FIRST STEP
TO
INORGANIC CHEMISTRY

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Atomic & Ionic Radii

Q.1 The size of the following species increases in the order:
(A) $Mg^{2+} < Na^{+} < F^{-}$ (B) $F^{-} < Na^{+} < Mg^{2+}$
(C) $Mg < F^{-} < Na^{+}$ (D) $Na^{+} < F^{-} < Mg^{2+}$

Q.2 Highest size will be of
(A) Br^{-} (B) I (C) I^{-} (D) I^{+}

Q.3 Element Hg has two oxidation states Hg^{+1} & Hg^{+2}. the right order of radii of these ions.
(A) $Hg^{+1} > Hg^{+2}$ (B) $Hg^{+2} > Hg^{+1}$ (C) $Hg^{+1} = Hg^{+2}$ (D) $Hg^{+2} \geq Hg^{+1}$

Q.4 The correct order of increasing atomic size of element N,F, Si & P.
(A) N < F < Si < P (B) F > N < P < Si
(C) F < N < P < Si (D) F < N < Si < P

Q.5 The correct order of atomic or ionic size
(A) N < Li < B (B) Cl < Mg < Ca (C) $Ca^{+2} < S^{-2} < Cl^{-}$ (D) $Na^{+} < Mg^{+2} < Cl^{-}$

Ionization Energy or Potential

Q.6 In which of the following electronic configuration ionisation energy will be maximum in
(A) [Ne] $3s^2\ 3p^1$ (B) [Ne] $3s^2\ 3p^2$ (C) [Ne] $3s^2\ 3p^3$ (D) [Ar] $3d^{10}\ 4s^2\ 4p^3$

Q.7 The correct order of second ionisation potential of C, N, O and F is:
(A) C > N > O > F (B) O > N > F >C (C) O > F > N > C (D) F > O > N > C

Q.8 Decreasing ionization potential for K, Ca & Ba is
(A) Ba> K > Ca (B) Ca > Ba > K (C) K > Ba > Ca (D) K > Ca > Ba

Q.9 The ionization energy will be maximum for the process.
(A) $Ba \rightarrow Ba^{++}$ (B) $Be \rightarrow Be^{++}$ (C) $Cs \rightarrow Cs^{+}$ (D) $Li \rightarrow Li^{+}$

Q.10 The correct order of second I.P.
(A) Na < Mg > Al < Si (B) Na > Mg < Al > Si
(C) Na > Mg > Al < Si (D) Na > Mg > Al > Si

Q.11 Alkaline earth metals always form dipositive ions due to
(A) $IE_2 - IE_1 > 10$ eV (B) $IE_2 - IE_1 = 17$ eV
(C) $IE_2 - IE_1 < 10$ eV (D) None of these

Q.12 Amongst the following, the incorrect statement is
(A) IE_1 (Al) < IE_1 (Mg) (B) IE_1 (Na) < IE_1 (Mg)
(C) IE_2 (Mg) > IE_2 (Na) (D) IE_3 (Mg) > IE_3 (Al)

Electron affinity or Electron Gain Enthalpy

Q.13 The electron affinity of the members of oxygen family of the periodic table, follows the sequence
(A) O > S > Se (B) S > O > Se (C) O < S > Se (D) Se > O > S

Q.14 The process requires absorption of energy is

(A) $F \rightarrow F^-$ (B) $Cl \rightarrow Cl^-$ (C) $O^- \rightarrow O^{2-}$ (D) $H \rightarrow H^-$

Q.15 Of the following elements, which possesses the highest electron affinity?
(A) As (B) O (C) S (D) Se

Q.16 Electron affinities of O,F,S and Cl are in the order.
(A) O < S < Cl < F (B) O < S < F < Cl
(C) S < O < Cl < F (D) S < O < F < Cl

Q.17 Which of the following statement is not true?
(A) F atom can hold additional electron more tightly than Cl atom
(B) Cl atom can hold additional electron more tightly than F atom
(C) The incoming electron encounters greater repulsion for F atom than for Cl atom
(D) It is easier to remove an electron from F^- than Cl^-.

Q.18 Increasing order of Electron affinity for following configuration.
(a) $1s^2, 2s^2\ 2p^3$ (b) $1s^2, 2s^2\ 2p^4$
(c) $1s^2, 2s^2\ 2p^6\ 3s^2\ 3p^4$ (d) $1s^2, 2s^2\ 2p^6, 3s^2\ 3p^3$
(A) a < d < b < c (B) d < a < c < b (C) a < b < c < d (D) a < b < d < c

Q.19 Highest electron affinity is shown by
(A) F^- (B) Cl^- (C) Li^+ (D) Na^+

Electronegativity

Q.20 The outermost electronic configuration of most electronegative element is:
(A) $ns^2\ np$ (B) $ns^2\ np^4$ (C) $ns^2\ np^5$ (D) $ns^2\ np^6$

Q.21 In the following which configuration of element has maximum electronegativity.
(A) $1s^2, 2s^2\ 2p^5$ (B) $1s^2, 2s^2\ 2p^6$ (C) $1s^2, 2s^2\ 2p^4$ (D) $1s^2, 2s^2\ 2p^6, 3s^2\ 3p^3$

Q.22 On the Pauling's electronegativity scale, which element is next to F .
(A) Cl (B) O (C) Br (D) Ne

Q.23 The increasing order of acidic nature of Li_2O, BeO, B_2O_3
(A) $Li_2O > BeO < B_2O_3$ (B) $Li_2O < BeO < B_2O_3$
(C) $Li_2O < BeO > B_2O_3$ (D) $Li_2O > BeO > B_2O_3$

Q.24 Bond distance C–F in (CF_4) & Si–F in (SiF_4) are respective 1.33Å & 1.54 Å. C–Si bond is 1.87 Å. Calculation the covalent radius of F atom ignoring the electronegativity differences.
(A) 0.64 Å (B) $\frac{1.33+1.54+1.8}{3}$ Å (C) 0.5 Å (D) $\frac{1.54}{2}$ Å

Q.25 Which of the following element is having highest electronegativity.
(A) $1s^2\ 2s^2\ 2p^1$ (B) [Ne] $3s^2\ 3p^1$ (C) [He] $2s^2\ 2p^4$ (D) [Ne] $3s^2\ 3p^5$

Q.26 The lowest electronegativity of the element from the following atomic number is.
(A) 37 (B) 55 (C) 9 (D) 35

Q.27 Which one is not correct order of electronegativity.
(A) F > Cl > Br > I (B) Si > Al > Mg > Na
(C) Cl > S > P > Si (D) None of these

Q.28 Calculate the bond length of C–X bond if C – C bond length is 1.54 Å and X–X bond length is 1.2 Å and electronegativities of C and X are 2.0 and 3.0 respectively.
(A) 2.74 Å (B) 1.37 Å (C) 1.46 Å (D) 1.28 Å

Miscellaneous

Q.29 Which of the following does not reflect the periodicity of element
(A) Bonding behaviour (B) Electronegativity (C) Ionisation potential (D) Neutron/ Proton ratio

Q.30 Choose the s-block element from the following:
(A) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5, 4s^1$ (B) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^1$
(C) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1$ (D) all of the above

Q.31 False statement for periodic classification of elements is
(A) The properties of the elements are periodic function of their atomic numbers.
(B) No. of non-metallic elements is less than the no. of metallic elements.
(C) First ionization energy of elements does not increase regularly with the increasing of atomic number in a period.
(D) d-subshell is filled by final electron with increasing atomic number of inner transition elements.

Q.32 Pick out the isoelectronic species from the following:
I. $^+CH_3$ II. H_3O^+ III. NH_3 IV. CH_3^-
(A) I and II (B) III and IV (C) I and III (D) II, III and IV

Q.33 If there were 10 periods in the periodic table then how many elements would this period can maximum comprise of.
(A) 50 (B) 72 (C) 32 (D) 98

Q.34 Among the following which species is/are paramagnetic
(i) Sr^{2+} (ii) Fe^{3+} (iii) Co^{2+} (iv) S^{2-} (v) Pb^{2+}
(A) i, iv, v (B) i, ii, iii (C) ii, iii (D) iv, v

Q.35 If each orbital can hold a maximum of three electrons, the number of elements in 9^{th} period of periodic table (long form) are
(A) 48 (B) 162 (C) 50 (D) 75

Q.36 The Z_{eff} for
3d electron of Cr
4s electron of Cr
3d electron of Cr^{3+}
3s electron of Cr^{3+} are in the order respectively
(A) 4.6, 2.95, 4.95, 8.05 (B) 4.95, 2.95, 4.6, 8.05
(C) 4.6, 2.95, 5.3, 12.75 (D) none of these

Q.37 Which among the following factors is most important in making fluorine, the strongest oxidising halogen:
(A) Bond dissociation energy (B) Ionisation Enthalpy
(C) Hydration enthalpy (D) Electron affinity

Q.38 Which of the following element has highest metallic character .

	Element	IP
(A)	P	17 eV
(B)	Q	2 eV
(C)	R	10 eV
(D)	S	13 eV

Q.39 The electronic configuration of an element is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$. The atomic number and the group number of the element 'X' which is just below the above element in the periodic table are respectively.
(A) 24 & 6 (B) 24 & 15 (C) 34 & 16 (D) 34 & 8

Q.40 The correct order of increasing hydration energy of following ion is
(A) $Fe^{+2} < Co^{+2} < Fe^{+3}$ (B) $Fe^{+2} < Co^{+2} > Fe^{+3}$
(C) $Fe^{+2} > Co^{+2} > Fe^{+3}$ (D) $Fe^{+2} < Fe^{+3} < Co^{+2}$

More than one correct

Q.41 Which of the following is correct order of EA.
(A) N < C < O < F (B) F > Cl > Br > I
(C) Cl > F > Br > I (D) C < N < O < F

Q.42 Select the correct statement(s).
(A) The value of electron gain enthalpy of an element can be -ve or +ve.
(B) In the periodic table, metallic character of the elements increases down the group and decreases across the period
(C) The Cl^- & S^{2-} are isoelectronic species but first one is not smaller in size than the second
(D) Ionization enthalpy of an atom is equal to electron gain enthalpy of cation

Q.43 In which of the following are the orders of electron affinity of the elements or ions shown correctly
(A) S > O^- (B) N^- > P (C) O^- > S^- (D) O > S^-

Q.44 Which of the following parameters can't be estimated by using Born-Haber cycle (for the formation of the ionic compound) ?
(A) Hydration energy (B) Electron gain enthalpy
(C) Lattice energy (D) Electronegativity

Q.45 Which of the following are correct
(A) $IE_2(Mg) < IE_2(Na)$
(B) EA (N) < EA (P)
(C) Atomic size Mg^{+2} > Atomic size (Li^+)
(D) IP of Na < Mg < Al

Q.46 If Aufbau's principle and Hund's rule were not followed.
(A) K would have been d–block element & paramagnetic.
(B) Cu would have been s–block element.
(C) Cr would have been diamagnetic
(D) Fe^{+3} ion would have 5 unpaired electrons.

Q.47 In halogen, which of the following properties increase from iodine to fluroine
(A) Ionisation energy (B) Electronegativity
(C) Bond length (D) Electron affinity

Q.48 Which of the following pair have nearly the same atomic radii
(A) Al and Ga (B) Fe and Ni (C) Zr and Hf (D) Pt & Pd

Q.49 In which of the following sets of elements 1st element is more metallic then second.
(A) Ba, Ca (B) Sb, Sn (C) Ge, S (D) Na, F

Q.50 Amongst the following statements, which is / are correct?
(A) Electronegtaivity of sulphur is greater than that of oxygen.
(B) Electron gain enthalpy of oxygen is smaller than that of sulphur.
(C) Electron gain enthalpy of fluorine is most negative
(D) Electron gain enthalpy of chlorine is most negative

Q.51 The ionic compound $A^+ B^-$ is formed when the
(A) electron gain enthalpy of B is high
(B) ionization energy of A is low
(C) lattice energy of AB is high
(D) lattice energy of AB is low

Q.52 Which of the following is/are correct?
(A) For $A(g) + e^- \longrightarrow A^-(g)$ ΔH may be negative
(B) For $A^-(g) + e^- \longrightarrow A^{2-}(g)$ ΔH may be negative
(C) For $A^-(g) + e^- \longrightarrow A^{2-}(g)$ ΔH may be positive
(D) For $Ne(g) + e^- \longrightarrow Ne^-(g)$ ΔH may be zero

Q.53 Two elements A & B are such that B. E. of A–A, B–B & A–B are respectively 81 Kcal / mole, 64 Kcal / mole, 76 Kcal / mole & if electronegativity of B is 2.4 then the electronegativity of A may be approximately
(A) 2.81 (B) 1.8 (C) 1.99 (D) 3.0

Answer Key

Q.1	A	Q.2	C	Q.3	A	Q.4	C	Q.5	B	Q.6	C	Q.7	C
Q.8	B	Q.9	B	Q.10	B	Q.11	C	Q.12	C	Q.13	C	Q.14	C
Q.15	C	Q.16	B	Q.17	A	Q.18	A	Q.19	C	Q.20	C	Q.21	A
Q.22	B	Q.23	B	Q.24	C	Q. 25	C	Q.26	B	Q.27	D	Q.28	D
Q.29	D	Q.30	C	Q.31	D	Q.32	D	Q.33	B	Q.34	C	Q.35	D
Q.36	C	Q.37	C	Q.38	B	Q.39	C	Q.40	A	Q.41	A,C		
Q.42	A,B,D	Q.43	A,D	Q.44	A,D	Q.45	A,B	Q.46	A,B,C	Q.47	A,B		
Q.48	A,B,C,D			Q.49	A,C,D	Q.50	B,D	Q.51	A,B,C	Q.52	A,C	Q.53	A,C

IONIC BOND

(Only one option is correct)

Q.1 An ionic bond A^+B^- is most likely to be formed when :
(A) the ionization energy of A is high and the electron gain enthalpy of B is low
(B) the ionization energy of A is low and the electron gain enthalpy of B is high
(C) the ionization energy of A and the electron gain enthalpy of B both are high
(D) the ionization energy of A and the electron gain enthalpy of B both are low

Q.2 The compound which contains ionic as well as covalent bonds is
(A) $C_2H_4Cl_2$ (B) CH_3I (C) KCN (D) H_2O_2

Q.3 The hydration of ionic compounds involves :
(A) Evolution of heat (B) Weakening of attractive forces
(C) Dissociation into ions (D) All of these

Q.4 In which of the following species the bonds are Non-directional ?
(A) NCl_3 (B) RbCl (C) $BeCl_2$ (D) BCl_3

Q.5 Which has the lowest anion to cation size ratio :
(A) LiF (B) NaF (C) CsI (D) CsF

Q.6 The compound which has the highest Lattice energy is
(A) LiF (B) LiCl (C) NaCl (D) MgO

Q.7 A bond formed between two like atoms cannot be
(A) ionic (B) covalent (C) coordinate (D) metallic

Q.8 Which of the following, when dissolved in water is non -conductor.
(A) Green Vitriol (B) Indian salt Petre
(C) Alcohol (D) Potash alum

Q.9 An electrovalent compound does not exhibit space isomerism because of
(A) Presence of oppositively charged ions (B) High melting points
(C) Non-directional nature of the ionic bond (D) Crystalline nature

Q.10 Which of the following contains electrovalent and polar covalent bonds ?
(A) CH_4 (B) H_2O_2 (C) NH_4Cl (D) HCN

COVALENT BOND , CO-ORDINATE BOND & LEWIS STRUCTURE

Q.11 A sigma bond is formed by the overlap of atomic orbitals of atoms A and B. If the bond is formed along the x-axis, which of the following overlaps is acceptable ?
(A) s orbital of A and p_z orbital of B (B) p_x orbital of A and p_y orbital of B
(C) p_z orbital of A and p_x orbital of B (D) p_x orbital of A and s orbital of B

