II YEAR

1. SOLID STATE

Synopsis

1. Solids have definite structure and shape.
2. Solids are rigid due to strong binding forces between the atoms (or) ions (or) molecules.
3. The effect of pressure is negligible on the volume of a solid.
4. Solids are mainly of two types: crystalline solids and amorphous solids
5. Crystalline solids have definite shape due to orderly arrangement of atoms or molecules or ions in three dimensional network, while amorphous solids do not have definite geometry due to irregular arrangement of constituent units.
6. Amorphous solids do not give any diffraction bands and they do not have definite melting temperature, eg. Fine powder, glass, pitch, plastics.
7. Gelatinous $Al(OH)_3$ can be considered as a tme amorphous substance. Amorphous silicon can be used as photovoltaic material.
8. Crystalline solids have long range order where as amorphous solids have short range order.
9. Quartz is a cnstalline substance, which has infinite chain of regular $Si0_4$ tetrahedra. Quartz glass is amorphous.
10. Crystalline solids are anisotropic, while : rphous solids are isotropic in nature.
11. Depending upon the constituent particles or nature of bonding, there are four types of cry sialline solids: Molecular, ionic, covalent and metallic solids.

    The four categories differ in physical properites - Ike standard molar enthalpy of fusion, electrical i! and thermal conductivities.
12. Metallic bond is explained by Electron sea model, Valence bond theory and Molecular orbital theory.
13. The force that binds the metal ion to the mobile electrons with in its sphere of influence is known as metallic bond.
14. Electron sea theory can successfully explain the properties like electrical and thermal conducitivity, lustre etc, but it fails to explain the lattice energies of ionic compounds.
15. According to valence bond theory the metallic bond is essentially a polar (or) non polar covalent bond.
16. It fails to explain conduction of heat in solids, lustre, retention of metallic properties in liquid solution state.
17. A regular arrangement of the constituent particles of a crystal in the three dimensional space is called crystal lattice.
18. The pattern of points which indicates the arrangement of particles in the crystal is known as space lattice.

19. The space lattice of sodium chloride is obtained by joining the space lattices of Na^+ and Cl^- ions.
20. The smallest three dimensional portion of the space lattice which when repeated again and again in different directions produces the complete space lattice is called the unit cell.
21. Unit cells are two types : The unit cell without a point inside is known as 'primitive unit cell'. The particles are present only at the corners of the unit cell. Centered unit cell contains a point inside.
22. In Face-centred unit cell in addition to the particles at the corners, there is one particle present at the centre of every face. It has 14 lattice points (8 comers and 6 face centres)
23. In End face centered unit cell : in addition to the particles at the comers, there is one particle in the centre of two opposite faces. It has 10 lattice points (8 comers and 2 face centres)
24. In Body-centred unit cell in addition to the particles at the corners, there is one particle present within the body of the unit cell. It has 9 lattice points (8 corners and body centre)
25. On the basis of symmetry and set of crystallographic parameters, crystals are classified into 14 types of crystal lattices (Bravais lattices) and 7 different types of crystal systems.
26. The intercepts on the X,Y and Z axes are designated as a, b and c respectively. The angle between the Y and Z axes is α , that between X and Z axes is (3 and that between X and Y axes is γ.
27. X- rays produce diffraction pattern with crystalline substances because the interatomic distance in a crystal is in the same order as the wave length of X - rays ($1 A^0$).
28. Bragg's equation is given as : $2d \sin \theta = n \lambda$, where d is distance between successive atomic planes, 0 is angle of the incident X-rays with the crystal surface, λ is wavelength of the X-rays used and n is order of diffraction maxima.
29. In NaC*l* crystal the 'd' values are in the ratio of 1:0.703:1.134. It confirms the F.C.C structure of NaC*l*.
30. Coordination Number is the number of nearest neighbours of an atom, molecule or ion in a crystal.
31. In metal lattices the coordination number of metal atom is usually 8 (or) 12.
32. Co-ordination of number depends on the limiting radius ratio. Radius ratio (ρ) = r_{cation} / r_{anjon}
33. The vacant space between the three dimensional layers is known as void.
34. Tetrahedral void is a triangular void surrounded by four spheres arranged tetrahedrally around it. Octahedral void is a combination of two triangular voids surrounded by six spheres.
35. Number of octahedral voids is equal to number of atoms in the close packed arrangement.
36. Number of tetrahedral voids is twice the number of atoms or octahedral voids.
37. In two dimensional square close packing the co-ordination number is 4. In two dimensional hexagonal close packing and in simple cubic structure the co-

ordination number is 6. In body centered cubic arrangement the coordination number is 8.

38. In three dimensional close packing, if the tetrahedral voids of second layer are occupied by the spheres of third layer it leads to hexagonal close packing (HCP) or AB AB AB ... type of packing. If the octahedral voids of second layer are occupied by the spheres of third layer it leads to cubic close packing (CCP) or ABC ABC ABC .... type of packing.
39. In both H.C.P and C.C.P structures, the co-ordination number is 12.
40. The covalent solids have low co-ordination number than in ionic solids and metallic solids.
41. Structural motif is a strucutural unit present in crystal. The basis may be a single atom (or) a group of atoms (or)a molecule (or) an ion.
42. Density of unit cell,

$$\rho = \frac{z \times M}{a^3 x N_0 x 10^{-30}} \text{ g/cm}^3$$

z = Number of atoms present per unit cell,
M = Atomic mass of element, a = Edge of the cube crystal in pm,
N_0 = Avogadro number,

43. Thermodynamically all solids possess a tendency to acquire defects to increase the entropy of the system..
44. The properties of the crystalline solids like mechanical strength, electrical conductivity, chemical activity, catalytic activity are profoundly affected and the properties like density, heat capacity or entropy are slightly affected by crystal defects.
45. The stoichiometric solids are also called as ‘daltonide compounds’, The defects in these solids are Schottky defect (vacancy defect) and Frenkel defect (dislocation defect)
46. Both schottky and frenkel defects increases with increasing temperature. Hence they are also known as ‘thermodynamic defects’.
47. Schottky defect arises due to the missing of constituent particles from their normal lattice sites. Na*Cl*, K*Cl*, Cs*Cl* and AgBr can show Schottky defect.
48. Since some of the ions are missing from their lattice sites, the density of the solid decrease due to Schottky defect.
49. When a ‘hole’ or ‘vacancy’ exists in the crystal lattice because an ion occupies an interstitial lattice site, it gives rise to Frenkel defect. Ag*Cl*, Agl, AgBr and ZnS can show this defect.
50. Frenkel defect has no effect on density of solid.
51. AgBr contains Schottky defect and Frenkel defect.
52. There is a close relationship between the properties of a solid, its structure and composition. Examples of these properties are electrical and magnetic properties.
53. Based on their electrical conductivity, solids can be broadly classified into three types : Metals (conductors), Insulators or Non-conductors and Semi-conductors.

54. The metals which allows the passage of electric current through them are called conductors.
55. Their conductivities of metals value is in the order of 10^3 - 10^8ohm^{-1} cm^{-1} at room temperature, which decreases with rise in temperature due to increase in lattice vibrations.
56. At laboratory temperatures the conductivity of metals is almost independent of impurities and defects.
57. At low temperatures the lattice vibrations are negligible and hence the conductivity should be large, however it is not true because of lattice imperfections and impurities.
58. Non-metals like diamond, P and S, solutions of non-electrolytes like sugar and urea, substances like wood, rubber and plastics are all examples of insulators.
59. Conductivity of insulators is extremely low and is in the order of 10^{-1} to 10^{-22}ohm^{-1}cm^{-1} at room temperature.
60. The solids possess conductivity values which are intermediate between those of typical metals and insulators i.e. in the range $10^{-6}$to 10^{-6} to 10^4ohm^{-1}cm^{-1} are called semi conductors.
61. The conductivity of semiconductors increases with temperature, because there is a small energy gap between valence and conduction bands.
62. Pure semi conductors are called intrinsic semi conductors, eg. pure Si, pure Ge.
63. The process in which a small amount of foreign impurity is added to a crystal is called doping.
64. The conductivity of semiconductors abnormally increases because of doping.
65. If Si (or) Ge is doped with a pentavalnet atom (P,As,Sb), n-type of semiconductors are formed.
66. If Si (or) Ge is doped with a trivalent atom (B, Al, Ga, In), p-type of semiconductors are formed.
67. Materials can be divided into different classes depending upon the behaviour of substances towards magnetic field.
68. Diamagnetic materials are weakly repelled by a magnetic field. Examples are ZrO_2, NaCl and benzene.
69. The property of diamagnetism is associated with completely filled electronic subshells.
70. Paramagnetic materials are weakly attracted by a magnetic field. Examples are (O_2,Cu^{2+}, Ti_2O_3, VO_2, NO, Na vapour.
71. Paramagnetism is observed due to the presence of permanent magnetic dipoles as a result of unpaired electrons in atoms, ions or molecules.
72. Ferromagnetism occurs due to spontaneous alignment of magnetic moments associated with unpaired electrons in the same direction, eg. Fe, Co, Ni, CrO_2.
73. The antiferromagnetism is shown when the alignments of magnetic moments are equal and in opposite direction so as to give the net magnetic moment zero. eg. MnO, V_2O_3, NiO.

74. Ferrimagnetism arises due to the alignment of magnetic moments are in parallel and antiparallel direction in unequal number. As a result the material has net magnetic moment and shows ferrimagnetism.

75. Ferrimagnetic materials show small paramagnetic character. Examples are Fe_30_4, ferrites of the formula $M^{2+} Fe_2O_4$, where M = Mg, Cu, Zn.

Question Bank – I

1. Which of the following is not a characteristic of crystalline solids?
   1) they have a regular geometry
   2) they have sharp melting points
   3) they are isotropic
   4) they undergo a clean cleavage

2. Which among the following will show anisotropy?
   1) glass
   2) barium chloride
   3) wood
   4) paper

3. Which of the following is not a crystalline solid?
   1) common salt
   2) sugar
   3) iron
   4) rubber

4. An amorphous solids
   1) NaCI 2) CsCI
   3) Tar 4) CaF_2

5. A pseudo solid is
   1) glass
   2) pitch
   3) KCI
   4) glass and pitch both

6. An example of a covalent crystalline solid is
   1) Si 2) NaF
   3) Ar 4) AI

7. Iodine crystal are
   1) metalline 2) ionic
   3) molecular 4) covalent

8. Ionic solids are characterised by
   1) good conductivity in solid state
   2) high vapour pressure
   3) low melting point
   4) solubility in polar solvents

9. Among the following which crystal will be soft and have low melting point?
   1) covalent 2) ionic
   3) metallic 4) molecular

10. Which one of the following will have a low heat of fusion?
    1) a covalent solid
    2) an ionic solsid
    3) a metallic solid
    4) a molecular solid

11. The number of atoms present in a unit cell of a monoatomic substance (element) of a simple cubic respectively are
    1) 8,9 and 14 2) 1,2 and 4
    3) 4,5 and 6 4) 2,3 and 5

12. Which of the following does not represent a type of crystal?
    1) Isomorphous
    2) Triclinic
    3) Hexagonal
    4) Rhombohedral

13. TeO_2 is an example of
1) monoclinic system
2) rhombic system
3) teragonal system
4) triclinic system

14. Diamond belongs to the crystal system
1) cubic 2) triclinic
3) tetragonal 4)hexagonal

15. In a simple cubic cell, each point on a corner is shared by
1) 2 unit cells 2) 1unit cell
3) 8 unit cell 4) 4 unit cells

