Li^+ > Be^{2+} > Na^+ > Mg^{2+}$

13. In which of the following arrangements, the sequence is not strictly according to the property written against it ?

(1) $HF < HCl < HBr < HI$: increasing acid strength **[AIEEE-2009]**

(2) $NH_3 < PH_3 < AsH_3 < SbH_3$: increasing basic strength

(3) $B < C < O < N$: increasing first ionization enthalpy

(4) $CO_2 < SiO_2 < SnO_2 < PbO_2$: increasing oxidising power

14. The correct sequence which shows decreasing order of the ionic radii of the elements is : **[AIEEE-2010]**

(1) $Al^{3+} > Mg^{2+} > Na^+ > F^- > O^{2-}$ **(2)** $Na^+ > Mg^{2+} > Al^{3+} > O^{2-} > F^-$

(3) $Na^+ > F^- > Mg^{2+} > O^{2-} > Al^{3+}$ **(4)** $O^{2-} > F^- > Na^+ > Mg^{2+} > Al^{3+}$

15. The outer electron configuration of Gd (Atomic No : 64) is : **[AIEEE 2011 (Cancelled)]**

(1) $4f^3\ 5d^5\ 6s^2$ **(2)** $4f^8\ 5d^0\ 6s^2$ **(3)** $4f^4\ 5d^4\ 6s^2$ **(4)** $4f^7\ 5d^1\ 6s^2$

16. Which one of the following orders presents the correct sequence of the increasing basic nature of the given oxides **[AIEEE 2011 (Cancelled)]**

(1) $Al_2O_3 < MgO < Na_2O < K_2O$ **(2)** $MgO < K_2O < Al_2O_3 < Na_2O$

(3) $Na_2O < K_2O < MgO < Al_2O_3$ **(4)** $K_2O < Na_2O < Al_2O_3 < MgO$

17. The correct order of electron gain enthalpy with negative sign of F, Cl, Br and I, having atomic number 9, 17, 35 and 53 respectively, is:

(1) $F > Cl > Br > I$ **(2)** $Cl > F > Br > I$ **(3)** $Br > Cl > I > F$ **(4)** $I > Br > Cl > F$

18. The increasing order of the ionic radii of the given isoelectronic species is : **[AIEEE-2012]**

(1) $Cl^-, Ca^{2+}, K^+, S^{2-}$ **(2)** $S^{2-}, Cl^-, Ca^{2+}, K^+$ **(3)** $Ca^{2+}, K^+, Cl^-, S^{2-}$ **(4)** $K^+, S^{2-}, Ca^{2+}, Cl^-$

19. Which of the following represents the correct order of increasing first ionization enthalpy for Ca, Ba, S, Se and Ar ? **[JEE Mains-2013]**

(1) $Ca < S < Ba < Se < Ar$ **(2)** $S < Se < Ca < Ba < Ar$

(3) $Ba < Ca < Se < S < Ar$ **(4)** $Ca < Ba < S < Se < Ar$

20. The first ionisation potential of Na is 5.1 eV. The value of electron gain enthalpy of Na^+ will be : **[JEE Mains-2013]**

(1) –2.55 eV **(2)** –5.1 eV **(3)** –10.2 eV **(4)** +2.55 eV

21. The correct stastement for the molecule, CsI_3 is : **[JEE Mains-2014]**

(1) it contains Cs^{3+} and I^- ions. **(2)** it contains Cs^+, I^- and lattice I_2 molecule

(3) it is a covalent molecule **(4)** it contains Cs^+ and I_3^- ions.

22. The ionic radii (in Å) of N^{3-}, O^{2-} and F^- are respectively: **[JEE Mains-2015]**

(1) 1.71, 1.40 and 1.36 **(2)** 1.71, 1.36 and 1.40 **(3)** 1.36, 1.40 and 1.71 **(4)** 1.36, 1.71 and 1.40

23. Which of the following atoms has the highest first ionization energy? **[JEE Mains-2016]**

(1) Na **(2)** K **(3)** Sc **(4)** Rb

24. Which of the following compounds contain (s) no covalent bond(s) ? **[JEE Mains-2018]**

KCl, PH_3, O_2, B_2H_6, H_2SO_4

(1) KCl, H_2SO_4 **(2)** KCl **(3)** KCl, B_2H_6 **(4)** KCl, B_2H_6, PH_3

Part # II [Previous Year Questions][IIT-JEE ADVANCED]

1. Arrange the following oxides in the increasing order of Bronsted basicity : **[JEE-2004]**

Hint : Consider Bronsted basicity to be simply basic strength.