Q.12 How many bond pairs are present in IF_7 molecule :
(A) 6 (B) 7 (C) 5 (D) 8

Q.13 PCl_5 exists but NCl_5 does not because :
(A) Nitrogen has no vacant 2*d*-orbitals (B) NCl_5 is unstable
(C) Nitrogen atom is much smaller than P (D) Nitrogen is highly inert

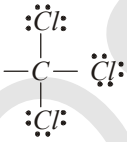
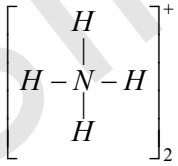
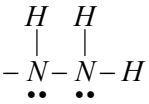
Q.14 Which of the following has/have a strong covalent bond?
(A) Cl-F (B) F-F (C) C-Cl (D) C-F

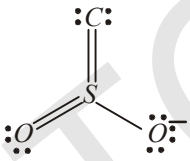
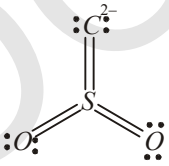
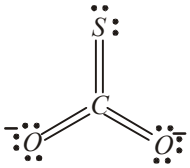
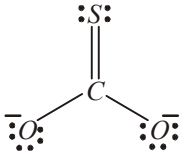
Q.15 Which of the following species are hypervalent?
1. PCl_5, 2. BF_3, 3. XeF_2, 4. CO_3^{2-}
(A) 1, 2, 3 (B) 1, 3 (C) 3, 4 (D) 1, 2

Q.16 The types of bond present in N_2O_5 are
(A) only covalent (B) only ionic (C) ionic and covalent (D) covalent & coordinate

Q.17 NH_3 and BF_3 combine readily because of the formation of :
(A) a covalent bond (B) a hydrogen bond
(C) a coordinate bond (D) an ionic bond

Q.18 Which of the following molecules does not have coordinate bonds?
(A) CH_3–NC (B) CO (C) O_3 (D) CO_3^{2-}

Q.19 Which of the following Lewis dot diagrams is(are) incorrect ?
(A)  (B)  (C)  (D) 

Q.20 The possible structure(s) of monothiocarbonate ion is :
(A)  (B)  (C)  (D) 

Q.21 The valency of sulphur in sulphuric acid is :
(A) 2 (B) 8 (C) 4 (D) 6

Q.22 The total number of valence electrons in 4.2g of N_3^- ion are :
(A) 2.2 N_A (B) 4.2 N_A (C) 1.6 N_A (D) 3.2 N_A

V.B.T. & HYBRIDISATION

Q.23 In the following compound $\overset{1}{C}H_2=\overset{2}{C}H-\overset{3}{C}H_2-C\equiv CH$, the C_2-C_3 bond is of the type :
(A) $sp-sp^2$ (B) sp^3-sp^3 (C) $sp-sp^3$ (D) sp^2-sp^3

Q.24 Which of the following has a geometry different from the other three species (having the same geometry)?
(A) BF_4^- (B) SO_4^{2-} (C) XeF_4 (D) PH_4^+

Q.25 Maximum bond energy is in :
(A) F_2 (B) N_2 (C) O_2 (D) equal

Q.26 Among the following species, identify the isostructural pairs : $NF_3, NO_3^-, BF_3, H_3O^+, OF_2$
(A) $[NF_3, NO_3^-]$ and $[BF_3, H_3O^+]$ (B) $[NF_3, OF_2]$ *and* $[NO_3^-, BF_3]$
(C) $[NF_3, H_3O^+]$ *and* $[NO_3^-, BF_3]$ (D) $[NF_3, H_3O^+]$ *and* $[OF_2, BF_3]$

Q.27 Number and type of bonds between two carbon atoms in CaC_2 are :
(A) one sigma (σ) and one pi (π) bond (B) one σ and two π bonds
(C) one σ and one and a half π bond (D) one σ bond

Q.28 In $C-C$ bond in C_2H_6 undergoes heteroltic fission, the hybridisation of carbon in the resulting two species is / are
(A) sp^2 both (B) sp^3 both (C) sp^2, sp^3 (D) sp, sp^2

Q.29 The hybridisation and shape of BrF_3 molecule are :
(A) sp^3d and bent T shape (B) sp^2d^2 and tetragonal
(C) sp^3d and bent (D) none of these

Q.30 The shape of methyl cation (CH_3^+) is likely to be:
(A) linear (B) pyramidal (C) planar (D) spherical

Q.31 The structure of XeF_2 involves hybridization of the type :
(A) sp^3 (B) dsp^2 (C) sp^3d (D) sp^3d^2

Q.32 In the XeF_4 molecule, the Xe atom is in the
(A) sp^2-hybridized state (B) sp^3-hybridised state
(C) sp^3d^3-hybridized state (D) sp^3d^2-hybridized state

Q.33 How many σ- and π- bonds are there in salicylic acid?
(A) 10σ, 4π (B) 16σ, 4π (C) 18σ, 2π (D) 16σ, 2π

Q.34 Which of the following has been arranged in increasing order of size of the hybrid orbitals ?
(A) $sp < sp^2 < sp^3$ (B) $sp^3 < sp^2 < sp$ (C) $sp^2 < sp^3 < sp$ (D) $sp^2 < sp < sp^3$

Q.35 In the context of carbon, which of the following is arranged in the correct order of electronegativity :
(A) $sp > sp^2 > sp^3$ (B) $sp^3 > sp^2 > sp$ (C) $sp^2 > sp > sp^3$ (D) $sp^3 > sp > sp^2$

Q.36 When $2s-2s, 2p-2p$ and $2p-2s$ orbitals overlap, the bond strength decreases in the order :
(A) $p-p > s-s > p-s$ (B) $p-p > p-s > s-s$
(C) $s-s > p-p > p-s$ (D) $s-s > p-s > p-p$

Q.37 The shapes of IF_5 and IF_7 are respectively :
(A) distorted square pyramidal and pentagonal bipyramidal
(B) octahedral and pyramidal
(C) trigonal bipyramidal and pentagonal bipyramidal
(D) distorted square planar and distorted octahedral

Q.38 Carbon atoms in $C_2(CN)_4$ are :
(A) *sp*-hybridized (B) sp^2-hybridized
(C) *sp*- and sp^2 hybridized (D) *sp*, sp^2 and sp^3 - hybridized

Q.39 CO_2 is isostructural with
(I) $HgCl_2$ (II) NO_2 (III) $SnCl_4$ (IV) C_2H_2
(A) I and III (B) II and IV (C) I and IV (D) III and IV

Q.40 The ratio of σ and π bonds in benzene is :
(A) 2 (B) 6 (C) 4 (D) 8

Q.41 The bond angle and hybridization in ether (CH_3OCH_3) is :
(A) 106°51′, sp^3 (B) 104°31′, sp^3 (C) > 109° 28' sp^3 (D) None of these

Q.42 The shape of a molecule which has 3 bond pairs and one lone pair is :
(A) Octahedral (B) Pyramidal (C) Triangular planar (D) Tetrahedral

Q.43 Which molecule is *T* shaped :
(A) BeF_2 (B) BCl_3 (C) NH_3 (D) ClF_3

Q.44 According to hybridisation theory maximum s-character is found in bond formed by () atom.
(A) $\overset{*}{C}H_4$ (B) $\overset{*}{S}F_6$ (C) $\overset{*}{X}eO_6^{4-}$ (D) $\overset{*}{S}F_4$

Q.45 A σ-bond is formed by two p_x orbitals each containing one unpaired electron when they approach each other along :
(A) *x* - axis (B) *y* - axis (C) *z* - axis (D) any direction

Q.46 Which of the following pairs is (are) isostructural?
(A) SF_4 and SiF_4 (B) SF_6 and SiF_6^{2-} (C) SiF_6^{2-} and SeF_6^{2-} (D) XeO_6^{4-} and TeF_6^{2-}

Q.47 The structure of XeF_6 in vapour phase is
(A) pentagonal bipyramidal (B) trigonal bipyramidal
(C) capped octahedron (D) square bipyramidal

MISCELLEANEOUS (INCLUDING BOND ANGLES & BOND LENGTH)

Q.48 Cyanogen, $(CN)_2$, has a ____ shape/structure :
(A) Linear (B) Zig-zag (C) V-shape (D) Cyclic

Q.49 In which of the following sovents, KI has highest solubility? The dielectric constant ($\in$) of each liquid is given in parentheses.
(A) $C_6H_6(\in = 0)$ (B) $(CH_3)_2CO$ ($\in$=2)
(C) CH_3OH ($\in$=32) (D) $CCl_4(\in=0)$

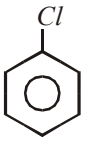
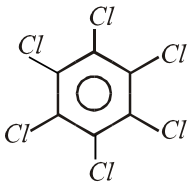
Q.50 The formal charges on the three O-atoms in O_3 molecule are
(A) 0, 0, 0 (B) 0, 0, –1 (C) 0, 0, +1 (D) 0, +1, –1

Q.51 The types of bonds present in $CuSO_4 \cdot 5H_2O$ are
(A) electrovalent and covalent
(B) electrovalent , coordinate covalent & H-bond
(C) covalent, coordinate covalent & H-bonds
(D) electrovalent, covalent, coordinate covalent & H-bond

Q.52 Which of the following has been arranged in order of decreasing dipole moment ?
(A) $CH_3Cl > CH_3F > CH_3Br > CH_3I$ (B) $CH_3F > CH_3Cl > CH_3Br > CH_3I$
(C) $CH_3Cl > CH_3Br > CH_3I > CH_3F$ (D) $CH_3F > CH_3Cl > CH_3I > CH_3Br$

Q.53 Which of the following has the least dipole moment
(A) NF_3 (B) CO_2 (C) SO_2 (D) NH_3

Q.54 The experimental value of the dipole moment of HCl is 1.03 D. The length of the $H-Cl$ bond is $1.275\,\mathring{A}$. The percentage of ionic character in HCl is :
(A) 43 (B) 21 (C) 17 (D) 7

Q.55 The dipole moment of  is 1.5 D. The dipole moment of  is :
(A) 0 D (B) 1.5 D (C) 2.86 D (D) 2.25 D

Q.56 The correct order of decreasing $X-O-X$ bond angle is ($X = H, F$ or Cl) :
(A) $H_2O > Cl_2O > F_2O$ (B) $Cl_2O > H_2O > F_2O$
(C) $F_2O > Cl_2O > H_2O$ (D) $F_2O > H_2O > Cl_2O$

Q.57 Which has higher bond energy :
(A) F_2 (B) Cl_2 (C) Br_2 (D) I_2

Q.58 The bond angle in PH_3 is :
(A) Much lesser than NH_3 (B) Equal to that in NH_3
(C) Much greater than in NH_3 (D) Slightly more than in NH_3

Q.59 $H-B-H$ bond angle in BH_4^- is :
(A) 180º (B) 120º (C) 109º (D) 90º

Q.60 In the series ethane, ethylene and acetylene, the $C-H$ bond energy is maximum in
(A) The same in all the three compounds (B) Ethane
(C) Ethylene (D) Acetylene

Q.61 If ethylene molecule lies in X-Y plane then nodal planes of the π-bond will lie in
(A) XZ plane (B) YZ plane
(C) In a plane that bisects C–C axis (D) XY plane

OTHER FORCES

Q.62 Which of the following models best describes the bonding between layer of the graphite structure ?
(A) metallic bonding (B) ionic bonding
(C) non-metallic covalent bonding (D) van der Waals forces

Q.63 Ethanol has a higher boiling point than dimethyl ether though they have the same molecular weight. This is due to :
(A) resonance (B) coordinate bonding
(C) hydrogen bonding (D) ionic bonding

Q.64 Arrange the following in order of decreasing boiling point :
(I) *n*-Butane (II) *n*-Butanol (III) *n*-Butyl chloride (IV) Isobutane
(A) $IV > III > II > I$ (B) $IV > II > III > I$
(C) $I > II > III > IV$ (D) $II > III > I > IV$

Q.65 Which of the following compounds would have significant intermolecular hydrogen bonding ?
HF, CH_3OH, N_2O_4, CH_4
(A) HF, N_2O_4 (B) HF, CH_4, CH_3OH
(C) HF, CH_3OH (D) CH_3OH, CH_4

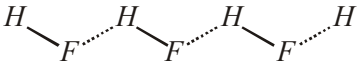
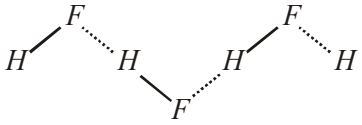
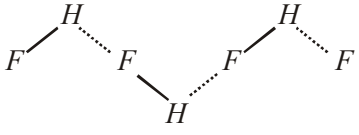
Q.66 For H_2O_2, H_2S, H_2O and HF, the correct order of decreasing strength of hydrogen bonding is :
(A) $H_2O > HF > H_2O_2 > H_2S$ (B) $HF > H_2O_2 > H_2O > H_2S$
(C) $HF > H_2O > H_2O_2 > H_2S$ (D) $H_2O_2 > H_2O > HF > H_2S$

Q.67 Which one of the following does not have intermolecular H-bonding?
(A) H_2O (B) *o*-nitro phenol (C) HF (D) CH_3COOH

Q.68 The order of strength of hydrogen bonds is:
(A) $ClH...Cl > NH...N > OH...O > FH...F$
(B) $ClH...Cl < NH...N < OH...O < FH...F$
(C) $ClH...Cl < NH...N > OH...O > FH...F$
(D) $ClH...Cl < NH...N < OH...O > FH...F$

Q.69 Which of the following exhibit/s H-bonding?
(A) CH_4 (B) H_2Se (C) N_2H_4 (D) H_2S

Q.70 Among the following, van der Waals forces are maximum in
(A) HBr (B) LiBr (C) LiCl (D) AgBr

Q.71 The *H* bond in solid *HF* can be best represented as:
(A) $H-F....H-F....H-F$
(B) 
(C) 
(D) 

Q.72 The volatility of *HF* is low because of :
(A) its low polarizability (B) Strong intramolecular H-bonding
(C) its small molecular mass (D) Strong intermolecular H-bonding

Q.73 Two ice cubes are pressed over each other and unite to form one cube. Which force is responsible for holding them together :
(A) van der Waal's forces (B) Covalent attraction
(C) Hydrogen bond formation (D) Dipole-dipole attraction

Q.74 Intramolecular hydrogen bonding is found in :
(A) Salicylaldehyde (B) Water (C) Acetaldehyde (D) Phenol

Q.75 The pairs of bases in DNA are held together by :
(A) Hydrogen bonds (B) Ionic bonds (C) Phosphate groups (D) Deoxyribose groups

Q.76 In dry ice there are :
(A) Ionic bond (B) Covalent bond (C) Hydrogen bond (D) Vander Waal's forces

Q.77 In which of the following compounds, breaking of covalent bond takes place?
(A) Boiling of H_2O (B) Melting of KCN
(C) Boiling of CF_4 (D) Melting of SiO_2

(More than one options are correct)

Q.78 Atoms combine so that,
(A) They can always attain stable configuration to that of nearest nobel gas.
(B) They can attain stable configuration if possible, to that of nearest nobel gas.
(C) Their potential energy can increase and hence bond energy may increase.
(D) Their potential energy can decrease and hence bond energy may increase.

Q.79 Which of the following statement(s) is/are correct regarding ionic compounds?
(A) They are good conductors of electricity at room temperature in aqueous solution.
(B) They are generally soluble in polar solvents.
(C) They consist of ions.
(D) They generally have high melting and boiling points.