16. In fact centred cubic cell, an atom at the face centres is shared by
1) 4 unit cells 2) 2 unit cells
3) one unit cell 4) 6 unit cells

17. In a body centred cubic cell, an atom at the body centre is shared by
1) 1 unit cell 2) 2 unit cells
3) 3 unit cells 4) 4 unit cells

18. Which one of the following is a primitive unit cell?
1) simple cubic
2) body-centred cubic
3) face-centred cubic
4) both body-centred and face-centred cubic

19. The maximum proportion of available volume that can be filled by hard spheres in diamond is
1) 0.52 2) 0.34
3) 0.32 4) 0.68

20. The more efficient mode of packing of identical atoms in one layer is
1) square close packing pattern
2) hexagonal close packing pattern
3) both (1) and (2)
4) none of the two

21. ccp tallies with
1) bcc 2) fcc
3) hcp 4) none of these

22. In a closest packed lattice, the number of tetrahedral voids formed will be
1) equal to the number of spheres in the lattice
2) half than that of the number of spheres
3) double than that of the number of spheres
4) none of these

23. The soze of an octahedral void fromed in a closest packed lattice as compared to tetrahedral void is
1) equal 2) smaller
3) large 4) not definite

24. The number of octahedral void formed in a closest packed lattice as compared to tetrahedral void is
1) 1 2) 2 3) 4 4) 8

25. If R is the radius of the spheres in the close packed arrangement and r is the radius of the octahedral void, then

26. The available space occupied by spheres of equal size in the dimensions in both hcp and ccp arrtangement is
1) 74% 2) 70%
3) 60.4% 4) 52.4%

27. Close packing is maximum in the crystal lattice of

1) Simple cubic 2) Face centred
3) Body centred 4) None

28. The type of structure assumed by an ionic compound is determined by
1) relative number of each kind of the ions
2) relative sizes of each kind of the ions
3) both (1) and (2)
4) none of these

29. If the dradius ratio is in the range of 0.414 –0.732, then the coordination number will be
1) 2 2) 4 3) 6 4) 8

30. At the limiting value of radius ratio r_+/r_-,
1) Forces of attraction are larger than the forces of repulsion
2) Forces of attraction are smaller than the forces of repulsion
3) Forces of attraction and repulsion are just equal
4) none of these

KEY

1) 3	2) 2	3) 4	4) 3	5) 4	6) 1	7) 3	8) 4	9) 4	10) 4
11) 2	12) 3	13) 1	14) 3	15) 2	16) 1	17) 2	18) 2	19) 2	20) 3
21) 3	22) 3	23) 3	24) 2	25) 3	26) 2	27) 3	28) 3	29) 3	30) 2

Question Bank – II

1.

Unit Cell	No. of Atoms per unit cell
A) Simple cube	1) 4
B) F.C.C.	2) 2
C) B.C.C.	3) 1

The correct match is

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

2. At zero Kelvin, most of the ionic crystals possess
(1) Frenkel Defect
(2) Schottky defect
(3) Metal excess defected
(4) no defect

3. **A:** Schottky and Frenkel defects are also called as ‘thermo dynamic defects’
R: Both Schottky and Frenkel defects increases with increase in temperature
(1) Both **A** and **R** are true and **R** is the correct explanation of **A**
(2) Both **A** and **R** are true and **R** is not the correct explanation of **A**
(3) **A** is true but **R** is false
(4) **A** is false but **R** is true

4. Which among the following is likely to have Schottky defect?
(1) AgCl (2) NaCl
(3) TiCl (4) $MgCl_2$

5. Schottky defect in crystals is observed when
(1) Unequal number of cations and anions are missing from the lattice
(2) Equal number of cations and anions are missing from the lattice
(3) An ion leaves its normal site and occupies an interstitial cells
(4) Density of the crystal is increased

6. Which of the following is correct statement?
(1) Silicon doped with boron is n-type semiconductor
(2) Silicon doped with arsenic is a *p*-type semiconductor
(3) Metals are good conductors of electricity
(4) Electrical conductivity of semiconductors decreases with increasing temperature

7. Which substance shows anti-ferromagnetism
(1) ZrO_2 (2) CdO
(3) CrO_2 (4) V_2O_3

8.

List-I (Crystal System)	**List-II (Example)**
A) Orthorhombic	1) Graphite
B) Monoclinic	2) $MgSO_4.7H_2O$
C) Triclinic	3) $FeSO_4.7H_2O$
D) Hexagonal	4) H_3BO_3

The correct match is

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

9. The constituent particles in carborundum
(1) Atoms
(2) Molecules
(3) Positive ions
(4) Negative ions in a sea of electrons

10. The crystal system without any element of symmetry is
(1) monoclinic (2) hexagonal
(3) triclinic (4) cubic

KEY

1) 3	2) 4	3) 1	4) 3	5) 1
6) 3	7) 4	8) 1	9) 1	10) 3

Question Bank - III

Types of Solids and Crystal structures

1) In which of the following numbers all zeros are significant?

1) 0.00004 2) 0.0060 3) 20.000 4) 0.800

2) On dividing 0.46 by 15.374, the actual answer is 0.029236. The correctly reported answer will be

1) 0.02 2) 0.029 3) 0.0292 4) 0.02924

1. Which of the following is not true about crystalline solids

1) They are rigid and hard

2) They possess plane surfaces

3) They are obtained by rapid cooling of motten substances

4) They have definite geometric configuration.

2. The consitutent particles in carborundum

1) atoms 2) molecules 3) +ve ions 4) +ve ions in a sea of electrons

3. Among the following highest melting point is associated with

1) $NaCl_{(s)}$ 2) graphite 3) P_4 4) K

4. A point that is located at the comer of a unit cell is shared by how many unit cells *?

1) 2 2) 4 3) 6 4) 8

5. The number of lattice points per unit cell in B.C.C and end centered lattice respectively

1) 6, 6 2) 9, 10 3) 6, 8 4) 6, 10

6. The minimum radius ratio that can give a specific coordination number to the compound is

1) 6.225 2) 0.15 3) 0.414 4) 0.73

7. The coordination numbers of oxygen and silicon in SiO_2 respectively

1) 1, 2 2) 2, 1 3) 2, 4 4) 4, 2

8. In metal lattices the co-ordination number of metal atom is usually

1) 2 (or) 4 2) 4 (or) 6 3) 6 (or) 8 4) 8 (or) 12 .

9. Which is not correct about electron sea model ?

a) It was proposed by Lorentz.

b) It explains the lattice energies of ionic compounds

c) It cau explain the electrical conductivity of metals

1) a 2) b 3) c 4) all

10. The crystal system having rectangular prisms is

1) Triclinic 2) rhombic 3) trigonal 4) Hexagonal

11. The crystal system without any element of symmetry is

1) monoclinic 2) hexagonal 3) triclinic 4) cubic

12. White Sn belongs to one of the seven crystal systems. The number of Bravis lattices possible for that crystal system

1) 2 2) 1 3) 4 4) 3

13. Crystallographic parameters in $KMnO_4$ are

1) $\alpha = \beta = \gamma \neq 90^0$ 2) $\alpha = \beta = \gamma = 90^0$

3) $\alpha \neq \beta \neq \gamma \neq 90^0$ 4) $\alpha = \beta = \gamma = 90^0 \ \beta > 90^0$

14. Among the unit cells given below, which are highly symmetric and unsymmetric respectively

1) Hexagonal, cubic 2) Orthorhombic, cubic

3) Cubic, triclinic 4) Monoclinic, cubic

15. For a crystal the angle of diffraction (2θ) is 90^0 and the second order line has a '*d*' value of $2.28A^0$. The wave length (in A^0) of x-rays used for Bragg's diffraction is :

1) 1.71 A° 2) 1.14 A^0 3) 2.28 A^0 % 4) 2.0 A^0

16. If two waves with the amplitude of E_0 each undergo constructive interference, the amplitude of the resulting wave is

1) 0 2) $<2E_0$ 3) $2E_0$ 4) E_0^2

Close packed structures and voids

17. Among the following which has a different structure from others ?

1) Ba 2) Cr 3) Mo 4) TI

18. List - I List II

(Metal)	(Co-ordination number)
A) Po	1) 6
B) K	2) 8
C) Co	3) 12
D) Pb	4) 4

1) 1 2 3 3 2) 1 2 3 4 3) 2 1 3 4 4) 2 1 4 3

19. In a hexagonal closest packing in two layers one above the other, the coordination number of each sphere will be

1) 4 2) 6 3) 8 4) 9

20. In a close packed lattice containing 'n' particles, the number of tetrahedral and octahedral voids respectively

1) n, 2n 2) n, n 3) 2n, n 4) 2n, n/2

21. The number of octahedral voids in a unit cll of cubic close packed structure is

1) 1 2) 2 3) 4 4) 8

22. In which of the following crystal the void efficiency is 32%?

1) Zn 2) Po 3) Cu 4) Rb

23. The intermetallic compound LiAg crystallizes; in cubic lattice in which both lithium and silver have co-ordination number of eight. The crystal class is

1) simple cubic 2) body centered cubic

3) face-centered cubic 4) none of these

24. In the crystals of which of the following ionic compounds would you expect maximum distance between the centres of the cations and anion

1) LiF 2) CsF 3) Csl 4) Lil

25. Gold crystallizes with a

1) fee 2) bec 3) simple cubic 4) orthorhombic

26. When molten zinc is cooled to solid state, it assumes HCP structure. Then the number of nearest neighbours of zinc atom will be

1) 4 2) 8 3) 6 4) 12

27. Sodium crystallizes in a bec lattice, hence the coordination number of sodium in sodium metal is

1) 0 2) 4 3) 6 4) 8

28. The metal having 26$- voidLspace in its crystal structure is

1) Cs 2) Po 3) Mo 4) Be

29. In modern periodic table, the position of the element with atomic number '84' is

1) 6th group, 6th period 2) IVA group, 6th period

3) 16th group, 6th period 4) VIA group, 5th period

30. The percentage of void space of a metallic element crystallising in a ABCABC ....type lattice pattern is

1) 24% 2) 26% 3) 34% 4) 74%

31. If the radius of K^+ and F arc 133 pm and 136 pm respectively, the distance between K^+ and F^- in KF is..... pm

1) 269 2) 134.5 3) 136 4) 3 Crystal defects

32. Schottky defect causes

1) Increase in the density of solid 2) Decrease in the density of solid

3) No change in the density of solid 4) Decrease in the conductivity of solid.