Cl_2O_7 , BaO , SO_3 , CO_2 , B_2O_3 .

2. **Statement-1 :** Pb^{4+} compounds are stronger oxidizing agents than Sn^{4+} compounds **[JEE-2008]**

Statement-2 : The higher oxidation states for the group 14 elements are more stable for the heavier members of the group due to 'inert pair effect'.

(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

3. The increasing order of atomic radii of the following Group 13 elements is **[JEE-2016]**

(A) Al < Ga < In < Tl **(B)** Ga < Al < In < Tl

(C) Al < In < Ga < Tl **(D)** Al < Ga < Tl < In

4. The option(s) with only amphoteric oxides is(are) **[JEE-2017]**

(A) Cr_2O_3, BeO, SnO, SnO_2 **(B)** ZnO, Al_2O_3, PbO, PbO_2

(C) NO, B_2O_3, PbO, SnO_2 **(D)** Cr_2O_3, CrO, SnO, PbO

MOCK TEST

SECTION - I : STRAIGHT OBJECTIVE TYPE

1. Consider the following statements;

(I) Rutherford name was associated with the developement of periodic table.

(II) A metal M having electronic configuration $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^1$ is d-block element.

(III) Diamond is not an element.

(IV) The electronic configuration of the most electronegative element is $1s^2, 2s^2, 2p^5$, and select the correct one from the given codes.

(A) I, II, IV **(B)** I, II, III, IV **(C)** II, IV **(D)** I, III, IV

2. The correct order of second ionisation potential of carbon, nitrogen, oxygen and flourine is :

(A) C > N > O > F **(B)** O > N > F > C **(C)** O > F > N > C **(D)** F > O > N > C

3. The electron gain enthalpies of halogens in kJ/mol are as given below.

F = –332, Cl = –349, Br = –324, I = –295

The less negative value for F as compared to that of Cl is due to :

(A) strong electron-electron repulsions in the compact 2p-subshell of F.

(B) weak electron-electron repulsions in the compact 2p- subshell of Cl

(C) smaller electronegativity value of F than Cl

(D) **(A)** and **(B)** both

4. Which of the following statement is not correct ?

(A) The first ionisation energies (in kJ/mol) of carbon, silicon, germaniu, tin and lead are 1086, 786, 761, 708 and 715 respectively.

(B) Down the group, electronegativity decreases from B to Tl in boron family.

(C) Among oxides of the elements of carbon family, CO is neutraql, GeO is acidic and SnO is amphoteric.

(D) The 4f- and 5f- inner transition elements are placed separately at the bottom of the periodic table to maintain its structure.

5. Which of the following order is correct ?

(A) F > N > C > Si > Ga – non-metallic character.

(B) F > Cl > O > N – oxidising property.

(C) C < Si > P > N – electron affinity value.

(D) All of these.

6. If the same element is forming oxides in different oxidation state then :

(A) that oxide will be neutral in nature in which element will be in its highest oxidation state.

(B) that oxide will be highest acidic in nature in which element will be in the highest oxidation state.

(C) that oxide will be amphoteric in nature in which element will be in the highest oxidation state.

(D) that oxide will be higly basic in nature in which element will be in the highest oxidation state.

SECTION - II : MULTIPLE CORRECT ANSWER TYPE

7. Which of the following statement(s) is/are true ?

(A) ionisation energy $\propto \frac{1}{\text{Screening effect}}$

(B) The first ionisation energies of Be and Mg are more than ionisation energies of B and Al respectively

(C) Atomic and ionic radii of Niobium and Tantalum are almost same.

(D) Metallic and covalent radii of potassium are 2.3Å and 2.03Å.

8. Which of the following pair(s) represent(s) the isoelectronic species ?

(A) S^{-2} and Sc^{+3} **(B)** SO_2 and NO_3^- **(C)** N_2 and CN^- **(D)** NH_3 and H_3O^+

9. The process(es) requiring the absorption of energy is/are :

(A) $Cl - Cl^-$ **(B)** $O^- - O^{2-}$ **(C)** $Fe^{+3} - Fe^{+2}$ **(D)** $Ar - Ar^-$

SECTION - III : ASSERTION AND REASON TYPE

10. **Statement – 1**: Flourine has only one oxoacids, HOF because,

Statement – 2 : Flourine has small size and high electronegativity.