Q.80 Which of the following compounds contain ionic, covalent and cordinate bonds?
(A) NH_4Cl (B) KCN (C) $NaBF_4$ (D) NaOH

Q.81 Most ionic compounds have :
(A) high melting points and low boiling points
(B) high melting points and nondirectional bonds
(C) high solubilities in polar solvents and low solubilities in nonpolar solvents
(D) three-dimensional arrangements of ions in solid state, and are good conductors of electricity in the molten state

Q.82 Which of the following have a three dimensional network structure ?
(A) SiO_2 (B) Diamond (C) $P_4(\text{white})$ (D) CCl_4

Q.83 Which of the following statements is/are true?
(A) Covalent bonds are directional
(B) Ionic bonds are nondirectional
(C) A polar bond is formed between two atoms which have the same electronegativity value.
(D) The presence of polar bonds in a polyatomic molecule suggests that it has zero dipole moment

Q.84 The octet rule is not obeyed in :
(A) CO_2 (B) BCl_3 (C) PCl_5 (D) SiF_4

Q.85 To which of the following species octet rule is not applicable :
(A) BrF_5 (B) SF_6 (C) IF_7 (D) CO

Q.86 Pick out among the following species isoelectronic with CO_2 :
(A) N_3^- (B) $(CNO)^-$ (C) $(NCN)^{2-}$ (D) NO_2^-

Q.87 Which of the following oxyacids of sulphur contain $S-S$ bonds ?
(A) $H_2S_2O_8$ (B) $H_2S_2O_6$ (C) $H_2S_2O_4$ (D) $H_2S_2O_5$

Q.88 Which of the following species contain coordinate covalent bond :
(A) $AlCl_3$ (B) CO (C) $[Fe(CN)_6]^{4-}$ (D) N_3^-

Q.89 Which of the following statement(s) is / are not correct?
(A) Hybridization is the mixing of atomic orbitals of large energy difference.
(B) sp^2 – hybrid orbitals are formed from two p - atomic orbitals and one s- atomic orbital
(C) sp^3d^2 – hybrid orbitals are all at 90º to one another
(D) sp^3 – hybrid orbitals are directed towards the corners of a regular tetrahedron

Q.90 Which of the following species is (are) isostructural with XeF_4 ?
(A) ICl_4^- (B) I_3^- (C) BrF_4^- (D) XeO_4

Q.91 Which of the following statements is/are correct ?
(A) NH_2^+ shows sp^2 – hybridisation whereas NH_2^- shows sp^3 – hybridisation
(B) $Al(OH)_4^-$ has a regular tetrahedral geometry
(C) sp^2 – hybridized orbitals bonded to same substituents have equal s- and p- character
(D) Hybridized orbitals always form σ - bonds

Q.92 There is change in the hybridisation when:
(A) NH_3 combines with H^+ (B) AlH_3 combines with H^-
(C) NH_3 forms NH_2^- (D) SiF_4 forms SiF_6^{2-}

Q.93 Which of the following statement is/are correct
(A) Hybridisation is the mixing of pure atomic orbitals having less energy difference
(B) sp^3d^2 – hybrid orbitals are at 90º to each other
(C) sp^3d – hybrid orbitals are directed towards the corners of a regular tetrahedron
(D) sp^3d^2 – hybrid orbitals are directed towards the corners of a regular octahedron

Q.94 State the wrong statement :
(A) Free rotation around the single bond is not possible.
(B) p-orbitals always overlap sideways
(C) s-orbitals never form π - bonds
(D) There can be more than one sigma bond between two atoms

Q.95 sp^3 hybridisation is in :

(A) AlH_4^- (B) CH_3^- (C) ClO_2^- (D) NH_2^-

Q.96 Which of the following has (have) regular octahedral geometry :

(A) $SbCl_6^-$ (B) $SnCl_6^{2-}$ (C) XeF_6 (D) IO_6^{5-}

Q.97 Shape of NH_3 is very similar to :

(A) SeO_3^{2-} (B) CH_3^- (C) BH_3 (D) CH_3^+

Q.98 Which of the following have same shape as NH_2^+ ?

(A) CO_2 (B) $SnCl_2$ (C) SO_2 (D) $BeCl_2$

Q.99 Which of the following is (are) linear ?

(A) I_3^- (B) I_3^+ (C) $PbCl_2$ (D) XeF_2

Q.100 Which of the following species are linear ?

(A) ICl_2^- (B) I_3^- (C) N_3^- (D) ClO_2

Q.101 Which of the following compounds possesses zero dipole moment?

(A) Water (B) Benzene (C) Carbon tetrachloride (D) Boron trifluoride

Q.102 Which of the following statements are correct?

(A) The crystal lattice of ice is formed by covalent as well as hydrogen bonds

(B) The density of water increases when heated from 0° C to 4° C

(C) Above 4° C the thermal agitation of water molecules increases. Therefore, intermolecular distance increases and water starts expanding

(D) The density of water decreases from 0° C to a maximum at 4° C

Q.103 Which of the following compounds has bond angle as nearly 90° ?

(A) NH_3 (B) H_2S (C) H_2O (D) SF_6

Q.104 For propadiene $\overset{1}{H_2}\overset{}{C} = \overset{2}{C} = \overset{3}{CH_2}$, correct statement(s) is / are :

(A) Molecule is non planar

(B) Molecule is nonpolar

(C) Nodal plane of π-bond formed by C_1 & C_2 is perpendicular to that of formed by C_2 & C_3.

(D) Nodal plane of π-bond formed by C_1 & C_2 is coplanar with that of formed by C_2 & C_3.

Q.105 Molecule(s) having both polar and non polar bonds is / are

(A) O_2F_2 (B) S_2Cl_2 (C) N_2H_4 (D) S_2F_{10}

Match the Column :

Q.106

	Column I		**Column II**
(A)	BrF_3	(P)	One angle $\leq 90°$
(B)	TeF_5^-	(Q)	Central atom is sp^3d^2 hybridised
(C)	IF_7	(R)	Non planar
(D)	XeF_4	(S)	Polar

Q.107

	Column I		**Column II**
(A)	$I(CN)_2^-$	(P)	Having $p\pi-p\pi$ bond & $\mu_D = 0$
(B)	CO_3^{2-}	(Q)	Having $p\pi-d\pi$ bond & $\mu_D \neq 0$
(C)	XeO_2F_2	(R)	Planar
(D)	SOF_4	(S)	Central atom is sp^3d

Q.108

	Column I		**Column II**
(A)	$H_2S_2O_5$	(P)	Central atom is sp^3 hybridised
(B)	$H_6B_2O_7^{2-}$	(Q)	M–O–M ie oxo linkage is present
(C)	$H_4P_2O_6$	(R)	M–M ie oxo linkage is absent
(D)	$H_6Si_2O_7$	(S)	Non planar

ANSWER KEY

EXERCISE - I

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

Q.97 A,B Q.98 B,C Q.99 A,D Q.100 A,B,C

Q.101 B,C,D Q.102 A,B,C Q.103 B,D Q.104 A,B,C

Q.105 A,B,C,D Q.106 (A) P,S (B) P,Q,R,S (C) P,R (D) P,Q
Q.107 (A) P,R,S (B) P,R (C) Q,S (D) Q,S

Q.108 (A) P,R,S (B) P,Q,S (C) P,R,S (D) P,Q,S

EXERCISE - II

(Assertion & Reason)

Q.1 **Statement-1 :** Higher the lattice energy greater will be the ease of formation of an ionic compound.
Statement-2 : Lattice energy is evolved during formation of an ionic compound.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

Q.2 **Statement-1 :** Lattice energy of an ionic solid can not be infinite.
Statement-2 : As inter ionic distance tends to zero, repulsive forces dominate over attractive forces.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

Q.3 **Statement-1 :** If all substituents and lone pairs are symmetrically placed around central atom, the molecule will be non polar.
Statement-2 : The direction of bond moment is from positive pole towards negative pole.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

Q.4 **Statement-1 :** During formation of co-ordinate bond acceptor accepts electron pair only when its octet has not been completed
Statement-2 : Inspite of having completed octet, acceptor can accept electron pair provided it has empty 'd' orbitals.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

Q.5 **Statement-1 :** On the basis of overlapping of pure atomic orbital the shape of NH_3 molecule will be trigonal pyramidal.
Statement-2 : According to pure atomic orbital overlapping each $\angle$ HNH is of 90°.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

Q.6 **Statement-1 :** lone pair – lone pair repulsion is found to be greater than lone pair b.p. repulsion.
Statement-2 : lone pair is under the influence of one nucleus while b.p. is under that of two nuceli.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

Q.7 **Statement-1 :** Phosphorus exists as P_4 not as P_2
Statement-2 : Sidewise overlapping between two 3p orbitals is less effective.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

Q.8 **Statement-1 :** Inorganic benzene ($B_3N_3H_6$) and organic benzene (C_6H_6) are isoelectronic & hence are isostructural.
Statement-2 : d_{C-C} in benzene is greater than d_{B-N} in inorganic benzene (borazine).
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

Q.9 **Statement-1 :** Compounds, like graphite, H_3BO_3, boron nitride (inorganic graphite etc.), which composed of layers in solid state have lubricating action.
Statement-2 : Two dimensional layers are bonded to one another by weak Vander Waals forces.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

EXERCISE - II

Q.1	B	Q.2	D	Q.3	A	Q.4	B
Q.5	A	Q.6	A	Q.7	B	Q.8	B
Q.9	A						

MOLE CONCEPT

1. The charge on 1 gram ions of Al^{3+} is : (N_A = Avogadro number, e = charge on one electron)
(A) $\frac{1}{27} N_A e$ coulomb **(B)** $\frac{1}{3} \times N_A e$ coulomb **(C)** $\frac{1}{9} \times N_A e$ coulomb **(D)** $3 \times N_A e$ coulomb

2. Which of the following expressions is correct (n = no. of moles of the gas, N_A = Avogadro constant, m = mass of 1 molecule of the gas, N = no. of molecules of the gas)?
(A) $n = m N_A$ **(B)** $m = N_A$ **(C)** $N = nN_A$ **(D)** $m = mn/N_A$

3. The modern atomic weight scale is based on :
(A) C^{12} **(B)** O^{16} **(C)** H^{1} **(D)** N^{14}

4. The weight of a molecule of the compound $C_{60}H_{22}$ is :
(A) 1.09×10^{-21} g **(B)** 1.24×10^{-21} g **(C)** 5.025×10^{-23} g **(D)** 16.023×10^{-23} g

5. Which of the following contains the greatest number of atoms ?
(A) 1.0 g of butane (C_4H_{10}) **(B)** 1.0 g of nitrogen (N_2)
(C) 1.0 g of silver (Ag) **(D)** 1.0 g of water (H_2O)

6. A gaseous mixture contains CO_2(g) and N_2O(g) in 2 : 5 ratio by mass. The ratio of the number of molecules of CO_2(g) and N_2O(g) is :
(A) 5 :2 **(B)** 2 : 5 **(C)** 1 : 2 **(D)** 5 : 4

7. Four 1-1 litre flasks are separately filled with the gases H_2, He, O_2 and O_3 at the same temperature and pressure. The ratio of total number of atoms of these gases present in different flask would be :
(A) 1 : 1 : 1 : 1 **(B)** 1 : 2 : 2 : 3 **(C)** 2 : 1 : 2 : 3 **(D)** 3 : 2 : 2 : 1

8. Under the same conditions, two gases have the same number of molecules. They must
(A) be noble gases **(B)** have equal volumes
(C) have a volume of 22.4 dm^3 each **(D)** have an equal number of atoms

9. 16 g of an ideal gas SO_x occupies 5.6 L. at STP. The value of x is
(A) x = 3 **(B)** x = 2 **(C)** x = 4 **(D)** none

10. 0.44 g of a colourless oxide of nitrogen occupies 224 mL at STP. The compound is :
(A) N_2O **(B)** NO **(C)** N_2O_2 **(D)** NO_2

11. 4.4 of CO_2 and 2.24 litre of H_2 at STPare mixed in a container. The total number of molecules present in the container will be :
(A) 6.022×10^{23} **(B)** 1.2044×10^{23} **(C)** 2 mole **(D)** 6.023×10^{23}

12. How many atoms are contained in one mole of sucrose ($C_{12}H_{22}O_{11}$) ?
(A) $45 \times 6.02 \times 10^{23}$ atom / mol **(B)** $20 \times 6.02 \times 10^{23}$ atom / mol
(C) $5 \times 6.02 \times 10^{23}$ atom / mol **(D)** None of these

13. 4 g atom of Ag contains :
(A) 108 g **(B)** 4 g **(C)** 432 g **(D)** none of these

14. Which sample contains the largest number of atoms ?
(A) 1 mg of C_2H_{10} **(B)** 1 mg of N_2 **(C)** 1 mg of Na **(D)** 1 mL of water

15. 1.0 g of hydrogen contains 6×10^{23} atoms. The atomic mass of helium is 4. It follows that the number of atoms in 1 g of He is :
(A) $\frac{1}{4} \times 6 \times 10^{23}$ **(B)** $4 \times 6 \times 10^{23}$ **(C)** 6×10^{23} **(D)** 12×10^{23}

16. The number of molecules in 4.25g of ammonia is approximately :
(A) 3.5×10^{23} **(B)** 1.5×10^{23} **(C)** 0.5×10^{23} **(D)** 2.5×10^{23}

17. The total number of protons, electrons and neutrons is 12g of $^{12}_{6}C$ is :
(A) 1.084×10^{25} **(B)** 6.022×10^{23} **(C)** 6.022×10^{22} **(D)** 18

18. Weight of a single molecule of water is :
(A) 3.0×10^{-23} g **(B)** 6.02×10^{23} g **(C)** 6.02×10^{-23} g **(D)** none of these

19. Number of electrons in 1.8 mL of H_2O is :
(A) 6.02×10^{23} **(B)** 3.011×10^{23} **(C)** 0.6022×10^{23} **(D)** 60.22×10^{23}

20. 22.4 litre of water vapour at NTP, when condensed to water, occupies an approximate volume of :
(A) 18 litre **(B)** 1 litre **(C)** 1 mL **(D)** 18 mL

21. The least number of molecules are contained in :
(A) 2 g hydrogen **(B)** 8 g oxygen **(C)** 4 g nitrogen **(D)** 16 g CO_2

22. Which has the maximum number of atoms ?
(A) 6 g C **(B)** 1 g H_2 **(C)** 12 g Mg **(D)** 30 g Ca

23. The number of atoms is 3.2 g of oxygen gas are :
(A) 6.02×10^{22} **(B)** 6.02×10^{23} **(C)** 12.04×10^{22} **(D)** 12.04×10^{23}

24. Number of atoms in 558.5g Fe (at. mass 55.85) is :
(A) twice that in 60g carbon **(B)** 6.023×10^{22}
(C) half in 8 g He **(D)** $558.5 \times 6.023 \times 10^{23}$

25. How many moles of magnesium phosphate $Mg_3(PO_4)_2$ will contain 0.25 mole of oxygen atoms ?
(A) 0.02 **(B)** 3.125×10^{-2} **(C)** 1.25×10^{-2} **(D)** 2.5×10^{-2}

26. In which of the following pairs do 1 g of each have an equal number of molecules?
(A) N_2O and CO **(B)** N_2 and C_3O_2 **(C)** N_2 and CO **(D)** N_2O and CO_2

27. Number of atoms in 560g of Fe (atomic mass 56g mol^{-1}) is :
(A) Twice that of 70g N **(B)** Half that of 20g H
(C) Both (A) and (B) **(D)** None of these

28. How many moles of electron weigh one kilogram :
(A) 6.023×10^{23} **(B)** $\frac{1}{9.108} \times 10^{31}$ **(C)** $\frac{6.023}{9.108} \times 10^{54}$ **(D)** $\frac{1}{9.108 \times 6.023} \times 10^{8}$

29. Which has maximum number of atoms :
(A) 24 g of C (12) **(B)** 56 g of Fe (56) **(C)** 27 g of Al (27) **(D)** 108 g Ag (108)

30. One litre of a gas at STP weight 1.16 g it can possible be
(A) C_2H_2 **(B)** CO **(C)** O_2 **(D)** CH_4

31. 100 mL of PH_3 on decomposition produced phosphorus and hydrogen. The change in volume is
(A) 50 mL increase **(B)** 500 mL decrease **(C)** 900 mL decrease **(D)** Nil.