33. What type of crystal defect is indicated in the diagram below

Na^+Cl^- Na^+CF Na^+ Cl^-

Cl^- ❒ Cl^- ❒ Na^+ ❒ Na^+

Na^+ Cl^- ❒ Cl^- Na^+Cl^-

1) Frenkel defect 2) Frenkel and Schottky defects

3) Interstitial defect 4) Schottky defect

34. Which among the following is likely to have Schottky detect.

1) AgCl 2) NaCl 3) TiCl 4) $MgCl_2$

35. Schottky defect in crystals is observed when

1) Unequal number of cations and anions are missing from the lattice

2) Equal number of cations and anions are missing from the lattice

3) An ion leaves its normal site and occupies an interstitial cells

4) Density of the crystal is increased

36. List - I List - II

A) Crystal defect 1) Amorphous
B) Carborundum 2) Frenkel
C) Pitch 3) Covalent crystal

The correct match is ABC

A B C A B C
1) 3 2 2 2) 2 1 3
3) 2 1 3 4) 1 2 3

37. Which of the following is a “Berthollide Compound”?

1) MgO 2) Al_2O_3 3) Na_2O 4) ZrH

38. The formula of an oxide of iron is $Fe_{0.93}O_{1.00}$. If the compound has hundred CH tons, then it contains

1) 93Fe^{+2}ions 2) 93Fe^{+3}ions 3) 79Fe^{+2}14Fe^{+3} 4) 93Fe^{+2},14Fe^{+3}

Properties of solids

39. To get n-type semiconductor, impurity to be added to silicon should have the following number of valence electrons

1) 2 2) 3 3) 1 4) 5

40. The mechanism of electrical conductivity may be given in terms of

1) vacancy mechanism 2) Interstitial mechanism
3) Interstitialcy mechanism 4) all

41. The oxide that is insulator is

1) VO 2) MnO 3) ReO_3 4) Ti_2O_3

42. In which of the following the conductivity would be in the order of 10^{-4} ohm^{-1} cm^{-1}

l) $NaCl_{(s)}$ 2)$Na_{(s)}$ 3) diamond 4) Ge

43. Which one of the following ratio gives the purity of the metal (ρ -resistivity (or) specific resistance)

1) 2) $\frac{\rho_{300K}}{\rho_{4.2^0K}}$ 3) $\frac{\rho_{27K}}{\rho_{4K}}$ 4) $\frac{\rho_{300K}}{\rho_{4^0C}}$

44. Germanium can be made n-type semi conductor by doping with

1) silicon 2) arsenic 3) gallium 4) either As (or) Ga

45. The magnetic behavior is different from others in

1) O_2 2) VO_2 3) ZrO_2 4) Ti_2O_3

46. Which of the following is correct statement

1) silicon doped with boron is n-type semiconductor
2) silicon doped with arsenic is a p-type semiconductor
3) metals are good conductors of electricity
4) electrical conductivity of semiconductors decreases with increasing temperature

47. The general formula of ferrites is MFe_20_4. Where 'M' would not be

1) Mg 2) Cu 3) Al 4) Zn

48. Which substance shows anti ferro magnetism?

1) ZrO_2 2) CdO 3) CrO_2 4) V_2O_3

49. The alignment of magnetic dipoles shown below ↑ ↓ ↓ ↑ ↓ ↓ represents which of the following ?

1) Diamagnetism 2) Ferri magnetism

3) Ferro magnetism 4) Anti-ferromagnetism

50.

List -I	List-II
A) Antiferromagnetic	1) $ZnFe_2O_4$
B) Covalent crystal	2) NiO
C) Ferrimagnetic	3) Diamond

The correct match is

	A	B	C		A	B	C
1)	2	3	1	2)	3	2	1
3)	1	2	3	4)	1	3	2

KEY

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

2. SOLUTIONS

Synopsis:

1. A solution is a homogeneous mixture of two or oore n: --reacting components. Formation of solution is a physical process.
2. *A* solution of a solid in another solid is known a solid solution. Many alloys are solid sciutions. An alloy of a metal with mercury is called an amalgam.
3. Aqueous solutions are those prepared using water. Non aqueous solutions have other solvents.
4. The components do not lose their identity during the formation of a solution. Dynamic equihbrium is established between dissolved solute and undissolved solute.
5. During formation of solution entropy of system increases due to greater disorder.
6. A solution whose molar concentration is definitely known a standard solution. The most ideal-method of expressing concentration is the molality (m). The commonly used method of expressing concentration is molarity (M).
7. Mass by volume percentage (w/v) indicates the mass of a solute in 100 ml of solution. Mass by weight indicates the mass of a solute in l00g of solution.
8. Molarity indicates the number of moles of the solute dissolved in one litre of the solution.lt also indicates the number of millimoles of the solute dissolved in one millilitre of the solution.
9. Number of millimoles of the solute present in V ml of the solution = Volume x Molarity = V x M. Number of moles of solute present in V litres of solution = MV.
10. When a solution is diluted its molarity decreases. $V_1M_1 = V_2M_2$, where V_1 = Volume of the solution before dilution, M_1 = Molarity of the solution before dilution, V_2 = Volume of the solution after dilution and M_2 = Molarity of the solution after dilution.
11. Molarity, $\frac{w}{GMW} \times \frac{100}{V}$

    w = weight of the solute in grams and

    V = volume of the solution in millilitres

    $$M = \frac{10(\%w/v)}{GMW} \quad M = \frac{(l0)(d)(\%w / w)}{GMW}$$

    where d is density in grams per ml.
12. Equivalent weight of a substance expressed in grams is known as gram-equivalent weight or gram-equivalent or equivalent.

    $$\text{Number of gram-equivalents} = \frac{\text{weight}}{\text{GEW}}$$

13. Equivalent weight = $\frac{\text{Molecular weight}}{n}$

where n is acidity of a base or basicity of an acid or valency or charge of ion or number of electrons transfered or number of faradays.

14. Normality indicates the number of gram- equivalents of solute present in one litre of the solution.

15. Number of gram equivalents of solute in V litres of solution = NV

16. A normal solution means IN solution. A decinormal solution is N/10 or 0.1 N solution. A centinormal solution is N/100 or 0.01 N solution.

17. Normality, $N = \frac{w}{GEW} \times \frac{1000}{V}$

$N = \frac{10(\%w/v)}{GEM}$ $N = \frac{10(d)(\%w/v)}{GMW}$

$N = \text{Molarity} \times N$

18. When a solution is diluted, its normality decreases.

V_1,N_1(Before dilution) = V_2,N_2 After dilution)

19. Molarity and Normality decrease with increase in temperature, except from 0^0 to 4^0C.

20. Normality of the mixture when two solutions of same solute are mixed.

$N = \frac{N_1V_1+N_2V_2}{V_1+V_2}$

21. Molality (m) indicates the number of moles of a solute dissolved in 1000 grams or one kilogram of the solvent.

Molality (m) = $\frac{w \times 1000}{GMW \times W}$

where w is weight of the solvent in grams.

22. Mole fraction of the solute = $\frac{n_1}{n_1 + n_2} = X_{solute}$

23. Mole fraction of the solvent = $\frac{n_2}{n_1 + n_2} = X_{solvent}$

where n_1 and n_2 are number of moles of solute and solvent.

24. For a binary solution $X_{solute} + X_{solvent} = 1$.

25. Weight percentage, molality and mole fraction are independent of temperature.

26. The process of escape of liquid molecules into space is called evaporation or vapourisation.

27. Rate of evaporation depends on : Nature of liquid, Surface area of liquid, Temperature and Flow of air current over the surface.

28. Rapid evaporation results in decrease in temperature leading to intense cooling.

29. When a liquid and its vapour are in equilibrium with each other, the pressure exerted by the vapour over the liquid surface is known as the vapour pressure of the liquid.
30. Volatile liquids with high vapour pressure at a given temperature have low boiling point. Less volatile liquids have high boiling point.
31. The vapour molecules have a higher potential energy than the liquid molecules at the same temperature.
32. The vapour pressure of a liquid depends upon the nature of the liquid and temperature. With an increase in temperature the vapour pressure of a liquid increases exponentially.
33. A liquid boils at that temperature when its vapour pressure becomes equal to the atmospheric pressure. When the external pressure is decreased, the boiling point decreases.
34. The vapour pressure of a solution of a nonvolatile solute is less than the vapour pressure of the pure solvent at the same temperature.
35. If P_0 is the vapour pressure of the pure solvent and P_s is the vapour pressure of the solution at the same temperature then, lowering of vapour pressure is $P_0 - P_s$.
36. The vapour pressure of a solution of a non-volatile solute, is directly proportional to the mole fraction of the solvent in the solution.

    $$P_s = P_0 X_{solvent}$$
37. Lowering of vapour pressure is directly proportional to mole fraction of solute
38. Raoul't Law states that the relative lowering of vapour pressure of a solution is equal to the mole fraction of the solute in the solution.

    $$\frac{P_0 - P_s}{P_0} = \frac{n}{N + n}$$
39. Relative lowering of vapour pressure is independent of temperature.
40. An ideal solution is one which obey Raoult's law at all concentrations and temperatures. In an ideal solution the volume changes are additive. In the formation of an ideal solution no heat is evolved or absorbed.
41. Chemically similar liquids form ideal solutions. An ideal solution can be separated into two pure components by fractional distillation.
42. Raoults law is applicable to dilute solutions only.
43. When the solute is non-volatile, if the solute does not undergo either ionisation (or) association and if the solution behaves as an ideal solution Raoult's law is good to apply.
44. Relative lowering of vapour pressure is determined by Ostwald and Walkers method.
45. In a solution n is very small compared to

    $$N. \frac{P_0 - P_s}{P_0}\frac{n}{N} = \frac{w/m}{W/M} = \frac{w.M}{M.w}$$

w = v -weight of the solute,
m = me lecular weight of the solute,
W = weight of the solvent and
M - molecular weight of the solvent

46. The properties which depend on the number of particles of the solute but not on the nature of v solute are called colligative properties.

47. Lowering of vapour pressure, Elevation of boiling point, Depression of freezing point and Osmotic pressure are four colligative properties.

48. All the colligative properties can be used to determine the molecular weight of non-volatile solute. Bui the best method by using Osmotic pressure.

49. When a non-volatile solute is dissolved in the pure solvent its boiling point increases, eg. sea water boils at greater than 100°C.

50. The difference between boiling points of solution containing a non- volatile solute (T_b) and the pure solvent T_o is called elevation of boiling point $\Delta T_b = T_b - T_0$.

51. Liquids with high boiling point have low vapour pressures and are less volatile.

52. Elevation of boiling point is directly proportional to molality of the solution.

53. $$\Delta T_b = K_b.m = K_b\left[\frac{w}{GMW}\times\frac{1000}{W}\right]$$

where K_b is molal elevation constant of the solvent or ebuliioscopic constant

54. K_b value changes from one solvent to another soh em. For water, K_b= 0.52 degree.Kg/mole. Units of K_b: K.K_b $mole^{-1}$

55. $$K_b = \frac{RT_b^{\,2}}{1000.L_v}$$

where, L_v is Latent heat of vapourisation per cram of the solvent.

56. Elevation in`boiling point is determined by Landsberger's method and Cottrell's method.

57. The temperature at which the pressure of a liquid is equal to that of the solid is called freezing point.

58. When a non - volatile solute is dissolved in a solvent, the freezing point of the solvent decreases, eg. Sea water freezes below 0°C.

59. Water taken in automobile radiators is mixed with glycerol (or) glycol to decrease its Freezing point (F.P.) to prevent the formation of ice when surroungding temperature falls.

60. T_0 =F.P of pure solvent and T = F.P. of solution. Then the depression in Freezing point is given by $\Delta Tf = T_O - T_s$.

61. Depression in freezing point is directly proportional to molality of the solution.

$$\Delta Tf = Kf.m = Kf\left[\frac{w}{GMW}\times\frac{1000}{W}\right]$$

where K_f is molal depression constant of the solvent or cryoscopic constant

62. $$Kf = \frac{RT_f^2}{1000L_f}$$

where, L_f = Latent heat of fusion.