(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.

11. **Statement – 1** : The 5th period of periodic table contains 18 elements not 32.

Statement – 2 : n = 5, __= 0, 1, 2, 3. The order in which the energy of available orbitals 4d, 5s and 5p increases is 5s < 4d < 5p and the total number of orbitals available are 9 and thus 18 electrons can be accomodated.

(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.

12. **Statement – 1** : Manganese (atomic number = 25) has a less favourable electron affinity than its neighbours on either side because,

Statement – 2 : The manganese has stable $[Ar]^{18}\ 3d^5\ 4s^2$ electrons configuration.

(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.

13. **Statement – 1** : The ionisation energy of phosphorus is larger than sulphur.

Statement – 2 : There is a larger amount of stability associated with filled s- and p- sub-shells (a noble gas elctron configuration) which corresponds to having eight electrons in the valence shell of an atom or ion.

(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.

14. **Statement – 1** : The electron gain enthalpies have large negative values towards the upper right of the periodic table precedign the noble gas.

Statement – 2 : The effective nuclear charge increases from left to right across a period and consequently it will be easier to add an electron to a smaller atom since the added electron on an average would be closer to the positively charged nucleus.

(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.

SECTION - V : MATRIX - MATCH TYPE

15. Match the species/elements listed in column I with their characteristic listed in column II.

Column I	Column II
(A) SO_2, NO^{-3}, CO_3^{-2}	**(p)** Semi-metals
(B) Ge, As, Sb	**(q)** Inert gases
(C) Ar, Kr, Xe	**(r)** Isoelectronic species
(D) Ca, Sr, Ba	**(s)** Alkaline earth metals

16. Match the values of ionization energy and electron gain enthalpi listed in column I with characteristic(s) of elements listed in column II.

Column I			Column II
Δ_1H_1 ,	Δ_1H_2 ,	$\Delta_{eg}H$ (in kJ mol^{-1}) ,	
(A) 2372	5251	+48	**(p)** Elements which acts as a strong reducing agent
(B) 419	3051	-48	**(q)** Elements which exists as a monoatomic molecule
(C) 1681	3374	-333	**(r)** Least reactive non-metal
(D) 1008	1846	-295	**(s)** Elements which acts as a strong oxidising agent
			(t) Element which oxide is a stronger basic in nature

17. Match the increasing order given in column I with the property(ies) given in column II.

Column I	Column II
(A) $Na^+ < F^- < O^{2-} < N^{3-}$	**(p)** Semi-metals
(B) $Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$	**(q)** Mobility of hydrated ions
(C) O < S < F < Cl	**(r)** Ionic size
(D) $Cl^- < K^+ < Ca^{2+} < Sc^{3+}$	**(s)** Electron affinity

SECTION - IV : COMPREHENSION TYPE

Read the following comprehensions carefully and answer the questions.

Comprehension # 1

Read the following comprehension carefully and answer the following questions.

Numerous forms of periodic table haev been revised from time to time. A modern version, which is most convinient and widely used is the long or extended form of periodic table.The afbau principle (electrons are filled in the progressive order of their increasing energy, i.e ny n+1 rule) and the electronic cconfiguration of atom provide a theoritical foundation for the periodic classification. The horizontal rows are called periods. There are altogether seven periods. The first period consists of 2 elements. The subsequent periods consist of 8, 8, 18, 18 and 32 elements respectively. The seventh period is incomplete and like the sixth period would have the maximum of 32 elements.

Elements having similar outer electronic configurations in their atoms are grouped together in vertical columns. These are reffered to as groups or families. According to the recommendation of IUPAC, the groups are numbered 1 to 18 replacing the older notifications of groups 0, IA, IIA.....VII A,VIII, IB.....VII B.

Each successive period in the periodic table is asssociated with the filling up next higher principal energy level following afbau principle. The number of eleementss in each period iss twice the number of atomic orbitals available in the energy level that is being filled. All the elements are classified into four blocks, i.e., s-block, p-block, d-block and f-block depending on the type of atomic orbitals that are being filled with their last electron of the element.