32. Number of g of oxygen in 32.2 g $Na_2SO_4.10H_2O$ is
(A) 20.8 **(B)** 22.4 **(C)** 2.24 **(D)** 2.08

33. The volume occupied by 4.4 g of CO_2 at STP is
(A) 22.4 L **(B)** 2.24 L **(C)** 0.224 L **(D)** 0.1 L

34. The number of water molecules present in a drop of water (volume 0.0018 mL) at room temperature is
(A) 6.023×10^{19} **(B)** 1.084×10^{18} **(C)** 4.84×10^{17} **(D)** 6.023×10^{23}

35. The total number of protons in 10 g of calcium carbonate is ($N_0 = 6.023 \times 10^{23}$)
(A) 1.5057×10^{24} **(B)** 2.0478×10^{24} **(C)** 3.0115×10^{24} **(D)** 4.0956×10^{24}

36. The incorrect statement for 14 g of CO is
(A) It occupies 2.24 litre at NTP
(B) It corresponds to $\frac{1}{2}$ mole of CO
(C) It corresponds to same mole of CO and N_2
(D) It corresponds to 3.01×10^{23} molecules of CO

37. The number of water molecules in 1 litre of water is
(A) 18 **(B)** 18×1000 **(C)** N_A **(D)** $55.55\ N_A$

38. The number of moles of $BaCO_3$ which contain 1.5 moles of oxygen atoms is
(A) 0.5 **(B)** 1 **(C)** 3 **(D)** 6.02×10^{23}

39. The number of moles of sodium oxide in 620g of it is
(A) 1 mol **(B)** 10 moles **(C)** 18 moles **(D)** 100 moles

40. The number of sodium atoms in 2 moles of sodium ferrocyanide is
(A) 12×10^{23} **(B)** 26×10^{23} **(C)** 34×10^{23} **(D)** 48×10^{23}

41. 100 ml O_2 and H_2 kept at same temperature and pressure. What is true about their number of molecules
(A) $N_{O_2} > N_{H_2}$ **(B)** $N_{O_2} < N_{H_2}$ **(C)** $N_{O_2} = N_{H_2}$ **(D)** $N_{O_2} + N_{H_2} = 1$ mole

42. Avogadro number (6.023×10^{23}) of carbon atoms are present in
(A) 12 grams of $^{12}CO_2$ **(B)** 22.4 litre $^{12}CO_2$ in room temperature
(C) 44 grams of $^{12}CO_2$ **(D)** 12 moles of $^{12}CO_2$

43. The number of water molecules is maximum in
(A) 18 molecules of water **(B)** 1.8 gram of water
(C) 18 gram of water **(D)** 18 moles of water

44. If Avogadro number N_A, is changed from $6.022 \times 10^{23}\ mol^{-1}$ to $6.022 \times 10^{20}\ mol^{-1}$ this would change
(A) The definition of mass in units of grams
(B) The mass of one mole of carbon
(C) The ratio of chemical species to each other in a balanced equation
(D) The ratio of elements to each other in a compound

45. Which of the following pairs of substances illustrate the law of multiple proportions
(A) CO and CO_2 **(B)** H_2O and D_2O **(C)** NaCl and NaBr **(D)** MgO and $Mg(OH)_2$

46. The law of definite proportions is not applicable to nitrogen oxide because
(A) Nitrogen atomic weight is not constant **(B)** Nitrogen molecular weight is variable
(C) Nitrogen equivalent weight is variable **(D)** Oxygen atomic weight is variable

47. The perecentage of copper and oxygen in samples of CuO obtained by different methods were found to be the same Thish illustrates the law os
(A) Constant proportions **(B)** Conservation of mass
(C) Multiple proportions **(D)** Reciprocal proportions

48. Two samples of lead oxide were separately reduced to metallic lead by heating in a current of hydrogen. The weight of lead from one oxide was half the weight of lead obtained from the other oxide. The data illustrates
(A) Law of reciprocal proportions **(B)** Law of constant proportions
(C) Law of multiple proportions **(D)** Law of equivalent proportions

49. Which one of the following paris of compounds illustrates the law of multiple proportion
(A) H_2O, Na_2O **(B)** MgO, Na_2O **(C)** Na_2O, BaO **(D)** $SnCl_2$, $SnCl_4$

50. Different proportions of oxygen in the various oxides of nitrogen prove the
(A) Equivalent proportion **(B)** Multiple proportion
(C) Constant proportion **(D)** Conservation of matter

51. A sample of calcium carbonate ($CaCO_3$) has the following percentage composition : Ca = 40%; C = 12% O = 48% If the law of constant proportions is true, then the weight of calcium in 4 g of a sample of calcium carbonate obtained from another source will be
(A) 0.016 g **(B)** 0.16 g **(C)** 1.6 g **(D)** 16 g

52. In compound A, 1.00 g nitrogen unites with 0.57 g oxygen. In compound B, 2.00 g nitrogen combines with 2.24 g oxygen. In compound C, 3.00 g nitrogen combines with 5.11 g oxygen. These results obey the following law
(A) Law of constant proportion **(B)** Law of multiple proportion
(C) Law of reciprocal proportion **(D)** Dalton's law of partial pressure

53. Hydrogen combines with oxygen to form H_2O in which 16 g of oxygen combine with 2 g of hydroen. Hydrogen also combines with carbon to form CH_4 in which 2 g of hydrogen combine with 6 g of carbon. if carbon and oxygen combine together then they will do show in the rato of
(A) 6 : 16 or 12 : 32 **(B)** 6 : 18 **(C)** 1 : 2 **(D)** 12 : 24

54. If N_A is Avogadro's number then number of valence electrons in 4.2 g of nitride ions (N^{3-})
(A) 2.4 N_A **(B)** 4.2 N_A **(C)** 1.6 N_A **(D)** 3.2 N_A

55. If 1 ml of water contains 20 drops. Then no. of molecules in a drop of water is
(A) 1.800×10^{22} molecules **(B)** 1.376×10^{26} molecules
(C) 1.344×10^{18} molecules **(D)** 4.346×10^{20} molecules

56. The percentage of oxygen in NaOH is
(A) 40 **(B)** 60 **(C)** 8 **(D)** 10

57. An organic compound contains carbon, hydrogen and oxygen. Its elemental analysis gave C. 38.71 % and H, 9.67% and O, 51.62%. The empirical formula of the compound would be
(A) CHO **(B)** CH_4O **(C)** CH_3O **(D)** CH_2O

58. A compound contains 69.5% oxygen and 30.5% nitrogen and its molecular weight is 92. The formula of the compound is
(A) N_2O **(B)** NO_2 **(C)** N_2O_4 **(D)** N_2O_5

59. An organic compound whose empirical and molecular formula are same, contains 20% carbon, 6.7% hydrogen, 46.7% nitrogen and the rest oxygen. On heating it yields ammonia, leaving a solid residue. The solid residue gives a violet colour with dilute solution of alkaline copper sulphate. The organic compound is
(A) NH_2COONH_4 **(B)** CH_3COONH_4 **(C)** NH_2NHCHO **(D)** $HCOONH_4$
(E) NH_2CONH_2

60. The percentage of P_2O_5 in diammonium hydrogen phosphate $(NH_4)_2HPO_4$ is
(A) 23.48 **(B)** 46.96 **(C)** 53.78 **(D)** 71.00

61. The empirical formula of a compound of molecular mass 120 is CH_2O. The molecular formula of the compound is :
(A) $C_2H_4O_2$ **(B)** $C_4H_8O_4$ **(C)** $C_3H_6O_3$ **(D)** all of these

62. Calculate the molecular formula of compound which contains 20% Ca and 80% Br (by wt.) if molecular weight of compound is 200. (Atomic wt. Ca = 40, Br = 80)
(A) $Ca_{1/2}Br$ **(B)** $CaBr_2$ **(C)** CaBr **(D)** Ca_2Br

63. H_2 evolved at STP on complete reaction of 27 g of Aluminium with excess of aqueous NaOH would be
(A) 22.4 **(B)** 44.8 **(C)** 67.2 **(D)** 33.6

64. What is the % of H_2O in $Fe(CNS)_3.3H_2O$
(A) 45 **(B)** 30 **(C)** 19 **(D)** 25

65. What weight of SO_2 can be made by burning sulphur in 5.0 moles of oxygen
(A) 640 grams **(B)** 160 grams **(C)** 80 grams **(D)** 320 grams

66. Haemoglobin contains 0.33% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms present in one molecule of haemoglobin is
(A) 6 **(B)** 1 **(C)** 4 **(D)** 2

67. Three oxides of nitrogen N_2O, NO_2 and N_2O_3 are mixed in a molar ratio of 3 : 2 : 1. Find the average molar mass of gaseous mixture.
(A) 50 **(B)** 25 **(C)** 90 **(D)** 75

68. Boron has two stable isotopes, ^{10}B (relative abundance = 19%) and ^{11}B (relative abundance = 81%). The atomic mass (in amu) that should appear for boron in the periodic table is :
(A) 10.8 **(B)** 10.2 **(C)** 11.2 **(D)** 10.6

69. Cortisone is a molecular substance containing 21 atoms of carbon per molecule. The mass percentage of carbon in cortisone is 69.98%. Its molar mass is :
(A) 176.5 **(B)** 252.2 **(C)** 287.6 **(D)** 360.1

70. 2 isotopes of an element are present in 1 : 2 ratio of number, having mass number M and (M + 0.5) respectively. The mean mass number of element will be
(A) 3M + 1 **(B)** 1.5 M + 0.5 **(C)** 0.5 M + 0.5 **(D)** None of these

71. Three isotopes of an element have mass numbers M, (M+1) and (M+2). If the mean mass number is (M + 0.5), then which of the following ratio of number may be accepted for M, (M+1) and (M+2) in the order
(A) 1 : 1 : 1 **(B)** 4 : 1 : 1 **(C)** 3 : 2 : 1 **(D)** 2 : 1 : 1

72. If the mass of proton is doubled and that of neutron is halved, the molecular weight of CO_2, consisting only C^{12} and O^{16} atoms, will
(A) not change **(B)** increase by 25%
(C) decrease by 25% **(D)** increase by 50%

73. Which of the following will occupy greater volume under the similar conditions of pressure and temperature?
(A) 6 gm oxygen **(B)** 0.98 gm hydrogen
(C) 5.25 gm nitrogen **(D)** 1.32 gm helium

74. Density of dry air containing only N_2 and O_2 is 1.15 g/L at 740 mm and 300 K. What is % composition of N_2 by weight in the air ?
(A) 78% **(B)** 85.5% **(C)** 70.02% **(D)** 62.75%

75. A gaseous mixture of H_2 and CO_2 gas contains 66 mass % of CO_2. the vapour density of the mixture is :
(A) 6.1 **(B)** 5.4 **(C)** 2.7 **(D)** 10.8

76. The vapour density of a mixture containing NO_2 and N_2O_4 is 27.6. The mole fraction of N_2O_4 in the mixture is :
(A) 0.1 **(B)** 0.2 **(C)** 0.5 **(D)** 0.8

77. Average atomic mass of magnesium is 24.31 a.m.u. This magnesium is composed of 79 mole % of ^{24}Mgand remaining 21 mole % of ^{25}Mg and ^{26}Mg. Calculate mole % of ^{26}Mg.
(A) 10 **(B)** 11 **(C)** 15 **(D)** 16

78. Calculate density of a gaseous mixture which consist of 3.01×10^{24} molecules of N_2 and 32 g of O_2 gas at 3 atm pressure and 860 K temperature (Given : R = 1/12 atm L/mole.K)
(A) 0.6 g/L **(B)** 1.2 g/L **(C)** 0.3 g/L **(D)** 12 g/L

79. A mixture of O_2 and gas "Y" (mol. wt. 80) in the mole ratio a : b has a mean molecular weight 40. What would be mean molecular weight, if the gases are mixed in the ratio b : a under identical conditions ? (gases are non-reaction) :
(A) 40 **(B)** 48 **(C)** 62 **(D)** 72

80. Complete combustion of 0.858 g of compound X gives 2.63 g of CO_2 and 1.28 g of H^2O. The lowest molecular mass X can have :
(A) 43 g **(B)** 86 g **(C)** 129 g **(D)** 172 g

81. The sulphate of a meta M contains 9.87% of M. This sulphate is isomorphous with $ZnSO_4 \cdot 7H_2O$. The atomic weight of M is :
(A) 40.3 **(B)** 36.3 **(C)** 24.3 **(D)** 11.3

82. In an organic compound of mmolar mass 108 gm mol^{-1} C, H and N atoms are present in 9 : 1 : 3.5 by weight. Molecular formula can be :
(A) $C_6H_8N_2$ **(B)** $C_7H_{10}N$ **(C)** $C_5H_6N_3$ **(D)** $C_4H_{18}N_3$

83. On analysis, a certain compound was found to contain 254 g of iodine (at. mass 127) and 80 g oxygen (at. mass 16). What is the formula of the compound ?
(A) IO **(B)** I_2O **(C)** I_5O_3 **(D)** I_2O_5

84. An element A is tetravalent and another element B is divalent. The formula of the compound formed from these elements will be :
(A) A_2B **(B)** AB **(C)** AB_2 **(D)** A_2B_3

85. A compound used in making nylon, is 43.8% oxygen. There are four oxygen atoms per molecule. What is the molecular weight of compound ?
(A) 36 **(B)** 116 **(C)** 292 **(D)** 146

86. Two element X (at. mass = 75) and Y (at. mass = 16) combine to give a compound having 75.8% of X. The formula of the compound is:
(A) XY **(B)** X_2Y **(C)** X_2Y_2 **(D)** X_2Y_3

87. 10 g of hydrogen and 64 g of oxygen were filled in a steel vessel and exploded. Amount of water produced in this reaction will be
(A) 2 mol **(B)** 3 mol **(C)** 4 mol **(D)** 1 mol

88. What volume of oxygen gas (O_2) measured at 0°C and 1 atm, is needed to burn completely 1L of propance gas (C_3H_8) measured under the same conditions
(A) 5L **(B)** 10L **(C)** 7L **(D)** 6L

89. 100 mL of PH_3 on decomposition produced phosphorus and hydrogen. The change in volume is
(A) 50 mL increase **(B)** 500 mL decrease **(C)** 900 mL decrease **(D)** Nil.