63. Depression in freezing point is determined by Beckmann's method and Rast's camphor method, and the method is applicable for solid in solid type of solution.
64. The passage of solvent molecules from a solution of low concentration into a solution of higher concentration through a semipermeable membrane is known as osmosis.
65. Semipermeable membrane is one which allows the solvent molecules to pass through but not solute particles, eg. Cellophane paper, cell walls, pig's gall blader, Copper ferrocyanide $Cu_2[Fe(CN)_6]$ etc.
66. Egg free from outer shell placed in distilled water enlarges (haemolysis) and when placed in Na*Cl* solution shrinks (plasmolysis) due to endomosis and exosmosis respectively.
67. Pressure developed due to osmosis is called osmotic pressure. It is the excess pressure which must be applied to a solution to prevent the flow of the solvent into the solution.
68. Osmotic pressure is directly related to molar concentration and temperature.
69. Osmotic pressure in terms of concentration (c) is, π - CRT
70. Molecular weight of solute = $\frac{wRT}{\pi V}$
71. Solutions having same osmotic pressure are known isotonic solutions. Isotonic solutions generally have the same molar concentrations at a given temperature.
72. The solution having lower osmotic pressure is known as hypotonic solution and that having higher osmotic pressure is known as hypertonic solution.
73. Osmotic pressure method is widely used to determine molecular massses of proteins, polymers and other macro molecules.
74. Osmotic pressure is determined by Morse and Frazers method and Berkeley and Hartley's method.
75. The colligative properties of solutions depend on the total number of solute particles present in solution.
76. For different molar concentrations of the same solute, the colligative property has greater value for the more concentrated solution.
77. For solutions of different solutes having same percentage strength, the colligative property has greater value for the solute with least molecular weight.
78. For different solutes of same molar concentration, the colligative properties have the greater value for the solution which gives more number of particles on ionization.
79. Certain solutes in solution are found to associate, leads to a decrease in the number of particles in the solutions. Thus, it results in a decrease in the values of colligative properties. The colligative properties are inversely related to the molecular mass.

80. Electrolytes dissociate in solution to give two or more particles (ions). Such solutions exhibit higher values of colligative properties. The molecular masses of such substances as calculated from colligative properties will be less than their normal values.

81. Certain solutes that undergo dissociation (or) association in solution are found to show abnormal molecular mass. The extent of dissociation (or) association of solutes in solution is determined by Van't Hoff factor.

82. Van't Hoff factor (i) = $\dfrac{\text{Normal molar mass}}{\text{Observed molar mass}}$

83. $\text{i} = \dfrac{\text{Observed colligative property}}{\text{Normal colligative property}}$

84. For ideal solutions with no association or dissociation of solute the Van't Hoff factor i = 1. For solutes showing association, i < 1 and showing dissociation, i > 1.

85. If a molecule of solute on dissociation gives 'n' ions and a is the degree of dissociation, $i = 1 + \text{a}(\text{n} - 1)$

Degree of dissociation $(\alpha) = \dfrac{\text{i}-1}{\text{n}-1}$

86. If a solute froms associated molecules $(\text{A})_\text{n}$ and α is the degree of association,

$$i = 1 - \alpha\left[1 - \frac{1}{n}\right]$$

Degree of association $\alpha = \dfrac{(1-i)\,\text{n}}{\text{n}-1}$

87. In terms of Van't Hoff factor (i)

Elevation of boliling point, $\Delta T_b = iK_b m$

Depression of freezing point, $\Delta T_f = iK_f m$

Osmotic pressure freezing point $\pi = \text{iCRT}$

Question Bank – I

1. If 5.85g of NaCl is dissolved in 90g of water, the mole fraction of NaCl is
1) 0.1 2) 0.01 3) 0.2 4) 0.0196

2. How many grams of CH_3OH would have to be added to water to prepare 150ml of a solution that is 2M CH_3OH?
1) 9.6 2) 2.4 3) $9.6\text{x}10^4$ 4) $4.3\text{x}10^2$

3. 10ml of conc. H_2SO_4 (18molar) is diluted to 1litre. the approximate strength of dilute acid could be
1) 0.18N 2) 0.09N 3) 0.36N 4) 18N

4. 100ml of 0.3N HCl is mixed with 200ml of 0.6N H_2SO_4. The final normality of the resulting solution will be
1) 0.1N 2) 0.2N 3) 0.3N 4) 0.5N

5. The normality of the acid solution obtained by mixing 100ml of N/2 H_2SO_4 solution and 300ml of N/10 HCl solution is

1) 0.2 2) 0.5 3) 0.6 4) 0.3

6. The concentration of a 100ml solution containing 'x' grams of Na_2CO_3 is y M. The values of x and y are

1) 2.12, 0.05 2) 1.06, 0.2 3) 1.06, 0.1 4) 2.12, 0.1

7. 3.65g of HCl is dissolved in 16.2grams of water. The mole fraction of HCl in the resulting solution is

1) 0.4 2) 0.3 3) 0.2 4) 0.1

8. The number of moles of $KMnO_4$ that will be needed to react with one mole of sulphite ion in acidic solution is

1) 2/5 2) 3/5 3) 4/5 4) 1

9. The morality and molality of a solution of sulphuric acid are 11.07 and 21.91 respectively. The density of the solution in gm/ml is

1) 4.36 2) 0.795 3) 2.18 4) 1.59

10. The normality of a mixture obtained by mixing 50ml of 0.01N HCl and 25ml of 0.01N NaOH is

1) 0.025 2) 0.0666 3) 0.125 4) 0

11. The normality of 0.3M Phosphorous acid (H_3PO_3) is

1) 0.1 2) 0.8 3) 0.3 4) 0.6

12. The number of milli equivalents in 100ml of 0.5N HCl solution is

1) 200 2) 100 3) 50 4) 25

13. The volume of water to be added to 100cm^3 of 0.5N H_2SO_4 to get decinormal concentration

1) 400cm^3 2) 450cm^3 3) 100cm^3 4) 500cm^3

14. The mole percentage of oxygen in a mixture of 7gms of Nitrogen and 8gms of Oxygen is

1) 8 2) 16 3) 21 4) 50

15. The normality of 4% (w/v) of NaOH is

1) 1 2) 2 3) 0.05 4) 0.01

16. How many litres of CO_2 at STP will be formed when 100ml of 0.1M H_2SO_4 reacts with excess of Na_2CO_3?

1) 22.4 2) 2.24 3) 0.224 4) 5.6

17. 6g of urea is dissolved in 16.2g of water at 25^{0}C. What is the vapour pressure (in mm) of the resulting solution? The vapour pressure of water at 25^{0}C is 24mm

1) 2.4 2) 21.6 3) 0.5 4) 10

18. What is the volume (in litres) of 0.1M H_2SO_4 required to completely neutralize 1 litre of 0.5M NaOH?

1) 5 2) 2.5 3) 0.5 4) 10

19. 250ml of a solution contains 2.65grams of Na_2CO_3.10ml of this solution is added to 'x' ml of water to obtain 0.001 M Na_2CO_3 solution.What is the value of 'x' in ml?
1) 1000 2) 990 3) 9990 4) 90

20. 250ml of sodium carbonate solution contains 2.65grams of Na_2CO_3. If 10ml of this solution is diluted to one litre, what is the concentration of the resultant solution?
1) 0.1M 2) 0.001M 3) 0.01M 4) 10^{-4}M

21. Equal volumes of 0.1M $AgNO_3$ and 0.2M NaCl solutions are mixed. The concentration of nitrate ions in the resultant mixture would be -----
1) 0.1M 2) 0.05M 3) 0.2M 4) 0.15M

22. The physical change among the following is
1) burning of coal 2) burning of sulphur
3) dissolution of Glucose in water 4) burning of white phosphorous

23. 100gm of an aqueous solution contains 10grams of Glucose. Then solute and solvent are
1) Water and Glucose 2) Glucose and Water
3) Alcohol and Glucose 4) Glucose and Alcohol

24. The ratio of the number of moles of solute to the total number of moles of solute and solvent is known as
1) Molarity 2) molality
3) mole fraction of solute 4) mole fraction of solvent

25. The number of gram moles of solute present per litre of the solution is known as
1) Molarity 2) Molality 3) Normality 4) Mole fraction

26. The number of milli moles of solute present in 10ml of decimolar solution is
1)1 2) 10^{-3} 3) 10^{-2} 4) 10^{-1}

27. The number of moles of solute present in $0.5dm^3$ of 0.5M solution is
1) 0.5 2) $5x10^{-3}$ 3) $5x10^{-2}$ 4) 0.25

28. The weight of H_2SO_4 present in 400ml of 0.125M solution is
1) 2.45g 2) 3.92g 3) 4.9g 4) 9.8g

29. The number of moles of KCl present in 250ml of 0.01M solution is
1) $2.5x10^{-1}$ 2) $2.5x10^{-2}$ 3) $2.5x10^{-3}$ 4) $2.5x10^{-4}$

30. 5 millimoles of solute present in how many litres of the solution will have 0.1M
1) 5 2) 0.5 3) 50 4) 0.05

31. The volume of water to be added to 100ml of 0.5M NaCl solution in order to make it decimolar is
1) 500ml 2) 400ml 3) 600ml 4) 50ml

32. HCl is labelled as 3.65% (w/v) 10ml of the solution is diluted to 1lit. The proton concentration in the resulting solution is
1) 10^{-3}M 2) $2.5x10^{-2}$M 3) $7.5x10^{-2}$M 4) 10^{-2}M

33. 100ml of an aqueous solution contains $6.023x10^{21}$ solute molecules. The solution is diluted to 1 lit. The number of solute molecules present in 10ml of the dilute solution is
1) $6.0x10^{20}$ 2) $6.0x10^{19}$ 3) $6.0x10^{18}$ 4) $6.0x10^{17}$

34. Molarity of 100ml HCl than can neutralise 200ml of 0.5M Na_2CO_3 solution is
1) 1M 2) 2M 3) 0.5M 4) 1.5M

35. In an aqueous solution, the mole fraction of ethanol is 0.8. The molarity of the solution is
1) 0.54m 2) 0.68m 3) 6.8m 4) 5.4m

36. A solution is 0.1M with respect to KCl and 0.2M with respect to $MgCl_2$. The molarity of Cl^- ions in the solution is
1) 0.1M 2) 0.3M 3) 0.2M 4) 0.5M

37. A sample of H2SO4 is labelled as 49% (W/W) and has a density of $1.5g.ml^{-1}$. Its Normality is
1) 30N 2) 7.5N 3) 15N 4) 18N

38. 18g of a non volatile solute is dissolved in 900g water of water such that the relative lowering of vapour pressure is 0.0019. The molecular weight of the solute is
1) 60 2) 342 3) 180 4) 18

39. 6g of urea is dissolved in 90g of water. If vapour pressure of pure water is 100 mm, the vapour pressure of the solution at the same temperature
1) 100mm 2) 98mm 3) 95mm 4) 101.2mm

40. The relative lowering of vapour pressure of 0.2molal solution in which solvent is Benzene is
1) $15.6x10^{-4}$ 2) $15.6x10^{-3}$ 3) $15.6x10^{-1}$ 4) 0.05

41. Vapour presence of 22NaCl solution is 23torr. That of 32NaCl solution as maybe
1) 12torr 2) 23torr 3) 22torr 4) 44torr

42. The Molarity of solution obtained by dissolving 0.01moles of NaCl in 500ml of solution is
1) 0.01M 2) 0.005M 3) 0.02M 4) 0.1M

43. Assertion: Mole fraction has no units.
Reason: Mole fraction is a ratio of number of moles of solute to number of moles of solvent.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

44. Assertion: Amalgam is an example for liquid in solid.
Reason: The solvent in Amalgam is mercury.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

45. Assertion: Vapour pressure of water is less than 1.013Bar at 373K.
Reason: Water boils at 373K as the vapour pressure at this temperature is equal to atmospheric pressure.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

46. Assertion: The physical and chemical properties of any part of solution are identical.

Reason: Solution is a homogenous mixture.