18. The element with atomic number 56 is likely to have the same outer shell configuration as the element with atomic number :

(A) 12 **(B)** 18 **(C)** 14 **(D)** 20

19. If afbau rule iss not allowed, Ca will be placed in _____ block.

(A) s- **(B)** p- **(C)** d- **(D)** f-

20. 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

Comprehension # 2

The first (Δ_1H_1) and second (Δ_1H_2) ionisation enthalpies (in kJ/mol) and the ($\Delta_{eg}H$) electron gain enthalpy (in kJ/mol) of a few elements are given below :

	Elements	Δ_1H_1	Δ_1H_2	$\Delta_{eg}H$
(A)	P	520	7300	-60
(B)	Q	419	3051	-48
(C)	R	1681	3374	-324
(D)	S	1008	1846	-295
(5)	T	2372	5251	+48
(6)	U	738	1451	-40

21. The least reactive element is :

(A) P **(B)** Q **(C)** R **(D)** T

22. The most reactive element is :

(A) P **(B)** Q **(C)** S **(D)** U

23. The most reactive non-metal is :

(A) R **(B)** S **(C)** P **(D)** U

Comprehension # 3

The amount of energy required to remove the most loosely bound eleectron from as isolated gaseous atom is called as first ionization energy (IE_1). Similarly the amount of energies required to knock out second, third etc. electrons from the isolated gaseous cation are called successive ionization energies and $IE_3 > IE_2 > IE_1$.

(i) Nuclear charge (ii) Atomic size (iii) penetration effect of the electrons (iv) shielding effect of the inner electrons and (v) electronic configurations (exactly half filled and completely filled configurations are considerd extra stable) affect the ionisation energies.

On the other hand, the amount of energy released when a neutral isolated gaseous atom accepts an extra electron to form a gaseous anion is called electron affinity.

$O(g) + e^- \xrightarrow{\text{Exothermic}} O^-(g)\ ;\ \Delta H_{eg} = -141\ kJ\ mol^{-1}$ .....(i)

$O(g) + e^- \xrightarrow{\text{Endothermic}} O^{2-}(g)\ ;\ \Delta H_{eg} = +780\ kJ\ mol^{-1}$ .....(i)

In (ii) the energy has to be supplied for the addition of second electron due to the electrostatic repulsion between an anion and extra electron (same charged species). The electron affinity of an elements depends upon (i) atomic size (ii) nuclear charge and (iii) electronic configuration. In general, ionisation energy and electron affinity increases as their atomic size decreases and nuclear chargee increases across a period. In general, in a group, ionisation energy and eleectron affinity decreasese as the atomic size increases down the group.

The members of the third period have some higher (e.g. S and Cl) electron affinity values that the members of the second period (e.g. O and F) because second period elements have very small atomic size. Hence there is a tendency of electron-electron repulsion, which result in less evolution of energy in the formation of corresponding anion.

24. The first ionization energy of Na, Mg, Al, Si are in the order of :

(A) Na < Mg > Al < Si **(B)** Na > Mg > Al > Si

(C) Na < Mg < Al > Si **(D)** Na > Mg > Al < Si

25. Which one the following statements is correct ?

(A) The elements like F, Cl, Br etc having high values of electronic affinity act as a strong oxidising agent.

(B) The elements having low values of ionisation energies act as a strong reducing agent.

(C) The formation of Be-(g) from Be (g) is an endothermic process.

(D) All of these

26. Which one the following statements in incorrect in relation to ionisation enthalpy ?

(A) Ionization enthalpy increase for each successive valence shell electron.

(B) The greatest increase in ionization enthalpy is experienced on removal of electron from core of noble gas configuration.

(C) End of valence electrons is marked by a big jump on ionization enthalpy.

(D) Removal of electron from orbitals bearing lower n value is easier than from orbital having higher n value.