90. Calculate the mass of residue obtained on strongly heating 2.76 g Ag_2CO_3.

$$Ag_2CO_3 \xrightarrow{\Delta} 2Ag + CO_2 + \frac{1}{2}O_2$$

(A) 2.16 g **(B)** 4.32 **(C)** 1.08 **(D)** 2

91. How many mole of $Zn(FeS_2)$ can be made from 2 mole zinc, 3 mole iron and 5 mole sulphur.
(A) 2 mole **(B)** 3 mole **(C)** 4 mole **(D)** 5 mole

92. A sample of $KClO_3$ on decomposition yielded 448 mL of oxygen gas at NTP.
The Weight of oxygen produced,
(A) 0.64 g **(B)** 1.64 g **(C)** 4 g **(D)** 1.4 g

93. 12 g of alkaline earth metal gives 14.8 g of its nitride. Atomic weight of metal is -

(A) 12 **(B)** 20 **(C)** 40 **(D)** 14.8

94. How many moles of potassium chlorate need to be heated to produce 11.2 litre oxygen at N.T.P.

(A) $\frac{1}{2}$ mol **(B)** $\frac{1}{3}$ mol **(C)** $\frac{1}{4}$ mol **(D)** $\frac{2}{3}$ mol

95. Equal weight of 'X' (At. wt. = 36) and 'Y' (At. wt. = 24) are reacted to form the compound X_2Y_3. Then :
(A) X is the limiting reagent
(B) Y is the limiting reagent
(C) No reactant is left over and mass of X_2Y_3 formed is double the mass of 'X' taken
(D) none of these

96. In a certain operation 358 g of $TiCl_4$ is reacted with 96 g of Mg. Calculate % yield of Ti if 32 g of Ti is actually obtained [At. wt. Ti = 48, Mg = 24]
(A) 35.38 % **(B)** 66.6 % **(C)** 100 % **(D)** 60 %

97. 500 mL of a glucose solution contains 6.02×10^{22} molecules. The concentration of the solution is
(A) 0.1 M **(B)** 1.0 M **(C)** 0.2 M **(D)** 2.0 M

98. Equal moles of H_2O and NaCl are present in a solution. Hence, molality of NaCl solution is :
(A) 0.55 **(B)** 55.5 **(C)** 1.00 **(D)** 0.18

99. Mole fraction of A in H_2O is 0.2. The molality of A in H_2O is :
(A) 13.9 **(B)** 15.5 **(C)** 14.5 **(D)** 16.8

100. The molarity of the solution containing 2.8%(mass / volume) solution of KOH is : (Given atomic mass of K = 39) is :
(A) 0.1 M **(B)** 0.5 M **(C)** 0.2 M **(D)** 1 M

101. A solution of $FeCl_3$ is $\frac{M}{30}$ its molarity for Cl^- ion will be :
(A) $\frac{M}{90}$ **(B)** $\frac{M}{30}$ **(C)** $\frac{M}{10}$ **(D)** $\frac{M}{5}$

102. The volume of water that must be added to a mixture of 250 ml of 0.6 M HCl and 750 ml of 0.2 M HCl to obtain 0.25 M solution of HCl is :
(A) 750 ml **(B)** 100 ml **(C)** 200 mℓ **(D)** 300 mℓ

103. What volume of a 0.8 M solution contains 100 milli moles of the solute?
(A) 100 mL **(B)** 125 mL **(C)** 500 mL **(D)** 62.5 mL

104. 2M of 100 ml Na_2SO_4 is mixed with 3M of 100 ml NaCl solution and 1M of 200 ml $CaCl_2$ solution. Then the ratio of the concentration of cation and anion.
(A) 1/2 **(B)** 2 **(C)** 1.5 **(D)** 1

105. Match the following :

	Column I		**Column II**
(A)	$C_{12}H_{22}O_{11}$	**(P)**	$16\ N_A$ atoms / mol
(B)	CH_3COOH	**(Q)**	$28 \times N_A$ atoms / mol
(C)	$Ca(OH)_2$	**(R)**	$90\ N_A$ atoms / mol
(D)	$CH_3COOC_2H_5$	**(S)**	$4\ N_A$ of O-atoms / mol

Ans- (A) R, (B) P,S (C) S (D) Q,S

106. Match the following:

	Column I		**Column II**
(A)	Gram atom present in one atom	**(P)**	$2\ N_A$
(B)	N_A gram atom contains atom	**(Q)**	$\frac{1}{N_A}$
(C)	No. of protons in 1 gm molecule of H_2	**(R)**	$4\ N_A$
(D)	No. of electrons added to 32 gm O atom to convert it into O^{2-}	**(S)**	N_A^2

Oxidation Number & Calculations

1. ***Calculate the O.N. of all atoms in following compounds:-***

(1) Fe_3O_4 **(2)** FeO **(3)** $Na_2S_4O_6$ **(4)** C_2H_5OH
(5) $FeSO_4.(NH_4)_2SO_4.6H_2O$ **(6)** CO_2 **(7)** FeS_2
(8) PbS **(9)** CS_2 **(10)** CrO_5 **(11)** $(N_2H_5)_2SO_4$
(12) N_2O_5 **(13)** HCN **(14)** HNC **(15)** $Ba[H_2PO_2]_2$
(16) OsO_4 **(17)** $H_2S_2O_3$ **(18)** CH_3SO_3H **(19)** Ba_2XeO_6
(20) $Ba(SCN)_2$

2. The oxidation number of Oxygen in Na_2O_2 is :
(A) + 1 **(B)** + 2 **(C)** – 2 **(D)** – 1

3. In $FeCr_2O_4$, the oxidation numbers of Fe and Cr are :
(A) + 2 and + 3 **(B)** 0 and + 2 **(C)** + 2 and + 6 **(D)** + 3 and + 6

4. The average oxidation state of Fe in Fe_3O_4 is :
(A) 2 and 3 **(B)** 8/3 **(C)** 2 **(D)** 3

5. Which of the following are examples of disproportionation reaction :

(A) $HgO \longrightarrow Hg + O_2$ **(B)** $KClO_3 \longrightarrow KCl + O_2$
(C) $KClO_3 \longrightarrow KClO_4 + KCl$ **(D)** $Cl_2 + OH^- \longrightarrow ClO^- + Cl^- + H_2O$

6. The oxidation number of Phosphorus in $Mg_2P_2O_7$ is :
(A) + 3 **(B)** + 2 **(C)** + 5 **(D)** – 3

7. The oxidation states of Sulphur in the anions SO_3^{2-}, $S_2O_4^{2-}$ and $S_2O_6^{2-}$ follow the order :
(A) $S_2O_6^{2-} < S_2O_4^{2} < SO_3^{2-}$ **(B)** $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$

(C) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$ **(D)** $S_2O_4^{2} < S_2O_6^{2-} < SO_3^{2-}$

8. Match List-I (Compounds) with List-II (Oxidation states of Nitrogen) and select answer using the codes given below the lists :

	List-I		**List-II**
(A)	NaN_3	**(1)**	+5
(B)	N_2H_2	**(2)**	+2
(C)	NO	**(3)**	–1/3
(D)	N_2O_5	**(4)**	–1

	(A)	**(B)**	**(C)**	**(D)**		**(A)**	**(B)**	**(C)**	**(D)**
(A)	3	4	2	1	**(B)**	4	3	2	1
(C)	3	4	1	2	**(D)**	4	3	1	2

9. 1 mole of N_2H_4 loses ten moles of electrons to form a new compound Y. Assuming that all the nitrogen appears in the new compound, what is the oxidation state of nitrogen in Y? (There is no change in the oxidation state of hydrogen).
(A) – 1 **(B)** – 3 **(C)** + 3 **(D)** + 5

10. MnO_4^- is good oxidising agent in different medium changing to -

$MnO_4^- \longrightarrow Mn^{2+}$

$\longrightarrow MnO_4^{2-}$

$\longrightarrow MnO_2$

$\longrightarrow Mn_2O_3$

Changes in oxidation number respectively are -

(A) 1, 3, 4, 5 **(B)** 5, 4, 3, 2 **(C)** 5, 1, 3, 4 **(D)** 2, 6, 4, 3

11. Oxidation number of Cl in $CaOCl_2$ (bleaching powder is)

(A) Zero, since it contains Cl_2

(B) -1, since it contains Cl^-

(C) +1, since it contains ClO^-

(D) +1 and -1 since it contains ClO^- and Cl^-

12. Which of the following is a redox

(A) $2NaAg(CN)_2 + Zn \longrightarrow Na_2Zn(CN)_4 + 2Ag$

(B) $BaO_2 + H_2SO_4 \longrightarrow BaSO_4 + H_2O_2$

(C) $N_2O_5 + H_2O \longrightarrow 2HNO_3$

(D) $AgNO_3 + KI \longrightarrow AgI + KNO_3$

13. In the coordination compound, $K_4[Ni(CN)_6]$, the oxidation state of nickel is

(A) +1 **(B)** +2 **(C)** -1 **(D)** 0

14. The oxidation state of Cr in $[Cr(NH_3)_4Cl_2]^+$ is -

(A) +2 **(B)** +3 **(C)** 0 **(D)** +1

15. The oxidation state of chromium in the final product formed by the reaction between Kl and acidified potassium dichromate solution is -

(A) +6 **(B)** +4 **(C)** +3 **(D)** +2

16. Which of the following chemical reaction depicts the oxidizing behaviour of H_2SO_4 ?

(A) $Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$

(B) $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

(C) $2PCl_5 + H_2SO_4 \rightarrow 2POCl_3 + 2HCl + SO_2Cl_2$

(D) $2HI + H_2SO_4 \rightarrow I_2 + SO_2 + 2H_2O$

17. Amongst the following, the pair having both the metals in their highest oxidation state is :

(A) $[Fe(CN)_6]^{3-}$ and $[Co(CN)_6]^{3-}$

(B) $[CrO_2Cl_2]$ and $[MnO_4^-]$

(C) TiO_2 and MnO_2

(D) $[MnCl_4]^{2-}$ and $[NiF_6]^{-2}$

18. The oxidation number of phosphorus in $Ba(H_2PO_2)_2$ is :

(A) +3 **(B)** +2 **(C)** +1 **(D)** -1

19. The number of electrons to balance the following equation :-

$NO_3^- + 4H^+ + e^- \rightarrow 2H_2O + NO$ is

(A) 5 **(B)** 4 **(C)** 3 **(D)** 2

20. Identify the oxidant and the reductant in the following reactions :

(A) $KMnO_4 + KCl + H_2SO_4 \longrightarrow MnSO_4 + K_2SO_4 + H_2O + Cl_2$

(B) $FeCl_2 + H_2O_2 + HCl \longrightarrow FeCl_3 + H_2O$

(C) $Cu + HNO_3\ (dil) \longrightarrow Cu(NO_3)_2 + H_2O + NO$

(D) $Na_2HAsO_3 + KBrO_3 + HCl \longrightarrow NaCl + KBr + H_3AsO_4$

(E) $I_2 + Na_2S_2O_3 \longrightarrow Na_2S_4O_6 + NaI$

21. **(A)** Write balanced net ionic equations for the following reactions in acidic solution :

(i) $\mathbf{MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O}$

(ii) $S_2O_3^{2-}(aq) + Cr_2O_7^{2-}(aq) \longrightarrow S_4O_6^{2-}(aq) + Cr^{3+}(aq)$

(iii) $IO_3^-(aq) + Re(s) \longrightarrow ReO_4^-(aq) + I^-(aq)$

(iv) $Cu + HNO_3 \longrightarrow Cu(NO_3)_2 + NO_2 + H_2O$

(B) Write balanced net ionic equations for the following reactions in basic solution :

(i) $H_2O_2(aq) + Cl_2O_7(aq) \longrightarrow ClO_2^-(aq) + O_2(g)$

(ii) $Cl_2 + OH^- \longrightarrow Cl^- + ClO^-$

22. Which of the following are examples of disproportionation reaction :

(A) $HgO \longrightarrow Hg + O_2$ **(B)** $KClO_3 \longrightarrow KCl + O_2$

(C) $KClO_3 \longrightarrow KClO_4 + KCl$ **(D)** $Cl_2 + OH^- \longrightarrow ClO^- + Cl^- + H_2O$

23. In the reaction $xHI + yHNO_3 \longrightarrow NO + I_2 + H_2O$, upon balancing with whole number coefficients

(A) x = 3, y = 2 **(B)** x= 2, y = 3 **(C)** x = 6, y = 2 **(D)** x = 6, y = 1

24. For the redox reaction $xP_4 + yHNO_3 \longrightarrow H_3PO_4 + NO_2 + H_2O$, upon balancing with whole number coefficients:

(A) x = 1, y = 5 **(B)** x = 2, y = 10 **(C)** x = 1, y = 20 **(D)** x = 1, y = 15

25. In the reaction $X^- + XO_3^- + H^+ \longrightarrow X_2 + H_2O$, the molar ratio in which X^- and XO_3^- react is :

(A) 1 : 5 **(B)** 5 : 1 **(C)** 2 : 3 **(D)** 3 : 2

26. CN^- is oxidised by NO_3^- in presence of acid :

$$a\ CN^- + b\ NO_3^- + c\ H^+ \longrightarrow (a+b)\ NO + a\ CO_2 + \frac{c}{2} H_2O$$

What are the whole number values of a, b, c in that order :

(A) 3, 7, 7 **(B)** 3, 10, 7 **(C)** 3, 10, 10 **(D)** 3, 7, 10

27. In the following reaction : $Cr(OH)_3 + OH^- + IO_3^- \rightarrow CrO_4^{2-} + H_2O + I^-$

(A) IO_3^- is oxidising agent **(B)** $Cr(OH)_3$ is oxidised

(C) $6e^-$ are being taken per iodine atom **(D)** None of these

28. For the redox reaction, $MnO_4^- + C_2O_4^{2-} + H^+ \rightarrow Mn^{2+} + CO_2 + H_2O$ the correct coefficients of the reactants for the balanced reaction are :

	MnO_4^-	$C_2O_4^{2-}$	H^+
(A)	2	5	16
(B)	16	5	2
(C)	5	16	2
(D)	2	16	5

29. The number of mole of $KMnO_4$ that will need to react completely with one mole ferrous oxalate in acidic solution is :
(A) 2/5 **(B)** 3/5 **(C)** 4/5 **(D)** 1

30. The number of mole of $KMnO_4$ that will be needed to react with one mole of sulphite ion in acidic solution is :
(A) 2/5 **(B)** 3/5 **(C)** 4/5 **(D)** 1

31. The equivalent mass of $MnSO_4$ is half its molecular mass when it is converted to :
(A) Mn_2O_3 **(B)** MnO_2 **(C)** MnO_4^- **(D)** MnO_4^{2-}

32. The oxidation number of sulphur in S_8, S_2F_2 and H_2S respectively are :
(A) 0, +1 and -2 **(B)** +2, +1 and -2 **(C)** 0, +1 and +2 **(D)** -2, +1 and -2

33. Among the following species in which oxidation state of the element is +6 :
(A) MnO_4^- **(B)** $Cr(CN)_6^{3-}$ **(C)** NiF_6^{2-} **(D)** CrO_2Cl_2

34. Oxidation number of iron in $Na_2[Fe(CN)_5NO^{\oplus}]$ is :
(A) +2 **(B)** +3 **(C)** +8/3 **(D)** none of these

35. An aqueous solution of 6.3 g of oxalic acid dihydrate is made upto 250 mL. The volume of 0.1 N NaOH required to completely neutralise 10 mL of this solution is :
(A) 40 mL **(B)** 20 mL **(C)** 10 mL **(D)** 4 mL

36. In basic medium I^- oxidises by MnO_4^-. In this process I^- replaces by
(A) IO_3^- **(B)** I_2 **(C)** IO_4^- **(D)** IO^-

37. Determine the equivalent weight of the following ions :
(A) Na^+ **(B)** Al^{3+} **(C)** NO^+ **(D)** Cl^-
(E) CO_3^{2-} **(F)** SO_4^{2-} **(G)** PO_4^{3-}

38. Determine the equivalent weights of the following salts :
(A) NaCl **(B)** K_2SO_4 **(C)** $Ca_3(PO_4)_2$

39. 1.12 litre dry chlorine gas at STP was passed over a heated metal when 5.56 gm of chloride of the metal was formed. What is the equivalent weight of the metal? Ans- 20.1

40. The equivalent weight of a metal is double that of oxygen. How many times is the weight of its oxide greater than weight of the metal? **Ans-** 1.5

41. An oxide of metal have 20% oxygen, the equivalent weight of oxide is :
(A) 32 **(B)** 40 **(C)** 48 **(D)** 52

42. Sulphur forms the chlorides SCl_2 and S_2Cl_2. The equivalent mass of sulphur in SCl_2 is 16. The equivalent mass of sulphur in S_2Cl_2 is :
(A) 8 **(B)** 16 **(C)** 64 **(D)** 32