1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

47. Assertion: Normality is always a multiple of Molarity.

Reason: There is no way related to normality.

1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

48.

List-I	List-II
A) 4g NaOH in 100ml solution.	1) 1m
B) 180g glucose in 10 lt solution	2) 2N
C) 9.8g of H_2SO_4 in 100ml solution	3) 0.1M
D) 4g of NaOH in 100 gm solvent	4) 1M
	5) 0.2 mole fraction

The correct match is

	A	B	C	D
1)	4	2	1	5
2)	2	4	1	3
3)	2	5	3	4
4)	4	3	2	1

49.

List-I	List-II
A) Gaseous solution	1) German silver
B) Liquid solution	2) Milk
C) Solid solution	3) Sand in water
D) Colloidal solution	4) Aqueous alcoholic solution
	5) air.

The correct match is

	A	B	C	D
1)	5	4	1	2
2)	2	4	1	3
3)	2	5	3	4
4)	4	3	2	1

50.

List-I	List-II
A) 0.5M H_2SO_4 solution	1) 0.1N
B) 0.1M NaCl solution	2) 1N
C) 0.2M $AlCl_3$ solution	3) 1.5N
D) 0.5M H_3PO_4 solution	4) 2N
	5) 0.6N

The correct match is

	A	B	C	D
1)	4	2	1	5
2)	2	4	1	3
3)	2	1	5	3
4)	4	3	2	1

KEY

1. 4	2. 1	3. 1	4. 4	5. 1	6. 3	7. 4	8. 1	9. 4	10. 2
11. 4	12. 3	13. 1	14. 4	15. 1	16. 3	17. 2	18. 2	19. 2	20. 2
21. 2	22. 1	23. 2	24. 3	25. 1	26. 1	27. 4	28. 3	29. 3	30. 4
31. 2	32. 4	33. 2	34. 2	35. 4	36. 4	37. 3	38. 4	39. 2	40. 2
41. 3	42. 3	43. 3	44. 3	45. 4	46. 1	47. 3	48. 4	49.1	50.3

Question Bank – II

1. Which of the following is a colligative property
   (1) vapour pressure of a liquid
   (2) boilint point
   (3) freezing point
   (4) relative lowering of vapour pressure of a solution
2. The freezing point of equ molar aqeoud solution will be highest for
   (1) $C_6H_5NH_3Cl$ (2) $Ca\ (No_3)_2$ (3) $Ca(No_3)_2$ (4) $C_6H_2O_6$
3. An aqeous solution containing one gram of urea boils at 100.25°C. The aqeous solution containing 3gm of glucose in the same volume will boil at
   (1) 100°C (2) 100.25°C (3) 100.5°C (4) 100.75°C
4. The molar freezing point constant for water is 1.86 K Kg mole^{-1}. The freezing point of 0.1m NaCl solution is
   (1) -1.86°C (2) -0.372°C (3) -0.186°C (4) 0.372°C
5. The osmotic pressure of solution containing 4 gm of solute (molar mess 246) per litre at 27°C (R = 0.0821 atm K^{-1} mole $^{-1}$)
   (1) 0.1 atm (2) 0.2 atm (3) 0.4 atm (4) 0.8 atm
6. 10 gm of solute with molecul mass 100gm molc-1 is dissolvd in 100g solvent to show 0.3 elevation in boiling point. The value of molar ebullioscopic constant will be
   (1) 10 (2) 3 (3) 0.3 (4) unpredictable
7. The latent heat of vapourisation of water is 9700 cal / mole and if the boiling point is 100°C, the ebullioscopic constant of water is
   (1) 0.513 (2) 1.026° (3) 1.832° (4) 10.26°
8. The freezing point of the solution containing 0.3 gm acetic acid in 30 gm of benzene is lowere by 0.45°C, then the Vant Hoff factor is (Kg for benzene = 5.12 Kg mol^{-1})
   (1) 1/ 2 (2) ¾ (3) ¼ (4) 1/3

9. Two solutions of glucose have osmotic pressures 1.5 and 2.5 atm. 1L of first is mixed with 2L of second solution, the osmotic pressure of resultant solution is $\Pi_1 V_1 + \Pi(V_1 + V_2)$

(1) 2.1 + 1.5 atm (2) 2.5 – 1.5 atm (3) $\frac{2.5+1.5}{2}$ atm (4) 2.16 atm

10. The osmotic pressure of a phenol solution in an organic solvent is determined to be 20% less than expected, it is due to
1) phenol is 20% ionized 2) phenol is 20% dimerised
3) phenol is 40% dimerised 4) phenol is 80% dimerised

KEY

1) **4** 2) **4** 3) **2** 4) **2** 5) **3** 6) **3** 7) **1** 8) **1**
9) **4** 10) **2**

Question Bank - III

Molarity

1. The number of Glucose molecules present in 10 ml of decimolar solution is
1) 6.0 x 10^{20} 2) 6.0 x 10^{19} 3) 6.0 x 10^{21} 4) 6.0 x 10^{22}

2. The number of ion s present in 1 ml of 0.1M $CaCl_2$ solution is
1) 1.8 x 10^{20} 3) 6.0 x 10^{20} 3) 1.8 x 10^{19} 4) 1.8 x 10^{21}

3. 100 ml of an aqueous solution contains 6.023 x 10^{21} solute molecules. The solution is diluted to 1 lit. The number of solute molecules present in 10ml of the dilute solution is
1) 6.0 x 10^{20} 2) 6.0 x 10^{19} 3) 6.0 x 10^{18} 4) 6.0 x 10^{17}

4. 11.1 g. of $CaCl_2$ is present in 100 ml of the aqueous solution. The chloride ion concen-tration is
1) 1M 2) 2M 3) 0.5M 4) 0.2M

5. 100 ml each of 1M $AgNO_3$ and 1M NaCl are mixed. The nitrate ion concentration in the resulting solution is
1) 1M 2) 0.5M 3) 0.75M 4) 0.25 M

6. H_2SO_4 is labelled as 9.8% by weight. Specific gravity of H_2SO_4 is 1.8. The volume of the acid to be taken to prepare 1000 ml of 0.18M solution is
1) 10ml 2) 100ml 3) 740 ml 4) 360 ml

7. HC1 is labelled as 3.65% (w/v) 10ml of the solution is diluted to 1 lit. The proton concentration in the resulting solution is
1) 10^{-3} M 2) 2.5 x 10^{-2} M 3) 7.5 x 10^{-2} M 4) 10^{-2} M^-

8. 100 ml of 1M HCl, 200 ml 2M HCl and 300 ml 3M HCl are mixed. The Molarity of the resulting solution is
1) 1M 2) 2.66M 3) 2.33 M. 4) 4.25 M

9. The volumes of 1M HCl and 5M HCl to be mixed to get 2 lit of 2M HCl are

1) 1 lit and 1 lit 2) 1.5 lit and 0.5 lit

3) 1.25 lit and 0.75 lit 4) 1.33 lit and 0.66 lit

10. A 20% (W/W) solution of NaOH is 5 M. The density of the solution is

1) 1 $g.ml^{-1}$ 2) 2 $g.ml^{-1}$ 3) 0.5 $g.ml^{-1}$ 4) 0.25$g.ml^{-1}$

11. Zinc reacts with $CuSO_4$ according to the equation $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$. If excess of zinc is added to 100ml of 0.05M $CuSO_4$, the amount of copper formed

1) 0.6354 g. 2) 0.3177g. 3) 3.177 g. 4) 6.354 g.

12. 10.6 g of a substance of molecular weight 106 was dissolved in 100 ml. 10 ml of this solution was pipetted out into a 1000 ml flask and made up to the mark with distilled water. The molarity of the resulting solution is

1) 1 M 2) 10^{-2} M 3) 10^{-3} 4) 10^{-4} M

13. The volume of decamolar aquous solutions of hydrochloric Acid is required to prepare $2dm^3$ of 5M HCl solution is

1) 0.5ML 2) 1 L 3) 2 L 4) 3 L

14. The concentration of a 100 ml solution containing 'x' grams of Na_2CO_3 is yM. The values of x and y are

1) 2.12, 0.05 2) 1.06, 0.2 3) 1.06, 0. 1 4) 2.12, 0.1

Normality

15. The number of millimoles of H_2SO_4 present in 5 litres of 0.2N H_2SO_4 solution is

1) 500 *2)* 1000 3) 250 4) 0.5 x 10^{-3}

16. 200 ml of 1M H_2SO_4. 300 ml 3M HCl and 100 ml of 2M HCl are mixed and made up to 1 litre. The proton concentration in the resulting solution is

1) 1.25M 2) $1.5M^{-}$ 3) 2.5M . 4) 0.75M

17. The volumne of 0.025M Cat $(OH)_2$ solution which can neutralise 100 ml of 10^{-4}M H_3PO_4 is

1) 10 ml 2) 60 ml 3) 0.6 ml 4) 2.8 ml

18. The Molarity of 200 ml of HCl solution which can neutralise 10.6 g. of anhydrous Na_2CO_3 is

1) 0.1M 2) 1M 3) 0.6M 4) 0.75M

19. 10 millimoles of a diacidic base exactly neutralises 100ml of an acid. Then the Normality of that acid is

1) 0.2 N 2) 0.1 N 3) 0.4 N 4) 0.5N

20. 100 ml of 0.1N $FeSO_4$ solution will be completely oxidised by '*x*' gms of $K_2Cr_2O_7$ in acidic medium (Mol.wt = 294). The value of '*x*' is

1) 4.9 2) 2.94 3) 0.49 4) 1.47

21. 100 ml of 2M HCl solution completely neutralises 10 g. of a metal carbonate. Then the equivalent weight of the metal is

1) 50 2) 20 3) 12 4) 100

22. What is the volume (in ml) of 0.1 M potasium permanganate solution required to completely oxidise 100 ml of 0.5 M ferrous sulphate solution in acidic medium?