27. Considering the elements F, Cl, O, and N, the correct order of their electron affinity values is :

(A) F > Cl > O > S **(B)** F > O > Cl > S

(C) Cl > F > S > O **(D)** O > F > S > Cl

ANSWER KEY

EXERCISE - 1

1. D	**2.** C	**3.** B	**4.** C	**5.** C	**6.** C	**7.** D	**8.** D	**9.** D	**10.** D	**11.** A	**12.** D	**13.** D
14. C	**15.** C	**16.** B	**17.** A	**18.** B	**19.** D	**20.** A	**21.** C	**22.** D	**23.** A	**24.** A	**25.** C	**26.** B
27. D	**28.** D	**29.** A	**30.** D	**31** B	**32.** B	**33.** C	**34.** D	**35.** D	**36.** D	**37.** C	**38.** A	**39** C
40. D	**41.** D	**42.** C	**43.** B	**44.** A	**45.** A	**46.** D	**47.** B	**48.** C	**49.** B	**50.** A	**51.** B	**52.** D
53. B	**54.** B	**55.** A	**56.** B	**57.** A	**58.** D	**59.** B	**60.** C	**61.** A	**62.** A	**63.** A	**64** B	**65.** D
66. A	**67.** D	**68.** D	**69.** D	**70.** D	**71.** C	**72.** C	**73.** C	**74.** A	**75.** C	**76.** D	**77.** C	**78.** A
79. D	**80.** B	**81.** D	**82.** B	**83.** A	**84.** A	**85.** B	**86.** A	**87.** A	**88.** B	**89.** A	**90.** A	**91.** A
92. B	**93.** C	**94.** D	**95.** D	**96.** B	**97.** B	**98.** C	**99.** D	**100.** C	**101.** C	**102.** A	**103.** A	**104.** D
105. A	**106.** A	**107.** D	**108.** C	109. A	**110.** B	**111.** C	**112.** A	**113.** C	**114.** B	**115.** B	**116.** A	**117.** D
118. D												

EXERCISE - 2 : PART # I

1. A, C	**2.** A, B, D	**3.** A, B, D	**4.** A, D	**5.** A, D	**6.** A, C	**7.** A, C
8. B, C, D	**9.** A, C	**10.** A, D	**11.** A, D	**12.** A, C, D	**13.** A, C	**14.** B, C, D
15. A, B	**16.** B, D	**17.** B, D	**18.** A	**19.** A	**20.** A, B, C, D	**21.** A, C
22. A, D	**23.** A, B	**24.** A, B, C	**25.** A, C, D	**26.** A, B, C	**27.** A, B, C	**28.** A, C, D
29. B, C	**30.** A, B, C, D	**31.** A, B, D	**32.** A, B	**33.** A, C	**34.** A, C, D	**35.** A, B, D
36. A, B, C, D	**37.** A, B					

PART # II

1. C	**2.** A	**3.** A	**4.** A	**5.** A	**6.** D	**7.** C	**8.** C	**9.** A	**10.** D	**11** C	**12.** C	**13.** C
14. D	**15.** D	**16.** A	**17.** A									

EXERCISE - 3 : PART # I

1. A → (q), B → (r), C → (s), D → (p)

2. A → (s), B → (r), C → (p), D → (q)

3. A → (r), B → (q), C → (p), D → (s)

4. A → (s), B → (r), C → (q), D → (p)

5. A → (r), B → (s), C → (p), D → (q)

6. A → (r), B → (s), C → (q), D → (p)

PART # II

Comprehension # 1 :	**1.** B	**2.** B,C	**3.** C	**4.** A	**5.** B	**6.** A				
Comprehension # 2 :	**1.** B	**2.** A								
Comprehension # 3 :	**1.** C	**2.** C,	**3.** C	**4.** A	**5.** B					
Comprehension # 4 :	**1.** C	**2.** B	**3.** D							
Comprehension # 5 :	**1.** C	**2.** C	**3.** D							

EXERCISE - 5 : PART # I

1. 3 **2.** 3 **3.** 4 **4.** 4 **5.** 2 **6.** 4 **7.** 3 **8.** 4 **9.** 4 **10.** 4 **11.** 1 **12.** 1 **13.** 2
14. 4 **15.** 4 **16.** 1 **17.** 2 **18.** 3 **19.** 3 **20.** 2 **21.** 4 **22.** 1 **23.** 3 **24.** 2

PART # II

1. $Cl_2O_7 < SO_3 < CO_2 < B_2O_3 < BaO$ **2.** C **3.** B **4.** AB

MOCK TEST

1.	C	**2.**	C	**3.**	D	**4.**	B	**5.**	D
6.	B	**7.**	A,B,C,D	**8.**	A,B,C,D	**9.**	B,D	**10.**	A
11.	A	**12.**	A	**13.**	D	**14.**	A		

15. $A \rightarrow (r), B \rightarrow (p), C \rightarrow (q), D \rightarrow (s)$

16. $A \rightarrow (q)$; $B \rightarrow (p,t)$; $C \rightarrow (s)$; $D \rightarrow (r)$

17. $A \rightarrow r)$; $B \rightarrow (q, r)$; $C \rightarrow s)$; $D \rightarrow$ (p, s)

18.	A	**19.**	C	**20.**	D	**21.**	D	**22.**	B
23.	A	**24.**	A	**25.**	D	**26.**	D	**27.**	C