43. Equivalent mass of a bivalent metal is 32.7. Molecular mass of its chloride is :
(A) 68.2 **(B)** 103.7 **(C)** 136.4 **(D)** 166.3

44. 20.0 gm of an acid furnished 0.5 moles of H_3O^+ ions in its aqueous solutions. The value of 1 g equivalent of the acid will be :
(A) 40 g **(B)** 20 g **(C)** 10 g **(D)** 100 g

45. In which of the following reaction equivalent mass of H_3PO_4 is M/2 (M molecular mass)
(A) $H_3PO_4 + NaOH \longrightarrow NaH_2PO_4$ **(B)** $H_3PO_4 + 2NaOH \longrightarrow Na_2HPO_4$
(C) $H_3PO_4 + NaOH \longrightarrow Na_3PO_4$ **(D)** None

46. The number of molecules in 100 mL of 0.02 N H_2SO_4 is :
(A) 6.02×10^{20} **(B)** 6.02×10^{18} **(C)** 6.02×10^{21} **(D)** 6.02×10^{22}

47. Upon heating a litre of (N/2) HCl solution, 2.675 g of hydrogen chloride is lost and the volume of the solution shrinks to 750 mL. What is the normality of the resultant solution?
(A) 0.569 N **(B)** 0.5 N **(C)** 0.42 N **(D)** 1.707 N

48. An ion is reduced to the element when it absorbs 6×10^{20} electrons. The number of equivalents of the ion is:
(A) 0.1 **(B)** 0.01 **(C)** 0.001 **(D)** 0.0001

49. How many equivalents of Mg would have to react in order to liberate 4 N_A electrons?
($Mg - 2e^- \longrightarrow Mg^{2+}$)
(A) 1 **(B)** 2 **(C)** 4 **(D)** 8

50. When N_2 is converted into NH_3, the equivalent weight of nitrogen will be :
(A) 1.67 **(B)** 2.67 **(C)** 3.67 **(D)** 4.67

51. $28\ NO_3^- + 3As_2S_3 + 4H_2O \longrightarrow 6AsO_4^{3-} + 28NO + 9SO_4^{2-} + 8H^+$.
What will be the equivalent mass of As_2S_3 in above reaction : (Molecular mass of As_2S_3 = M)
(A) $\frac{M}{2}$ **(B)** $\frac{M}{4}$ **(C)** $\frac{M}{24}$ **(D)** $\frac{M}{28}$

52. In the following reaction :
$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$, if the atomic weight of iron is 56, then its equivalent weight will be :
(A) 42 **(B)** 21 **(C)** 63 **(D)** 84

53. If 25 mL of a H_2SO_4 solution reacts completely with 1.06 g of pure Na_2CO_3, what is the normality of this acid solution :
(A) 1 N **(B)** 0.5 N **(C)** 1.8 N **(D)** 0.8 N

54. In the ionic equation $2K^+BrO_3^- + 12H^+ + 10e^- \longrightarrow Br_2 + 6H_2O + 2K^+$,
the equivalent weight of $KBrO_3$ will be :
(A) M/5 **(B)** M/2 **(C)** M/6 **(D)** M/4

55. In the reaction : $Na_2S_2O_3 + 4Cl_2 + 5H_2O \longrightarrow Na_2SO_4 + H_2SO_4 + 8HCl$,
the equivalent weight of $Na_2S_2O_3$ will be : (M = molecular weight of $Na_2S_2O_3$)
(A) M/4 **(B)** M/8 **(C)** M/1 **(D)** M/2

56. In the reaction

$$2CuSO_4 + 4KI \longrightarrow 2Cu_2I_2 + I_2 + 2K_2SO_4$$

the equivalent weight of $CuSO_4$ will be :

(A) 79.75 **(B)** 159.5 **(C)** 329 **(D)** None of these

57. The normality of 0.3 M phosphorus acid (H_3PO_3) is :

(A) 0.1 **(B)** 0.9 **(C)** 0.3 **(D)** 0.6

58. If equal volumes of 0.1 M $KMnO_4$ and 0.1 M $K_2Cr_2O_7$ solutions are allowed to oxidise Fe^{2+} to Fe^{3+} in acidic medium, then Fe^{2+} oxidised will be :

(A) more by $KMnO_4$ **(B)** more by $K_2Cr_2O_7$

(C) equal in both cases **(D)** cannot be determined.

59. Which of the following solutions will exactly oxidize 25 mL of an acid solution of 0.1 M iron (II) oxalate:

(A) 25 mL of 0.1 M $KMnO_4$ **(B)** 25 mL of 0.2 M $KMnO_4$

(C) 25 mL of 0.6 M $KMnO_4$ **(D)** 15 mL of 0.1 M $KMnO_4$

60. An element A in a compound ABD has oxidation number –n. It is oxidised by $Cr_2O_7^{2-}$ in acid medium. In the experiment, 1.68×10^{-3} moles of $K_2Cr_2O_7$ were used for 3.36×10^{-3} moles of ABD. The new oxidation number of A after oxidation is :

(A) 3 **(B)** 3 – n **(C)** n – 3 **(D)** +n

61. The number of moles of oxalate ions oxidized by one mole of MnO_4^- ion in acidic medium is :

(A) $\frac{5}{2}$ **(B)** $\frac{2}{5}$ **(C)** $\frac{3}{5}$ **(D)** $\frac{5}{3}$

62. The number of moles of ferrous oxalate oxidised by one mole of $KMnO_4$ in acidic medium is :

(A) $\frac{5}{2}$ **(B)** $\frac{2}{5}$ **(C)** $\frac{3}{5}$ **(D)** $\frac{5}{3}$

63. How many moles of $KMnO_4$ are needed to oxidise a mixture of 1 mole of each $FeSO_4$ & FeC_2O_4 in acidic medium :

(A) $\frac{4}{5}$ **(B)** $\frac{5}{4}$ **(C)** $\frac{3}{4}$ **(D)** $\frac{5}{3}$

64. How many millilitres of 0.1N H_2SO_4 solution will be required for complete reaction with a solution containing 0.125 g of pure Na_2CO_3 :

(A) 23.6 mL **(B)** 25.6 mL **(C)** 26.3 mL **(D)** 32.6 mL

65. The volume of 1.5M H_3PO_4 solution required to neutralize exactly 90 mL of a 0.5 M $Ba(OH)_2$ solution is:

(A) 10 mL **(B)** 30 mL **(C)** 20 mL **(D)** 60 mL

66. One litre of a solution contains 18.9 gm of HNO_3 and one litre of another solution contains 3.2 gm of NaOH. In what volume ratio must these solution be mixed to obtain a neutral solution?

(A) 3 : 8 **(B)** 8 : 3 **(C)** 15 : 4 **(D)** 4 : 15

67. 100 milli moles of dichloroacetic acid ($CHCl_2COOH$) can neutralize how many moles of ammonia to form ammonium dichloroacetate :

(A) 0.0167 **(B)** 0.1 **(C)** 0.3 **(D)** 0.6

68. When $KMnO_4$ acts as an oxidising agent and ultimately forms MnO_4^{2-}, MnO_2, Mn_2O_3 and Mn^{2+}, then the umber of electrons transferred in each case is : **[AIEEE 2002]**

(A) 4, 3, 1, 5 **(B)** 1, 5, 3, 7 **(C)** 1, 3, 4, 5 **(D)** 3, 5, 7, 1

69. What will happen if the solution of potassium chromate reacts with excess amount of nitric acid **[AIEEE 2003]**

(A) Cr reduces in the oxidation state +3 from CrO_4^{2-}.

(B) Cr oxidises in the oxidation state +7 from CrO_4^{2-}.

(C) Cr^{+3} and $Cr_2O_7^{2-}$ will be formed.

(D) $Cr_2O_7^{2-}$ and H_2O will be formed.

70. Amount of oxalic acid present in a solution can be determined by its titration with $KMnO_4$ solution in the presence of H_2SO_4. The titration gives unsatisfactory result when carried out in the presence of HCl, because HCl : **[AIEEE 2008, 3/105]**

(A) furnishes H^+ ions in addition to those from oxalic acid.

(B) reduces permanganate to Mn^{2+}.

(C) oxidises oxalic acid to carbon dioxide and water.

(D) gets oxidised by oxalic acid to chlorine.

71. 29.5 mg of an organic compound containing nitrogen was digested according to Kjeldahl's method and the evolved ammonia was absorbed in 20 mL of 0.1 M HCl solution. The excess of the acid required 15 mL of 0.1 M NaOH solution for complete neutralization. The percentage of nitrogen in the compound is : **[AIEEE 2010, 4/144]**

(A) 59.0 **(B)** 47.4 **(C)** 23.7 **(D)** 29.5

72. Consider the following reaction : **[JEE Mains-2013, 4/120]**

$$xMnO_4^- + yC_2O_4^{2-} + zH^+ \rightarrow xMn^{2+} + 2yCO_2 + \frac{z}{2}H_2O$$

The values of x, y and z in the reaction are, respectively :

(A) 5, 2 and 16 **(B)** 2, 5 and 8 **(C)** 2, 5 and 16 **(D)** 5, 2 and 8

73. The equivalent mass of $MnSO_4$ is half its molecular mass when it is converted to : **[JEE 1998, 2]**

(A) Mn_2O_3 **(B)** MnO_2 **(C)** MnO_4^- **(D)** MnO_4^{2-}

74. An aqueous solution of 6.3 g of oxalic acid dihydrate is made upto 250 mL. The volume of 0.1 N NaOH required to completely neutralise 10 mL of this solution is : **[JEE 2001, 1/35]**

(A) 40 mL **(B)** 20 mL **(C)** 10 mL **(D)** 4 mL

75. In basic medium, I^- is oxidised by MnO_4^-. In this process, I^- changes to : **[JEE 2004, 3/84]**

(A) IO_3^- **(B)** I_2 **(C)** IO_4^- **(D)** IO^-

76. The oxidation state of chromium in the final product formed by the reaction between KI and acidified potassium dichromate solution is : **[AIEEE 2005]**

(A) + 4 **(B)** + 6 **(C)** + 2 **(D)** + 3

77. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is : **[JEE 2007, 3/162]**

(A) 3 **(B)** 4 **(C)** 5 **(D)** 6

78. 25 mL of household bleach solution was mixed with 30 mL of 0.50 M KI and 10 mL of 4N acetic acid. In the titration of the liberated iodine, 48 mL of 0.25 N $Na_2S_2O_3$ was used to reach the end point. The molarity of the household bleach solution is : **[JEE 2012, 3/136]**

(A) 0.48 M **(B)** 0.96 M **(C)** 0.24 M **(D)** 0.024 M

79. Bleaching powder contains a salt of an oxoacid as one of its components. The anhydride of that oxoacid is **[JEE 2012, 3/136]**

(A) Cl_2O **(B)** Cl_2O_7 **(C)** ClO_2 **(D)** Cl_2O_6

80. The following equations are balanced atomwise and chargewise.

(i) $Cr_2O_7^{2-} + 8H^+ + 3H_2O_2 \longrightarrow 2Cr^{3+} + 7H_2O + 3O_2$

(ii) $Cr_2O_7^{2-} + 8H^+ + 5H_2O_2 \longrightarrow 2Cr^{3+} + 9H_2O + 4O_2$

(iii) $Cr_2O_7^{2-} + 8H^+ + 7H_2O_2 \longrightarrow 2Cr^{3+} + 11H_2O + 5O_2$

The precise equation/equations representing the oxidation of H_2O_2 is/are :

(A) (i) only **(B)** (ii) only **(C)** (iii) only **(D)** all the three

QUANTUM NUMBERS & FILLING OF ELECTRONS

1. Given below are the sets of quantum numbers for given orbitals. Name these orbitals.

(A) n = 3, ℓ = 1 **(B)** n = 5, ℓ = 2 **(C)** n = 4, ℓ = 1 **(D)** n = 2, ℓ = 0 **(E)** n = 4, ℓ = 2

2. Point out the angular momentum of an electron in,

(A) 4s orbital **(B)** 3p orbital **(C)** 4th orbit (according to Bohr model)

3. Which of the following sets of quantum numbers are impossible for electrons ?

Set	*n*	ℓ	*m*	*s*
(i)	1	0	1	$+\frac{1}{2}$
(ii)	3	0	0	$-\frac{1}{2}$
(iii)	1	2	2	$+\frac{1}{2}$
(iv)	4	3	–3	$+\frac{1}{2}$
(v)	5	2	1	$-\frac{1}{2}$
(vi)	3	2	1	0

4. The orbital with zero orbital angular momentum is :

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

5. Which of the following is electronic configuration of Cu^{2+} (Z = 29) ?

(A) $[Ar]4s^1\ 3d^8$ **(B)** $[Ar]4s^2\ 3d^{10}\ 4p^1$ **(C)** $[Ar]4s^1\ 3d^{10}$ **(D)** $[Ar]\ 3d^9$

6. Spin magnetic moment of X^{n+} (Z = 26) is $\sqrt{24}$ B.M. Hence number of unpaired electrons and value of n respectively are :

(A) 4, 2 **(B)** 2, 4 **(C)** 3, 1 **(D)** 0, 2

7. Which of the following ions has the maximum number of unpaired d-electrons?

(A) Zn^{2+} **(B)** Fe^{2+} **(C)** Ni^{3+} **(D)** Cu^{+}

8. Find the total spin and spin magnetic moment of following ion.

(i) Fe^{+3} (ii) Cu^{+}

9. The total spin resulting from a d^7 configuration is :

(A) 1 **(B)** 2 **(C)** 5/2 (D) 3/2

10. Given is the electronic configuration of element X :

K	L	M	N
2	8	11	2

The number of electrons present with ℓ = 2 in an atom of element X is :

K	L	M	N
2	8	11	2

(A) 3 **(B)** 6 **(C)** 5 **(D)** 4

11. Consider the ground state of Cr atom (Z = 24). The numbers of electrons with the azimuthal quantum numbers, $\ell = 1$ and 2 are, respectively :
(A) 16 and 5 **(B)** 12 and 5 **(C)** 16 and 4 **(D)** 12 and 4

12. The orbital angular momentum of an electron in 2s-orbital is :
(A) $+\frac{1}{2}\frac{h}{2\pi}$ **(B)** zero **(C)** $\frac{h}{2\pi}$ **(D)** $\sqrt{2}\frac{h}{2\pi}$

13. The possible value of ℓ and m for the last electron in the Cl^- ion are :
(A) 1 and 2 **(B)** 2 and + 1 **(C)** 3 and – 1 **(D)** 1 and – 1

14. For an electron, with n = 3 has only one radial node. The orbital angular momentum of the electron will be
(A) 0 **(B)** $\sqrt{6}\frac{h}{2\pi}$ **(C)** $\sqrt{2}\frac{h}{2\pi}$ **(D)** $3\left(\frac{h}{2\pi}\right)$

15. The possible set of quantum no. for the unpaired electron of chlorine is :

	n	ℓ	m		n	ℓ	m
(A)	2	1	0	**(B)**	2	1	1
(C)	3	1	1	**(D)**	3	0	0

16. Which of the following statement(s) is (are) correct?
(A) The electronic configuration of Cr is [Ar] $(3d)^5 (4s)^1$. (Atomic number of Cr = 24)
(B) The magnetic quantum number may have negative values.
(C) In silver atom, 23 electrons have a spin of one type and 24 of the opposite type. (Atomic number of Ag = 47)
(D) None of these

17. The maximum probability of finding electron in the d_{xy} orbital is:
(A) Along the x-axis **(B)** Along the y-axis
(C) At an angle of 45^0 from the x and y axis **(D)** At an angle of 90^0 from the x and y axis.