1) 20 2) 200 3) 50 4) 100

23. The Normality of 0.98 (w/v) H_2SO_4 solution is

1) 0.1N 2) 0.2N 3) 0.4N 4) 1N

24. Molarity of 3N H_3PO_4 solution is

1) 9M 2) 1.5 M 3) 6M 4) 1 M

Molality

25. 0.1 gram mole of urea is dissolved in l00g. of water. The molality of the solution is

1) 1 m 2) 0.01 M 3) 0.01 m 4) 1.0 M

26. The molality of 2% (W/W) NaCl solution nearly

1) 0.02m 2) 0.35 m 3) 0.25 m 4) 0.45 m

21. 100 ml of ethyl alcohol [d = 0.92 g/ml] and 900 ml of water [d = 1 g/ml are mixed to form 1 lit solution. The Molarity and molality of the resulting solution are

1) 2M and 2m 2) 2M and 2.22m

3) 2.2M and 1.1 m 4) 2M and lm

28. Which of the following aqueous solutions is more concentrated [Assume the density of the solution as 1g/ml]

1) 1M Glucose 2) lm Glucose

3) 0.5m Glucose 4) 0.5M Glucose

29. Which of the following solution is more concentrated

1) 03% H_3PO_4 2) 0.3M H_3PO_4

3) 0.3m H_3PO_4 4) 0.3N H_3PO_4

30. Molarity of lm aqueous NaOH solution [density of the solution is 1.02 g/ml]

1) 1M 2) 1.02 M 3) 1.2 M 4) 0.98 M

Mole fraction

31. 6 g. of Urea is dissolved in 90 g. of water. The mole fraction of solute is

1) 1/5 2) 1/50 3) 1/51 4) 1/501

32. A gaseous mixture contain four gases A, B, C and D. The mole fraction of “B” is 0.5. The mole fraction of “A” is

1) 0.525 2) 0.375 3) 0.625 4) 0.732

33. Aqueous NaOH solution is labelled as 10% by weight mole fraction of the solute in it is

1) 0.05 2) 0.0476 3) 0.052 4) 0.52

34. The mole percentage of oxygen in a mixture of 7 gm of Nitrogen and 8 gm of oxygen is

1) 8 2) 16 3) 21 4) 50^N

35. The mole fraction of solvent in 0.1 moial aqueous solution is

1) 0.9982 2) 0.0017 3) 0.017 4) 0.17

36. NaOH aqueous solution is labelled as 10% (w/v). Density of the solution is 1.02 g/ml. Then the mole fraction of the solute in the solution is

1) 0.05 2) 0.0466 3) 0.53 4) 0.053

Solubility

37. If 0.05 mole of gas are dissolved in 500 grams of water under 1 Mm. pressure , 0.1 moles will be dissolved if the pressure is 2atm. It illustrates »

1) Graham’s Law 2) Dalton’s Law

3) Henry’s Law 4) Boyle’s Law

38. O_2 is bubbled through water at 293K. assuming that O_2 exerts a partial pressure of 0.98 bar, the solubility of O_2 in gm.L^{-1} is (Henry’s law constant = 34 k bar)

1) 0.025 2) 0.05 3) 0.1 4) 0.2

39. H_2S a toxic gas with rottenegg like smell is used for the qualetative analysis, if the solubility of H_2S in water, at STP is 0.195 mole. kg^1, the Henry’s jaw constant is

1) 285.6 bar 2) 324.8 bar 3) 462.9 bar 4) 534.8 bar

40. Air contains O_2 and N_2 in the ratio 0.2 : 0.8. If Henry law constant for O_2 and N, are 3.3 x 10^7 torr and 6.6 x 10^7 torr respectively, then the ratio of mole fractions of O_2 to N_2 dissolved in water at 1 bar pressure is

1) 1 : 1 2) 2 :1 3) 1 : 2 4) 1 : 3

41. The quantity of CO_2 in 500ml of soda water when packed under 2.5 atm CO_2 pressure at 298 k is.........gm (Henry’s law constant 1.67 x 10^8 pa at 298 k)

1) 0.64 2) 1.86 3) 6.4 4) 18.6

42. Henry law constant for the solubility of methane in benzene at 298K is 4.27 x 10^5 mm Hg then the solubility of methane in benzene at 298K under 760mm Hg is

1) 7.8 x 10^{-2} mole/kg 2) 7.8 x 10^{-3} mole/kg

3) 7.8 x $l0^{-4}$mole/kg 4) 1.78 x 10^{-3} mole/kg

Vapour pressure - Raoult's law

43. 6 g. of urea is dissolved in 90 g. of boiling water. The vapour pressure of the solution is

1) 744.8 mm 2) 758 mm 3) 761 mm 4) 760 mm

44. At 20^0C, the vapour pressure of diethyl ether is 442mm. When 6.4 g. of a non-volatile solute is dissolved in 50g. of ether, the vapour pressure falls to 410mm. Trie Molecular weight of the solute is

1) 150 2) 130.832 3) 160 4) 180

45. The vapour pressure of pure water at 25^0C is 30 mm. The vapour pressure of 10% (W/V) glucose solution at 25^0C is

1) 31.5 mm 2) 30.6 mm 3) 29.67 mm 4) 26.56 mm

46. The weight of urea to be dissolved in 100 g. of water to decrease the vapour pressure of water by 5% is

1) 20 g 2) 14.66 g 3) 15.24 g 4) 16.66 g

47. 139.18 g of glucose is added to 178.2 g of water the vapour pressure of water for this aqueous solution at 100° C is

1) 704 torr 2) 759 torr 3) 7.6 torr 4) 76 torr

48. The relative lowering of vapour pressure of 0.2 molal solution in which the solvent is Benzene is

1) 15.6 x 10^{-4} 2) 15.6 x 10^{-3} 3) 15.6 x 10^{-1} 4) 0.05

49. Vapour pressure of an aqueous solution is 2% less than that of the solvent. The molality of the solution is

1) 2m 2) 1.5 m 3) 1.13 m 4) 0.2 m

50. The amount of Glucose to be dissolved in 300 g. of water so as to produce the same lowering in vapour pressure as that of 0.2 molal aqueous urea solution

1) 9 g. 2) 18 g. 3) 36 g. 4) 1.8 g.

51. A Current of dry air was first passed through the bulb containing solution of 'A' in water and then throush the bulb containing pure water. The loss in mass of a solution bulb is 1.92g gm Where as that in pure water bulb is 0.08g, then mole fraction of 'A' is

1) 0.86 2) 0.2 3) 0.96 4) 0.04

Elevation of B.P.

52. An aqueous solution containing one gram of urea boils at 100.25°C. The aqueous solution containing 3gm of glucose in the same volume will boil at

1) 100°C 2) 100.25°C 3) 100.5°C 4) 100.75°C

53. A solution prepared by dissolving 0.8gm of naphthalene in l00g of $CC1_4$ has a boiling point elevation of 0.4°C. A 1.24 g of an un-known solute in same amount of $CC1_4$ produced boiling point elevation of 0.62°C. then molar mass of un-known solute is

1) 25g ` 2) 50g 3) 75g 4) 128g

54. Molality of an aqueous solution that produces an elevation of boiling point of 1.00 K at 1 atm pressure. (K_b tor water = 0.512 K. kg. mol^{-1})

1) 0.512 M 2) 0.195 m 3) 1.95 m 4) 5.12 M

Depression of F.P.

55. The solution containing 6.8g of non-ionic solute in l00g of water was found to freeze at -0.93°C. If K_f for water is 1.86, the molar Mass of solute is

1) 13.6 2) 68 3) 34 4) 136

56. The molal freezing point constant for water is 1.86 K.kg $mole^{-1}$. The freezing point of 0.1m NaCl solution is

1) –1.86°C 2) –0.372°C 3) –0.186°C 4) 0.372°C

57. Molal depression constant for water is 1.86 K.Kg.$mole^{-1}$. The freezing point of a 0.05 molal solution of a non electrolyte in water is

l) –1.86°C 2) –0.93°C 3) –0.093°C 4) 0.93°C

58. The depression in freezing point of 0.01 m aqueous solution of urea, sodium chloride and sodium sulphate is in the ratio

1) 1:1:1 2) 1:2:3 3) 1:2:4 4) 2:2:3

Osmotic Pressure

59. The Osmotic pressure of solution containing 4.0g of solute (molar mass 246) per litre at 27°C is (R = 0.082L atm k^{-1} mol^{-1}) :

1) 0.1 atm 2) 0.2 atm 3) 0.4 atm 4) 0.8 atm

60. Average osmotic pressure of human blood is 7.4 atm at 27°C. then total concentration of various solutes is

1) 0.1 $molL^{-1}$ 2) 0.2 $molL^{-1}$ 3) 0.3 $molL^{-1}$ 4) 0.4 $molL^{-1}$

61. At 10°C, the osmotic pressure of urea solution was formed to be 500 mm. The solution is diluted 'x' times and the temperature raised to 25°C when the osmotic prssure was noticed to be 105.3mm, then V is

1) 3 2) 4 3) 5 4) 12

62. The osmotic pressure of 5% aqueous solution of sugar (mol. Mass 342) at 15°C is

1) 4 atm. 2) 3.45 atm 3) 3.75 atm 4) 2.45 atm.

63. A 5% solution of cane suger is isotonic with 0.5% of X. The molecular weight of substance X is

1) 34.2 2) 119.96 3) 95.58 4) 126.98

64. At 273K, 100Cm^3 of a solution containing 3gm of an unidentified solute exhibits an osmotic pressure of 2.24 atm. then molar mass of the solute is

1) 88$gmol^{-1}$ 2) 188$gmol^{-1}$ 3) 300$gmol^{-1}$ 4) 388$gmol^{-1}$

65. Ther osmotic pressure of the solution obtained by mixing 200cm^3 of 2% (mass-volume) solution of urea with 200cm^3 of 3.42% solution of sucrose at 20^{o}C is

1) 4 bar 2) 1.2 bar 3) 5.2 bar 4) 15.4 bar

Abnormal Molecular Masses - Vant Hoffs factor

66. A decimolar solution of $K_2[Fe(CN)_6]$ at 300K is 50% dissociated, then, osmotic pressure of the solution is

1) 3.61 atm 2) 7.38 atm 3) 12.32 atm 4) 21.34 atm

67. A solution containing 25.6gm of sulphur dissolved in 1000gm of asphithalence gave a freezing point lowering of 0.680, then molecular formula of sulphur is

[K_P for naphthalence = 6.8K kg mol^{-1})

1) S_2 2) S_4 3) S_6 4) S_8

68. Two elements A and B form compounds having molecular formula AB_2 and AB_3. When dissolved in 25gm of benzene 1gm of AB_2 lowers the freezing point by 1.6K, where as 1gm at AB_4 lowers it by 1.25K, then atomic masses of A & B respectively.

[K_P for benzene = 5.12 K.m^{-1})

1) 64.4, 128.2 2) 25.5, 42.6

3) 56, 35.7 4) 101.3, 186.5

69. Van't Hoff's factor for 0.01M aqueous solution acetic acid is 1.04, the pH of tht solution is

1) 3.4 2) 6.4 3) 9.6 4) 10.6

70. If $BaCl_2$ ionizes to an extent of 89% in aqueous solution, the volue of Van't Hoff factor is

1) 2.6 2) 0.4 3) 0.8 4) 2.4

KEY

1) 1	2) 1	3) 2	4) 2	5) 2	6) 2	7) 4	8) 3
9) 2	10) 1	11) 2	12) 2	13) 2	14) 3	15) 1	16) 2
17) 3	18) 2	19) 1	20) 3	21) 2	22) 4	23) 2	24) 4
25) 1	26) 2	27) 2	28) 1	29) 2	30) 4	31) 3	32) 2
33) 2	34) 4	35) 1	36) 2	37) 3	38) 2	39) 1	40) 3
41) 2	42) 4	43) 1	44) 2	45) 3	46) 4	47) 1	48) 2
49) 3	50) 2	51) 4	52) 2	53) 4	54) 3	55) 4	56) 2
57) 3	58) 2	59) 3	60) 3	61) 3	62) 2	63) 1	64) 3
65) 3	66) 2	67) 4	68) 3	69) 1	70) 1		

3a. ELECTROCHEMISTRY

Synopsis

1. The substance which allows the flow of electricity through it is called electric conductor. Electrical conducters are of two types
2. Electronic conductors conduct electricity due to mobility of free electrons.
   eg.Graphite, gas carbon, petroleum coke, metals, alloys, solid salts like CdS, CuS, etc.,
3. Electrolytic conductors conduct electricity due to mobility of free ions.
   eg. Aqueous solutions of salts, acids and bases, fused salts like NaC*l*, KC*l*, etc.,
4. Solutions of alkali metals in liquid ammonia are mixed conductors. They contain solvated cations and solvated electrons.
5. Substances which do not conduct electric current in the molten state or in solution are called non-electrolytes.
   eg. Sugar, Glucose, Urea, Fructose, etc.,
6. Non-electrolytes are non-polar covalent substances. They do not undergo ionization.
7. All electrolytes spontaneously dissociate into charged particles (ions) when dissolved in water.
   $MA \rightleftharpoons M^+A^-$
8. The degree of ionisation, (a) is the fraction of the total number of ionised molecules in solution.
9. The extent of ionisation is different for differe n: electrolytes and depends on the nature of electrolyte, concentration of electrolyte and temperature.
10. The degree of ionisation increases with increase of dilution and at infinite dilution it approaches unity.
11. Strong electrolytes ionise to a greater extent
    eg. Strong acids , strong bases and soluble salts
12. Weak electrolytes ionise to a lesser extent
    eg. Weak acids, weak bases and sparingly soluble salts.
13. Degree of ionisation of electrolytes increases with increase of temperature.
14. Arrhenius theory is applicable to only weak electrolytes.
15. The chemical decomposition of an electrolyte by the influence of electric current is called electrolysis.
16. In electrolytic cell, electrical energy is converted in to chemical energy.
17. During eletrolysis, reduction (electronation) takes place at cathode and oxidation (de - electronation) takes place at anode.
18. During electrolysis, electrons flow from anode to cathode in the external circuit.