18. $3p_y$ orbital has.....nodal plane :
(A) XY **(B)** YZ **(C)** ZX **(D)** All of these

19. A 3p-orbital has
(A) Two non-spherical nodes
(B) Two spherical nodes
(C) One spherical and one non spherical nodes
(D) One spherical and two non spherical nodes

20. According to Schrodinger model nature of electron in an atom is as :
(A) Particle only **(B)** Wave only
(C) Both simultaneously **(D)** Sometimes waves and sometimes particle

21. The radial distribution curve of 2s sublevel consists of x nodes, x is :
(A) 1 **(B)** 3 **(C)** 2 **(D)** 0

22. d_{z^2} orbital has :
(A) Two lobe along Z axis & a ring in X-Y plane
(B) A lobe & a ring along Z axis
(C) A lobe along Z axis and a ring in Y-Z plane
(D) None of these

23. Consider the following statements :
(A) Electron density in the XY plane in $3d_{x^2-y^2}$ orbital is zero
(B) Electron density in the XY plane in $3d_{z^2}$ orbital is zero.
(C) 2s orbital has one nodal surface
(D) for $2p_z$ orbital, YZ is the nodal plane.
Which of these are incorrect statements :
(A) a & c **(B)** b & c **(C)** Only b **(D)** a, b, d

24. Which orbital is non-directional
(A) s **(B)** p **(C)** d **(D)** All of These

25. For which orbital angular probability distribution is maximum at an angle of 45° to the axial direction-
(A) $d_{x^2-y^2}$ **(B)** d_{z^2} **(C)** d_{xy} **(D)** P_x

26. If n and ℓ are respectively the principal and azimuthal quantum numbers, then the expression for calculating the total number of electrons in any orbit is -
(A) $\sum_{\ell=1}^{\ell=n} 2(2\ell+1)$ **(B)** $\sum_{\ell=1}^{\ell=n-1} 2(2\ell+1)$ **(C)** $\sum_{\ell=0}^{\ell=n+1} 2(2\ell+1)$ **(D)** $\sum_{\ell=0}^{\ell=n-1} 2(2\ell+1)$

27. The quantum numbers + 1/2 and – 1/2 for the electron spin represent :
(A) Rotation of the electron in clockwise and anticlockwise direction respectively.
(B) Rotation of the electron in anticlockwise and clockwise direction respectively.
(C) Magnetic moment of the electron pointing up and down respectively,
(D) Two quantum mechanical spin states which have no classical analogue.

28. What are the values of the orbital angular momentum of an electron in the orbitals 1s, 3s, 3d and 2p -
(A) 0, 0, $\sqrt{6}\,\hbar$, $\sqrt{2}\,\hbar$ **(B)** 1, 1, $\sqrt{4}\,\hbar$, $\sqrt{2}\,\hbar$ **(C)** 0, 1 $\sqrt{6}\,\hbar$, $\sqrt{3}\,\hbar$ **(D)** 0, 0 $\sqrt{20}\,\hbar$, $\sqrt{6}$

29. After np orbitals are filled, the next orbital filled will be :
(A) (n + 1) s **(B)** (n + 2) p **(C)** (n + 1) d **(D)** (n + 2) s

30. The value of the spin magnetic moment of a particular ion is 2.83 Bohr magneton. The ion is :
(A) Fe^{2+} **(B)** Ni^{2+} **(C)** Mn^{2+} **(D)** Co^{3+}

31. Total number of electrons having $n + \ell = 3$ in Cr (24) atom in its ground state is :
(A) 8 **(B)** 10 **(C)** 12 **(D)** 6

32. The correct set of four quantum numbers for the valence electron of Rubidium (Z = 37) is :
(A) n = 5, ℓ = 0, m = 0, s = + $\frac{1}{2}$ **(B)** n = 5, ℓ = 1, m = 0, s = + $\frac{1}{2}$
(C) n = 5, ℓ = 1, m = 1, s = + $\frac{1}{2}$ **(D)** n = 6, ℓ = 0, m = 0, s = + $\frac{1}{2}$

33. Which of the given statement (s) is/are **false.**
I Orbital angular momentum of the electron having n = 5 and having value of the azimuthal quantum number as lowest for this principle quantum number is $\frac{h}{\pi}$.
II If n = 3, ℓ = 0, m = 0, for the last valence shell electron, then the possible atomic number must be 12 or 13.

III Total spin of electrons for the atom $_{25}Mn$ is $\pm \frac{7}{2}$.
IV Spin magnetic moment of inert gas is 0
(A) I, II and III **(B)** II and III only **(C)** I and IV only **(D)** None of these

34. In case of $d_{x^2-y^2}$ orbital
(A) Probability of finding the electron along x-axis is zero.
(B) Probability of finding the electron along y-axis is zero.
(C) Probability of finding the electron is maximum along x and y-axis.
(D) Probability of finding the electron is zero in x-y plane

35. The maximum number of electrons that can have principal quantum number, n = 3, and spin quantum number, $m_s = -1/2$, is **[JEE 2011]**

36. Which of the following ions has the maximum magnetic moment? **[AIEEE 2002]**
(A) Mn^{+2} **(B)** Fe^{+2} **(C)** Ti^{+2} **(D)** Cr^{+2}.

37. The numbers of d-electrons retained in Fe^{2+} (atomic number Fe = 26) ion is **[AIEEE 2003]**
(A) 3 **(B)** 4 **(C)** 5 **(D)** 6

38. The orbital angular momentum for an electron revolving in an orbit is given by $\sqrt{\ell(\ell+1)}\ \frac{h}{2\pi}$. This momentum for an s-electron will be given by **[AIEEE 2003]**
(A) $+\frac{1}{2}\cdot\frac{h}{2\pi}$ **(B)** Zero **(C)** $\frac{h}{2\pi}$ **(D)** $\sqrt{2}\cdot\frac{h}{2\pi}$

39. Which of the following set a of quantum numbers is correct for an electron in 4f orbital?
(A) n = 4, l =3, m = +4, s = +1/2 **(B)** n = 4, l = 4, m = –4, s = –1/2 **[AIEEE 2004]**
(C) n = 4, l = 3, m = +1, s = +1/2 **(D)** n = 3, l=2, m =–2, s = +1/2

40. Consider the ground state of Cr atom (Z = 24). The numbers of electrons with the azimuthal quantum numbers, ℓ = 1 and 2 are, respectively **[AIEEE 2004]**
(A) 12 and 4 **(B)** 12 and 5 **(C)** 16 and 4 **(D)** 16 and 5

41. Which of the following statements in relation to the hydrogen atom is correct ? **[AIEEE 2005]**
(A) 3s, 3p and 3d orbitals all have the same energy
(B) 3s and 3p orbitals are of lower energy than 3d orbital
(C) 3p orbital is lower in energy than 3d orbital
(D) 3s orbital is lower in energy than 3p orbital

42. In a multi-electron atom, which of the following orbitals described by the three quantum numbers will have the same energy in the absence of magnetic and electric field ? **[AIEEE 2005]**
(i) n = 1, l = 0, m = 0 (ii) n =2, l = 0, m = 0
(iii) n = 2, l = 1, m = 1 (iv) n = 3, l = 2, m =1
(v) n = 3, l = 2, m = 0
(A) (iv) and (v) **(B)** (iii) and (iv) **(C)** (ii) and (iii) **(D)** (i) and (ii)

43. The 'spin-only' magnetic moment [in units of Bohr magneton (μ_β)] of Ni^{2+} in aqueous solution would be (Atomic number : Ni = 28) **[AIEEE 2006]**
(A) 2.84 **(B)** 4.90 **(C)** 0 **(D)** 1.73

44. Which of the following set of quantum numbers represents the highest energy of an atom ?

(A) n = 3, l = 0, m = 0, s = + $\frac{1}{2}$ **(B)** n = 3, l = 1, m =1, s = + $\frac{1}{2}$ **[AIEEE 2008]**

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

45. Arrange the orbitals of H-atom in the increasing order of their energy
$3p_x$, 2s, $4d_{xy}$, 3s, $4p_s$, $3p_y$, 4s

(A) $2s < 3s = 3p_x = 3p_y < 4s = 4p_z = 4d_{xy}$ **(B)** $2s < 3s < 3p_x = 3p_y < 4s = 4p_z = 4d_{xy}$

(C) $2s < 3s < 3p_x = 3p_y < 4s = 4p_z = 4d_{xy}$ **(D)** $2s < 3s < 3p_x = 3p_y < 4s < 4p_z < 4d_{xy}$

46. Which of the following orbitals is closer to the nucleus ?

(A) 5*f* **(B)** 6d **(C)** 7s **(D)** 7p

47. The radii of maximum probability for 3s, 3p, 3d electrons is :

(A) $(r_{max})_{3d} > (r_{max})_{3p} > (r_{max})_{3s}$ **(B)** $(r_{max})_{3d} > (r_{max})_{3s} > (r_{max})_{3p}$

(C) $(r_{max})_{3s} > (r_{max})_{3p} > (r_{max})_{3d}$ **(D)** None of these

48. The correct order of penetrating power of 3s, 3p, 3d electrons is :

(A) 3d > 3p > 3s **(B)** 3s > 3p > 3d **(C)** 3s > 3d > 3p **(D)** 3d > 3s >3p

49. The correct order of total number of node of atomic orbitals is :

(A) 4*f* > 6s > 5d **(B)** 6s > 5d > 4*f* **(C)** 4*f* > 5d > 6s **(D)** 5d > 4*f* > 6s

50. If the subsidiary quantum number of a subenergy level is 4, the maximum and minimum values of the spin multiplicities are :

(A) 9, 1 **(B)** 10, 1 **(C)** 10, 2 **(D)** 4, –4

51. Which two orbitals are located along the axis, and not between the axis ?

(A) dxy, d_{z2} **(B)** dxy, pz **(C)** dyz, px **(D)** pz, $d_{x^2-y^2}$

52. In a set of degenerate orbitals the electrons distribute themselves to retain similar spin as far as possible. This statement is attributed to

(A) Pauli's exclusion principle **(B)** Aufbau principle

(C) Hund's Rule **(C)** Slater rule

53. Which of the following rules could explain the presence of three unpaired electrons in N-atom ?

(A) Hund's rule **(B)** Aufbau's principle

(C) Heisenberg's uncertainty principle **(D)** Pauli's exclusion principle

54. For which of the following sets of quantum numbers, an electron will have the highest energy ?

	n	*l*	m	s		n	*l*	m	s
(A)	3	2	1	–1/2	**(B)**	4	3	–1	+1/2
(C)	4	1	–1	+1/2	**(D)**	5	0	0	–1/2

55. Which of the following statements concerning the four quantum numbers is false ?

(A) n gives idea of the size of an orbital

(B) l gives the shape of an orbital

(C) m gives the energy of the electron in the orbital

(D) s gives the direction of spin of the electron in an orbital

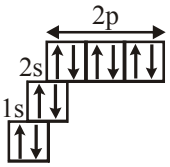
56. Maximum number of electrons in a subshell is given by
(A) $(2l+1)$ **(B)** $2(2l+1)$ **(C)** $(2l+1)^2$ **(D)** $2(2l+1)^2$

57. In any subshell, the maximum number of electrons having same value of spin quantum number is :
(A) $\sqrt{l(l+1)}$ **(B)** $l+2$ **(C)** $2l+1$ **(D)** $4l+2$

58. The orbital angular momentum of 3p electron is :
(A) $\sqrt{3}\,h$ **(B)** $\sqrt{6}\,h$ **(C)** zero **(D)** $\sqrt{2}\,\frac{h}{2\pi}$

59. The atomic orbitals are progressively filled in order of increasing energy. The principle is called as :
(A) Hund's rule **(B)** Aufbau principle **(C)** Exclusion principle **(D)** de-Broglie rule

60. Which of the following elements is represented by the electronic configuration ?



(A) Nitrogen **(B)** Fluorine **(C)** Oxygen **(D)** Neon

61. The ratio of magnetic moments of Fe (III) and Co (II) is :
(A) $\sqrt{5}:\sqrt{7}$ **(B)** $\sqrt{35}:\sqrt{15}$ **(C)** 7 : 3 **(D)** $\sqrt{24}:\sqrt{15}$

62. A compound of vanadium has a magnetic moment (μ) of 1.73 BM. If the vanadium ion in the compound is present as V^{x+}, then, the value of x is ?
(A) 1 **(B)** 2 **(C)** 3 **(D)** 4

63. The probability of finding electrons in d_{xy} orbital is :
(A) along X- and Y - axis **(B)** along X - and Z -axis
(C) along Y - and Z - axis **(D)** at an angle of 45° with X - axis

64. The correct order of screening effects of s, p, d, *f* sub-shells is :
(A) s > p > d > *f* **(B)** s < p < d < *f* **(C)** d > p > s > f **(D)** s > f > d > p

65. Read the following statements and choose the correct option :
(I) If the radius of the first Bohr orbit of hydrogen atom is r, then radius of 2nd orbit of Li^{2+} would be 4r
(II) For s-orbital electron, the orbital angular momentum is zero
(A) only I is correct **(B)** only II is correct **(C)** both are correct **(D)** both are incorrect

66. The quantum number of four electrons (e1 to e4) are given below :

	n	l	m	s		n	l	m	s
e1	3	0	0	+1/2	e2	4	0	0	1/2
e3	3	2	2	–1/2	e4	3	1	–1	1/2

The correct order of decreasing energy of these electrons is :
(A) e4 > e3 > e2 > e1 **(B)** e2 > e3 > e4 > e1
(C) e3 > e2 > e4 > e1 **(D)** e1 < e4 < e2 < e3

67. The energy of an electron of $2p_y$ orbital is
(A) Greater than $2p_x$ orbital **(B)** Less than $2p_z$ orbital
(C) Equal to 2s orbital **(D)** Same as that of $2p_x$ and $2p_z$ orbital

68. The number of unpaired valence electrons in an atom of phosphorus is :
(A) 0 **(B)** 2 **(C)** 3 **(D)** 4

69. Which quantum number defines the orientation of orbital in the space around the nucleus ?
(A) Principal quantum number (n) **(B)** Angular momentum quantum number
(C) Magnetic quantum number (m_l) **(D)** Spin quantum number (m_s)

70. What is the maximum number of electrons in an atom that can have the quantum numbers n= 3 and l = 2?
(A) 2 **(B)** 5 **(C)** 6 **(D)** 10

71. Which of the following statements about an electron with $m_l = +2$ incorrect ?
(A) The electron could be in the third shell **(B)** The electron is in a non-spherical orbital
(C) The electron may have $m_s = \frac{1}{2}$ **(D)** The electron is not in a d-orbital

72. Which of the following set of quantum numbers is impossible for an electron ?
(A) n = 1, l= 0, $m_s = +\frac{1}{2}$ **(B)** n = 0, l = 7, $m_l = -6$, $m_s = -\frac{1}{2}$
(C) n = 2, l = 1, m_l = 0, $m_s = +\frac{1}{2}$ **(D)** n = 3, l = 2, $m_l = -3$, $m_s = +\frac{1}{2}$

73. In a 3d subshell, all the five orbitals are degenerate. What does it mean ?
(A) All the orbitals have the same orientation. **(B)** All the orbitals have the same shape.
(C) All the orbitals have the same energy. **(D)** All the orbitals are unoccupied.

74. Which of the following subshell can accommodate as many as 10 electrons ?
(A) 2d **(B)** 3d **(C)** $3d_{xy}$ **(D)** $3d_{z^2}$

75. Which of the following statements is correct for an electron having azimuthal quantum number l = 2 ?
(A) The electron may be in the lowest energy shell.
(B) The electron is in a spherical orbital.
(C) the electron must have spin $m_s = +\frac{1}{2}$
(D) The electron may have a magnetic quantum number = – 1

76. For $4p_y$ orbital : There are
nodal plane = ...and azimuthal quantum number l =
(A) 1, 0 **(B)** 0, 1 **(C)** 1, 1 **(D)** 2, 1

77. Which of the following statement is correct ?
(A) Number of angular nodes = n – l – 1 **(B)** Number of radial nodes = l
(C) Total number of nodes = n – 1 **(D)** All

78. Give the correct order of initials **T** (True) or **F** (False) for following statements.
(I) if electron has zero magnetic number, then it must be present in s-orbital.
(II) In  orbital diagram, Pauli's exclusion principle is violated.
(III) Bohr's model can explain spectrum of the hydrogen atom.
(IV) A d-orbital can accommodate maximum 10 electrons only.
(A) TTFF **(B)** FFTF **(C)** TFTT **(D)** FFTT

79. "No two electrons in an atom can have the same set of four quantum numbers".
This principle was enunciated by
(A) heisenberg **(B)** Pauli **(C)** Maxwell **(D)** De-Broglie

80. The orbital diagram in which both the Pauli's exclusion principle and Hund's rule are violated is :
(A)  **(B)**  **(C)**  **(D)** 

81. It is not possible to explain the Pauli's exclusion principle with the help of this atom.
(A) B **(B)** Be **(C)** C **(D)** H

82. The subshell that arises after *f* subshell is called g subshell.
What is the total number of orbitals in the shell in which the g subshell first occur ?
(A) 9 **(B)** 16 **(C)** 25 **(D)** 36

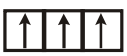
83. If hydrogen atom in ground state is passed through an inhomogeneous magnetic field, the beam splits in two parts. This interaction with magnetic field shows :
(A) existence of ortho and para hydrogen
(B) existence of magnetic moment associated with orbital motion of electron
(C) existence of spin magnetic moment of electron
(D) existence of magnetic moment of proton

84. In iron atom, how many electrons atom have n = 3 and $l = 2$?
(A) 2 **(B)** 4 **(C)** 6 **(D)** 8

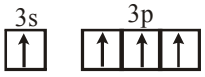
85. For similar orbitals having different values of n :
(A) the most probable distance increases with increase in n
(B) the most probable distance decrease with increase in n
(C) the most probable distance remains constant with increase in n
(D) none of these

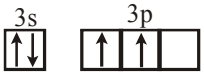
86. The possible correct set of quantum numbers for the unpaired electron of Cl atom is :
(A) $2, 0, 0, +\frac{1}{2}$ **(B)** $2, 1, -1 + \frac{1}{2}$ **(C)** $3, 1, 1, \pm\frac{1}{2}$ **(D)** $3, 0, \pm\frac{1}{2}$

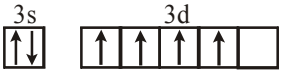
87. The aufbau principle implies that a new electron will enter an orbital for which :
(A) n has a lower value **(B)** l has a lower value
(C) $(n + l)$ value is maximum **(D)** $(n + l)$ value is minimum

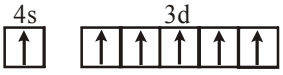
88. The orbital diagram in which aufbau principle is violated, is :
(A)  **(B)**  **(C)**  **(D)** 

89. Consider the following six electronic configurations (remaining inner orbitals are completely filled) and mark the incorrect option.

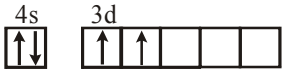
I. 

II. 

III. 

IV. 

V. 

VI. 

(A) Stability order : II > I > IV > III
(B) Order of spin multiplicity : IV > III = I > II
(C) V does not violate all the three rules of electronic configuration
(D) if VI represents A and A^+ when kept near a magnet, acts as diamagnetic substance.

90. Which of the following set of quantum number belong to highest energy ?

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

(C) n = 3, l = 1, m = 1, s = $+\frac{1}{2}$ **(D)** n = 3, l = 2, m = 1, s = $+\frac{1}{2}$

91. A subshell n = 5, l = 3 can accommodate :
(A) 10 electrons **(B)** 14 electrons **(C)** 18 electrons **(D)** None of these

92. In H-atom energy of electron is determined by :
(A) only n **(B)** n, l
(C) n, l, m **(D)** all the four quantum numbers

93. How many electron(s) in an atom can have n = 3, l = 2 ?
(A) 1 **(B)** 2 **(C)** 5 **(D)** 10

94. How many electron(s) in an atom can have n = 4, l = 2, m = – 2 and s = $+\frac{1}{2}$?
(A) 1 **(B)** 2 **(C)** 5 **(D)** 10

95. Which orbital has only positive values of wave function at all distances from the nucleus :
(A) 1s **(B)** 2s **(C)** 2p **(D)** 3d

96. The set of quantum numbers, n = 3, l = 2, m_l = 0
(A) describes an electron in a 2s orbital **(B)** is not allowed
(C) describes an electron in a 3p orbital **(D)** describes one of the five orbitals of same energy

97. The set of quantum numbers, n = 2, l = 2, m_l = 0 :
(A) describes an electron in a 2s orbital **(B)** describes one of the five orbitals of a similar type
(C) describes an electron in a 2p orbital **(D)** is not allowed

98. Consider the argon atom. For how many electrons does this atom have m_l = 1?
(A) 1 **(B)** 6 **(C)** 4 **(D)** 2

99. An orbital is occupied by an electron with the quantum numbers n =4, l = 1. How many orbitals of this type are found in a multi-electron atom ?
(A) 4p, 3 **(B)** 4s, 1 **(C)** 4d, 5 **(D)** 3p, 6

100. Which of the following sets of quantum numbers describes the electron which is removed most easily from a potassium atom in its ground state ?

(A) n = 3, l = 1, m_l = 1, m_s = $-\frac{1}{2}$ **(B)** n = 2, l = 1, m_l = 0, m_s = $-\frac{1}{2}$

(C) n = 4, l = 0, m_l = 1, m_s = $+\frac{1}{2}$ **(D)** n = 4, l = 0, m_l = 0, m_s = $+\frac{1}{2}$

101. The subshell that arises after *f* is called the g subshell. How many electron may occupy the g subshell ?
(A) 9 **(B)** 7 **(C)** 5 **(D)** 18

102. Which of the following electron configurations is correct for iron, (atomic number 26) ?
(A) [Kr] $4s^1 3d^6$ **(B)** [Kr] $4s^1 3d^7$ **(C)** [Ar] $4s^1 3d^6$ **(D)** [Kr] $4s^2 3d^6$

103. Which of the following electron configurations is correct for copper, (atomic number 26) ?
(A) [Ar] $3d^{10} 4s^1$ **(B)** [Kr] $3d^9 4s^1$ **(C)** [Ar] $3d^9 4s^2$ **(D)** [Kr] $3d^{10} 4s^1$

104. The electronic configurations of $_{24}Cr$ and $_{29}Cu$ are abnormal
(A) Due to extra stability of exactly half filled and exactly fully filled sub shells
(B) Because they belong to d-block
(C) Both the above
(D) None of the above

105. Which of the following representation of excited states of atoms is impossible ?
(A) $1s^1 2s^1$ **(B)** [Ne] $3s^2 3p^3 4s^1$ **(C)** [Ne] $3s^2 3p^6 4s^1 3d^6$ **(D)** $1s^2 2s^2 2p^7 3s^2$

106. Among the following representation of excited states of atoms which is impossible ?
(A) $1s^1 2s^1$ **(B)** [Ne] $3s^2 3p^3 4s^1$ **(C)** $1s^2 2s^2 2p^4 3s^2$ **(D)** [Ne] $3s^2 3p^6 4s^3 3d^2$

107. Among the following series of transition metal ions, the one where all metal ions have same 3d electronic configuration is :
(A) Ti^{2+}, V^{3+}, Cr^{4+}, Mn^{5+} **(B)** Ti^{3+}, V^{2+}, Cr^{3+}, Mn^{4+}
(C) Ti^{+}, V^{4+}, Cr^{6+}, Mn^{7+} **(D)** Ti^{4+}, V^{3+}, Cr^{2+}, Mn^{3+}

108. Which of the following has the maximum number of unpaired electrons ?
(A) Mn **(B)** Ti **(C)** V **(D)** Al

109. Which of the following sets of quantum number is/are not permitted ?
(A) $n = 3, l = 3, m = +1, s = +\frac{1}{2}$ **(B)** $n = 3, l = 2, m = +2, s = -\frac{1}{2}$
(C) $n = 3, l = 1, m = +2, s = -\frac{1}{2}$ **(D)** $n = 3, l = 0, m = 0, s = +\frac{1}{2}$

110. Which orbital of the following is lower in energy in a many electron atom ?
(A) 2P **(B)** 3d **(C)** 4s **(D)** 5*f*

111. Which of the following is/are possible ?
(A) 3*f* **(B)** 4d **(C)** 2d **(D)** 3p

112. If the value of (n + 1) is more than 3 and less than 6, then what will be the possible number of orbitals ?
(A) 6 **(B)** 9 **(C)** 10 **(D)** 13

113. An electron has spin quantum number (s) +1/2 and magnetic quantum number is –1. It can be present in
(A) s orbital **(B)** d orbital **(C)** p orbitla **(D)** *f* orbital

114. Which sets of quantum number are consistent with the theory ?
(A) $n = 2, l = 1, m = 0, s = -1/2$ **(B)** $n = 4, l = 3, m = -2, s = -1/2$
(C) $n = 3, l = 2, m = -3, s = +1/2$ **(D)** $n = 4, l = 3, m = -3, s = -1/2$

115. Which of the following statements are incorrect for an electron that has n = 4 and m = –2 ?
(A) The electron may be in a d-orbital
(B) The electron is in the fourth principal electronic shell
(C) The electron may be in a p-orbital
(D) None of these

116. Which of the following sets of quantum number is allowable :
(A) n = 2, l = 1, m = 0, s = +1/2 **(B)** n = 2, l = 2, m = –1, s = –1/2
(C) n = 2, l = –2, m = 1, s = +1/2 **(D)** n = 2, l = 1, m = 0, s = 0

117. Which shape is associated with the orbital designated by n = 2; l = 1 ?
(A) Spherical **(B)** Tetrahedral **(C)** Dumb-bell **(D)** Pyramidal

118. Which out of the following configurations is incorrect ?
(A) $1s^2\ 2s^2\ 2p_x^2\ 2p_y^2\ 2p_z^0$ **(B)** $1s^2\ 2s^2\ 2p_x^1\ 2p_y^1$ **(C)** $1s^2\ 2s^2\ 2p_x^1\ 2p_y^1\ 2p_z^1$ **(D)** $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

119. Which of the following set of quantum numbers is an impossible arrangement ?
(A) n = 3, m = –2, s = +1/2 **(B)** n = 4, m = 3, s = +1/2
(C) n = 5, m = 2, s = –1/2 **(D)** n = 3, m = –3, s = –1/2

120. Which of the following sets of quantum number is not possible ?
(A) n = 4, l = 1, m = 0, s = +1/2 **(B)** n = 4, l = 3, m = – 3, s = –1/2
(C) n = 4, l = – 1, m = + 2, s = –1/2 **(D)** n = 4, l = 1, m = 0, s = –1/2

Mole Concept

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

105. A → (R), B → (P, S), C → (S), D → (Q, S)

106. A → (Q), B → (S), C → (P), D → (R)

Oxidation Number & its Calculation

2.	D	**3.**	A	**4.**	B	**5.**	D	**6.**	C	**7.**	B	**8.**	A
9.	C	**10.**	C	**11.**	D	**12.**	A	**13.**	B	**14.**	B	**15.**	C
16.	D	**17.**	B	**18.**	C	**19.**	C						

20.	Oxidant	Reductant
A	$KMnO_4$	KCl
B	H_2O_2	$FeCl_2$
C	HNO_3	Cu
D	$KBrO_3$	Na_2HAsO_3
E	I_2	$Na_2S_2O_3$

21. **(A)**

(i) $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

(ii) $6S_2O_3^{2-}(aq) + Cr_2O_7^{2-}(aq) + 14\,H^+ \longrightarrow 3S_4O_6^{2-}(aq) + 2Cr^{3+}(aq) + 7H_2O$

(iii) $7IO_3^-(aq) + 6Re(s) + 3H_2O \longrightarrow 6ReO_4^-(aq) + 7I^-(aq) + 6H^+$

(iv) $Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

(B)

(i) $4H_2O_2(aq) + Cl_2O_7(aq) + 2OH^- \longrightarrow 2ClO_2^-(aq) + 4O_2(g) + 5H_2O$

(ii) $Cl_2 + 2OH^- \longrightarrow Cl^- + ClO^- + H_2O$

22.	CD	**23.**	C	**24.**	C	**25.**	B	**26.**	D	**27.**	ABC	**28.**	A
29.	B	**30.**	A	**31.**	B	**32.**	A	**33.**	D	**34.**	A	**35.**	A
36.	A												

37. **(A)** 23 ; **(B)** E = 9 ; **(C)** E = 30 ; **(D)** $E = \frac{35.5}{1}$;

(E) E = 30 ; **(F)** E = 48 ; **(G)** E = 31.67

38.	**(A)** E = 58.5			**(B)** E = 87			**(C)** E = 51.67					
39.	20.1	**40.**	1.5	**41.**	B	**42.**	D	**43.**	C	**44.**	A	**45.**	B
46.	A	**47.**	A	**48.**	C	**49.**	C	**50.**	D	**51.**	D	**52.**	B
53.	D	**54.**	A	**55.**	B	**56.**	B	**57.**	D	**58.**	B	**59.**	D
60.	B	**61.**	A	**62.**	D	**63.**	A	**64.**	A	**65.**	C	**66.**	D
67.	B	**68.**	C	**69.**	D	**70.**	B	**71.**	C	**72.**	C	**73.**	B
74.	A	**75.**	A	**76.**	D	**77.**	D	**78.**	C	**79.**	A	**80.**	A

Quantum Numbers & Filling of electrons

1. 3p, 5d, 4p, 2s, 4d 2. **(A)** 0 **(B)** $\frac{h}{\sqrt{2\pi}}$ **(C)** $\frac{2h}{\pi}$ 3. (i), (iii) and (vi)

4.	A	**5.**	D	**6.**	A	**7.**	B	**8.**	(i) (ii)	**9.**	D	**10.**	A
11.	B	**12.**	B	**13.**	D	**14.**	C	**15.**	C	**16.**	ABC	**17.**	C
18.	C	**19.**	C	**20.**	C	**21.**	A	**22.**	A	**23.**	A	**24.**	A
25.	C	**26.**	D	**27.**	D	**28.**	A	**29.**	A	**30.**	B	**31.**	A
32.	A	**33.**	A	**34.**	C	**35.**	9	**36.**	A	**37.**	D	**38.**	B
39.	C	**40.**	B	**41.**	A	**42.**	A	**43.**	A	**44.**	C	**45.**	A
46.	C	47.	C	**48.**	B	**49.**		**50.**	C	**51.**	D	**52.**	C
53.	A	**54.**	B	**55.**	C	**56.**	B	**57.**	C	**58.**	D	**59.**	B
60.	D	**61.**	B	**62.**	D	**63.**	D	**64.**	A	**65.**	B	**66.**	C
67.	D	**68.**	C	**69.**	C	**70.**	D	**71.**	D	**72.**	D	**73.**	C
74.	B	**75.**	D	**76.**	C	**77.**	C	**78.**	B	**79.**	B	**80.**	A
81.	D	**82.**	C	**83.**	C	**84.**	C	**85.**	A	**86.**	C	**87.**	D
88.	B	**89.**	C	**90.**	D	**91.**	B	**92.**	A	**93.**	D	**94.**	A
95.	A	**96.**	D	**97.**	D	**98.**	C	**99.**	A	**100.**	D	**101.**	D
102.	C	**103.**	A	**104.**	A	**105.**	D	**106.**	D	**107.**	A	**108.**	A
109.	A	**110.**	A	**111.**	AC	**112.**	D	**113.**	BCD	**114.**	D	**115.**	C
116.	A	**117.**	C	**118.**	A	**119.**	D	**120.**	C				