19. When a solution contains different kinds of cations and anions, during electrolysis, the cation of least electropositive element and the anion of least electronegative element are discharged first.

20. Preferential discharge of cations : $K^+ < Ca^{2+} < Na^+ < Mg^{2+} < Al^{3+} < Zn^{2+} < Fe^{2+} < H^+ < Cu^{2+} < Ag^+ < Au^+$.

21. Preferential discharge of anions : $F^- < PO_4^{3-} < SO_4^{2}- < NO_3^- < OH^- < HSO_4^- < Cl^- < Br < I^-$.

22. Electrodes which do not involve in chemical reaction during electrolysis are called inert electrodes, eg. Graphite, Platinum, Gold etc.

23. Active electrodes involve in chemical reaction during the electrolysis. In general anodic metal dissolves in solution, eg. Cu anode in aqueous $CuSO_4$.

24. Quantitative relationship of electrolysis was given by Faraday. There are two Faraday's laws.

25. The mass of the substance evolved, deposited or dissolved at an electrode is directly proportional to the quantity of electricity passed through the electrolyte. m = e Q, where, e is electrochemical equivalent

26. Quantity of electricity (Q) = current strength in amperes (c) ×time in seconds (t). Coulomb is amp-sec.

27. If same quantity of electricity is passed into different electrolytes (connected in series), the ratio of the amount of substances deposited at respective electrode is equal to the ratio of their equivalent weights.

$\frac{m_1}{m_2} = \frac{E_1}{E_2}$, where m,, m, are masses of elements and E_1 E_2 are chemical equivalents

28. Resistance to the flow of electricity in a solution is directly proportional to the length and inversely proportional to the area of the tube in which solution is taken.

29. Resistivity is the resistance of a conductor of lm length and lm^2 area of cross section.

30. Units of specific resistance are : ohm.metre $(\Omega.m)$

31. For a given electrolytic cell, the quantity $^1\!/_6$ is constant which is called cell constant.

Units of cell constant are nr^{-1} (or) cm-1

32. Conductance is the ease of flow of electric current through the conductor. Conductance is the reciprocal of resistance. Units of conductance are ohm^{-1} (or) Ω^{-1} (or) mho. In SI system it is seimen (S).

33. Specific conductance or conductivity (k , kappa) is the coductance of a conductor of lm length and lm^2 area of cross section. It is the reciprocal of resistivity.

Units of k are $ohm\text{-}fm^{-1}$ (or) Sun^{-1}

34. Conductance of all the ions produced by one gram equivalent weight of an electrolyte in Vm*l* of solution is called equivalent conductance, $A_{eq} = \kappa . V$

$$A_{eq} = \frac{\kappa \times 1000}{N}, \text{where N is normality}$$

35. Units of equivalent conductivity are Ω^{-1}. cm$^{2\cdot}$ equi^{-1} (or) S.cm^{2}. eq^{-1}.
36. Conductance of all the ions produced by one gram mole of an electrolyte in V*ml* of solution is called molar conductivity, $A_m = \kappa.V$

    $$\Lambda_m = \frac{\kappa \times 1000}{M}, \text{ where M is molarity.}$$
37. Units of Λ_m are Ω^{-1}. cm^2, mol^{-1} (or) S.m^2. mol^{-1}
38. The conductance of increase in all electrolyte; increases with temperature.
39. With decrease in concentration of solution o increase in dilution, Λ_m increases, Λ_{eq} increases and κ decreases.
40. At infinite dilution, concentration approache zero. Molar conductance at this dilution is callei limiting molar conductivity μ_0.
41. Equivalent conductance at this dilution is called limiting equivalent conductivity Λ_0.
42. In case of strong electrolytes A_{eq} or p increases to less extent with dilution. Strong electrolytes are almost completely ionised at all concentrations increases in A_{eq} or μ, with dilution is only due to decrease in the inter ionic forces.
43. For stron electrolytes, variation of conductance with dilution is given by Huckel-Onsagar equation

    $$\Lambda_C = \Lambda_0 - A\sqrt{C}$$
44. Kohlrausch law : Limiting equivalent conductance of an electrolyte is the sum of equivalent conductivities of cations and anions.

    $$\Lambda_m^0 = x\lambda_+^0 + y\lambda_-^0$$
45. The cell in which chemical energy is converted to electrical energy is called as Galvanic or Voltaic cell.
46. In Galvanic cell oxidation takes place at anode and electrons are released, reduction takes place at cathode and electrons are used up.
47. Electrons travel along external circuit from anode to cathode. Cathode is +ve electrode and anode is -ve electrode. These are connected by salt bridge.
48. Salt bridge is U-shaped glass tube containing KCl or NH_4NO_3 solution impregnated in a gelatin gel.
49. KCl solution is used in salt bridge, because the speeds of cation and anion are almost equal in them (transport numbers are same).
50. Salt bridge provides electrical contact between the solutions of half cells. It prevents the accumulation of charges in half cells. It allows the passage of charge.

51. Salt bridge prevents the physical mixing of the solutions of half cells. It completes the electrical circuit.
52. Daniel cell is an example of Galvanic cell. It is constructed using Zn and Cu electrodes and a poms partition.
53. The representation of the Daniel cell is $^{(-)}Zn_{(s)} / Zn^{2+}_{(aq)} // Cu^{2+}_{(aq)} / Cu_{(s)}^{(+)}$.

    The emf of Daniel cell is 1.10 volt
54. Single electrode potential is the developed at metal and metal ion intense or non - metal and non - metal ion interface.
55. Non - metallic element is generally gas. Therefore single electrode of non- metal non - metal ion needs an inert metal rod like Pi. eg. Pt, $H_{2\,(g)}$ / $H^{+}_{(aq)}$
56. The magnitude of potential developed by a single electrode depends on the nature cf mem or non - metal, number of electrons in\ olved in half cell reaction, concentration of ions in solution and temperature. These four factors are related by Nernst equation.
57. Normal hydroge electrode, N.H.E. or S.H.E. is represented as : Pt, $H_{2(g)}$(latm) /H^{+}(1M).
58. The potential of SHE is assumed to be volts.
59. A saturated calomel electrode is now used as secondary reference electrode. It is represented as Hg/ $Hg_2Cl_{2(s)}$, KCl (saturated) and potential of saturated calomel electrode is -0.2422 volts.
60. Standard electrode potential (E°) is the potential developed by single electrode if concentration of ions is 1 M(unit cone.) at 298 K arc 1 atmosphere pressure.
61. The potentials are standard reduction potentials only (SRP).
62. Standard oxidation potential (SOP) is equal:: SRP in magnitude, but with opposite sign.
63. Electrochemical series is the arrangement of various electrode systems in the ascending order of their SRP values. It is also called activity series.
64. All the metals which are present above the hydrogen in the electrochemical series are called active metals. They have -ve SRP values. Tney liberate hydrogen from dilute mineral acids.
65. All the elements which are present below the hydrogen in the activity series have +ve SRP values. They do not liberate H_2 from acid.
66. Metal with less SRP, has high tendency to lose electrons, undergoes oxidation and acts as reducing agent, is represented on LHS in tgalvanic cell and replaces other metal ions which have more SRP from their salt solution.
67. Metal with more SRP, has high tendency to gain electrons, undergoes reduction and acts as oxidant, is represented on RHS in galvanic cell and is replaced by other metals which have less SRP from its salt solution.
68. An element with a lower reduction potential is a more powerful reducing agent.

    Li > K > Ca > Zn > Cu

69. An element with a higher reduction potential is a more powerful oxidising agent.
$F_2 > Cl_2 > Br_2 > I_2$

70. The potential difference between the two electrodes when no current is drawn from the cell is known as the E.M.F. (electromotive force) of the cell.

71. If the emf of the cell is negative, the cell reaction is non-spontaneous and that cell cannot be constructed.

72. If the salt bridge is removed, the cell reaction stops, the E.M.F. of the cell becomes zero and ions move randomly.

73. Nernst equation gives the dependence of the electrode potential on the concentration of ion. Nernst equation holds good for reversible electrodes.

74. For metal electrodes, the half-cell reaction is

$$M^{n+} + ne^- \rightleftharpoons M$$

$$E = E^0 - \frac{2.303RT}{nF} \log \frac{[M]}{\left[M^{n+}\right]} \text{ or}$$

$$E = E^0 + \frac{0.059}{n} \log C$$

75. For non - metal electrodes, the half cell reaction is $A + ne^- \rightleftharpoons A^{n-}$

$$E = E^0 - \frac{2.303RT}{nF} \log \frac{[A^{n-}]}{[A]} \text{ or}$$

$$E = E^0 - \frac{0.059}{n} \log C$$

For hydrogen electrode, E = - 0.059 pH

76. Concentration cell is galvanic cell in which both the electrodes are of same type but the electrolyte have different concentration.
$Cu|CuSO_4(C_1)||\ CuSO_4(C_2)|Cu$

77. The cell potential of the concentration cell can be calculated using the equations

$$E_{cell} = \frac{2.303RT}{nF} \log \frac{C_2}{C_1} = \frac{0.0591}{n} \log \frac{C_2}{C_1}$$

78. When the cell reaction is in equlibrium, the cell EMF (E) is zero. So the Nernst Equation is

$$E^0 = \frac{2.303RT}{nF} \log K_c \text{ (or) } E^0 = \frac{0.0591}{n} \log K_c$$

79. The change in free energy is represented by ΔG.

For spontaneous reaction, ΔG will have negative value (ΔG = -ve)

80. Electrical work done in one second is the product of electrical potential and total charge passed.

81. To obtain maximum work from a galvanic cell, the charge has to be passed reversibly.

82. The reversible work done by a galvanic cell is the decrease in its free energy.

$w_{max} = -\Delta G$

83. When no current is drawn from the cell, the EMF of the cell is E, the amount of charge passed is nF (n = number of electrons and F = Faraday).

$\Delta G = -nEE$

84. If the activity of reacting species is unity, then E and E° are same, we have,

$\Delta G^0 = -nEE^0$

85. From standard free energy, the equilibrium constant can be calculated

$\Delta G^0 = -RT\ lnk_c\ (or)\ AG^0\ \Delta G = -2.303RT\ logK_c$

86. Battery is a single galvanic cell (or) more than one cell connected in series. Commercial batteries are of two types.

87. **Primary battery:** This cell becomes dead after some time and can not be used again, eg. Dry cell, Mercury cell.

88. ***Secondary battery*** **:** After its use, can be recharged and can be used again, eg. Lead storage battery, Nickel cadmium cell, Alkali storage cell (Edison's battery)

89. Dry cell isalso called Leclanche cell. It is a Zn container. Cathode is a Graphite rod, surrounded by powdered MnO_2 and carbon. Gap between cathode and anode is filled with moist paste of NH_4Cl and $ZnCl_2$ which acts as electrolyte.

90. Reactions in dry cell

Anode: $Zn_{(s)} \rightarrow Zn^{2+}_{(aq)} + 2^{e-}$

Cathode : $MnO_2(s) + NH_4^+{}_{(aq)} + e^- \rightarrow MnO(OH) + NH_3$

Zn is reductant and MnO_2 is oxidant. NH_3 produced at cathode forms complex with Zn^{2+}, $[Zn(H_3)_2Cl_2]$. Cell potential is 1.5 volt.

91. Mercury cell is used for low current devices. Anode is ZnHg. Cathode is a paste of HgO and Carbon. Electrolyte is a paste of KOH and ZnO. Anode reaction is

ZnHg +20H"—» $ZnO_{(s)}$+H_20 + $Hg_{(l)}$ + 26- Cathode reaction is

$HgO + H_2O + 2e^- \rightarrow Hg_{(l)} + 2OH^-$

Zn is reductant and HgO is oxidant

92. Overall cell reaction in mercury cell is Zn + $HgO_{(s)}$ ->• $ZnO_{(s)}$ + $Hg_{(l)}$. Overall reaction does not involve any ion.

Cell potential remains constant during its life. Cell potential is 1.35 volt.

93. Lead storage battery is used in automobiles and $_v$ invertors. Anode is Lead grids of filled with spongy lead. Cathode is Lead grids of filled ^{L}with PbO ,. Cathode and anode are arranged alternately and are separated by thin fibre glass sheets. Electrolyte is 38% (by weight) solution of H_2SO_4.

94. Reactions in storage battery : Anode reaction,

$Pb + SO_4^{2-}{}_{(aq)} \rightarrow PbSO_{4(s)} + 2e^-$

Cathode reaction,

$Pb + SO_4^{2-}{}_{(aq)} + 4H^+ + 2e^- \rightarrow PbSO_{4\,(s)} + 2H_2O_{(l)}$

Overall cell reaction,

$Pb_{(s)} + PbO_{2\,(s)} + 2H_2SO_{4(aq)} \underset{\text{charging}}{\overset{\text{discharging}}{\rightleftharpoons}} 2PbSO_{4(s)} + 2H_2O_{(l)}$

95. During working storage of cell. H_2SO_4 is used (during discharge). The cell reactions ae reversed. Each set of anode and cathode produces a potential of 2 volts.

96. Nickel - Cadmium cell has longer life than lean storage battery. Anode is $Cd_{(s)}$, Cathode $-Ni(OH)_{3(s)}$ and Electrolyte is moist NaOH or KOH. Cd - reductant and $Ni(OH)_3$ - oxidant

97. Fuel cells are Galvanic cells that convert energy, of combustion of fuels like hydrogen, methane, methanol etc., directly into electrical energy are called fuel cells.

98. Fuel cell is used to supply electrical power in the Apollo space program. Porous carbon electrodes are used with catalysts like finely divided platinum or palladium. H, and 0_7 are bubbled through concentrated aqueous NaOH solution.

99. Cathode reaction in fuel cell is: $O_{2(g)} + 2H_2O_{(l)} + 4e^- \rightarrow 4OH^-{}_{(aq)}$

Anode reaction is: $2H_{2(g)} + 4OH^-{}_{(aq)} \rightarrow 4H_2O_{(l)} + 4e^-$

Overall reaction is: $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)}$

100. Fuel cell runs continuously as long as reactants are supplied. Fuel cells are pollution free Efficiency of fuel cell is about 70%.

101. Corrosion is the process of gradual destructio n of metal by environment is called corrosion eg : Rusting of iron, tarnishing of silver and green coating on copper.

102. More active metals are corroded more easily

103. Corrosion is due to the formation of oxide or other salts on the metal. Corrosion is electrochemical phenomenon galvanic cell formation)

104. During rusting of iron, at a particular place , iron undergoes oxidation forming hydrated ferric oxide (rust).

$Fe_2O_3 + x\,H_2O \rightarrow Fe_2O_3.xH_2O$

105. Prevention of corrosion of iron can be prevented by painting iron surface, by electroplating the iron with corrosion resistant metals, like chromium, by coating of iron surface with zinc metal (is called galvanization), by connecting iron with a sacrificial anide (electro + ve metals)

106. Metals which are used as sacrificial anode are more electropositive elements like Zn, Mg, A1 and their alloys.

107. A state of non-reactivity reached with time of action after an initial state of reactivity is called E passivity.

Question Bank - I

1. The best conductor of electricity is 1M solution of
1) H_2SO_4 2) H_3PO_4 3) CH_3COOH 4) H_3BO_3

2. A solution of Sodium metal in liquid Ammonia is strongly reducing due to
1) Sodium atoms 2) Sodium hydride
3) Sodamine 4) Solvated electrons

3. Which one of the following is not a strong electrolyte?
1) Acetic acid 2) Aqueous NaOH solution
3) Molten NaCl 4) Sulphuric acid

4. With increase in temperature the electrical conductivity of metallic conductor
1) increases 2) remains same
3) decreases 4) changes irregularly

5. The reason for increase in electrical conduction of electrolyte with increase in temperature is
1) increase in the number of ions
2) increase in the speed of ions
3) increase in the degree of dissociation of electrolyte
4) all the three

6. Electrical conduction of fused electrolyte depends upon
1) the number of ions in it
2) the charge of the ions
3) the velocity of the ions
4) all the above

7. The degree of dissociation of an electrolyte in aqueous solution depends on
1) temperature 2) concentration of the electrolyte
3) nature of the electrolyte 4) all the three

8. Arrhenius theory of electrolytic conduction does not apply to an aqueous solution of
1) CH_3COOH 2) HCN 3) NaCl 4) NH_4OH

9. The electrolyte through which the electrons enter the electrolytic solution is
1) cathode 2) anode
3) may be anode and cathode 4) neither anode and cathode

10. The reactions taking place at anode and cathode are
1) Oxidation and Reduction 2) Reduction and Oxidation
3) Oxidation and Hydrolysis 4) Reduction and Hydrolysis

11. During electrolysis all ions
    1) move in the same direction
    2) move towards the oppositely charged electrodes
    3) do not move
    4) none of the above

12. According to Faraday's law of electrolysis the amount of chemical change produced by the passage of an electric current is proportional to the
    1) electrical current 2) equivalent weight of the substance
    3) voltage 4) quantity of electricity passed

13. The electric charge for electrode deposition of one gram equivalent weight of a substance is
    1) one ampere for one second 2) 96500 coulombs per sec
    3) charge of one mole of electrons 4) one ampere for one hour

14. Unit of electro chemical equivalent is
    1) gram 2) gram/ampere 3) gram/col 4) col/gram

15. According to Faraday's first law of electrolysis mass of ion liberated is equal to
    1) ZC 2) ZQ 3) Zt 4) ZC/nF

16. One Faraday is equal to
    1) 96.5c mol^{-1} 2) 96500c mol^{-1}
    3) $6.023x10^{23}$ mol^{-1} 4) $96.5x10^{23}$ c mol^{-1}

17. Which of the following ions is discharged at the anode when an aqueous solution of sulphuric acid is electrolysed?
    1) Hydrogen 2) Hydroxyl 3) Oxygen 4) Sodium

18. Which of the following ions is discharged at the cathode when an aqueous solution of sodium hydroxide is electrolysed?
    1) Hydrogen 2) Hydroxyl 3) Oxygen 4) Sodium

19. An electrolysis is in progress, if the cathode plate is removed
    1) the movement of ions stopped
    2) the ions moves at random
    3) all ion move towards anode
    4) only anions move towards the anode

20. During the electrolysis of cryolite, Aluminium and Fluorine are formed in the molar ratio of
    1) 3:1 2) 1:3 3) 2:3 4) 3:2

21. Which of the following electrode is used as standard reference electrode
    1) Cu electrode 2) Zn electrode
    3) normal Hydrogen electrode 4) Chlorine electrode

22. The following statements is correct w.r.t both electrolytic cell and Galvanic cell
    1) in both cells, anode is shown by +ve sign
    2) in both cells, cathode is shown by –ve sign

3) in both cells, reduction reaction takes place at the cathode
4) in both cells, oxidation reaction takes place at the cathode

23. In a Daniel cell when Cu and Zn electrodes are connected current flows from
1) Cut to Zn with in the cell 2) Cu to Zn outside the cell
3) Zn to Cu outside the cell 4) All the above

24. Which of the following statements is wrong about galvanic cells
1) cathode is the positive electrode
2) cathode is the negative electrode
3) electrons flow from anode to cathode in the external circuit
4) reduction occurs at cathode

25. The difference of potential of two electrodes in a galvanic cell is known as
1) EMF 2) Potential difference
3) Electrode difference 4) Ionic difference

26. The number of grams of copper deposited from a solution of $CuSO_4$ by 0.5F of electricity is (At . wt of Cu = 64)
1) 64g 2) 6.4g 3) 32g 4) 16g

27. $Cu-2e^- \rightarrow Cu^{2+}$; $E^0 = +0.377V$
$Sn-2e^- \rightarrow Sn^{2+}$; $E^0 = -0.143V$
The E.M.F of the cell constructed with these electrodes is
1) +0.066V 2) –0.0066V 3) +0.520V 4) 0.54V

28. The weight of Ag deposited by passing 241.25 coulombs of current through $AgNO_3$ solution is
1) 0.27g 2) 2.7g 3) 27g 4) 0.54g

29. The weight of copper deposited when a Daniel cell produced 0.5F of electricity is
1) 3.175g 2) 0.3175g 3) 15.875g 4) 6.35g

30. Copper rod dipped in $AgNO_3$ solution gives blue colour to the solution. In this process
1) copper is oxidised 2) copper is reduced
3) silver is oxidised 4) silver is reduced

31. 3amperes of current is passed for 4 hours through copper salt solution. The amount of copper deposited is (At. wt of Cu = 63.54)
1) 1.43g 2) 14.3g 3) 16g 4) 143g

32. The reaction takes place at anode when an aqueous solution of $CuSO_4$ is electrolysed using Pt electrodes is
1) $2SO_4^{2-} \rightarrow S_2O_8^{2-}+2e^-$ 2) $Cu^{2+}+2e^- \rightarrow Cu$
3) $2H_2O \rightarrow 4H^++O_2+4e^-$ 4) $2H^++2e^- \rightarrow H_2$

33. The reaction taking place at anode is
1) oxidation 2) reduction 3) ionisation 4) hydrolysis

34. When zinc metal is added to $CuSO_4$ solution, copper is precipitated. It is due to
1) oxidation of Cu^{2+} 2) reduction of Cu^{2+}

3) hydrolysis of $CuSO_4$ 4) ionisation of $CuSO_4$

35. Which of the following metals will not reduce H_2O

1) Ca 2) Fe 3) Cu 4) Li

36. Normal aluminium electrode coupled with normal hydrogen electrode gives an emf of 1.66volts. So the standard electrode potential of aluminium is

1) –1.66V 2) +1.66V 3) –0.83V 4) +0.83V

37. Other things being equal, the emf of a Daniel cell may be increased by

1) keeping low temperature 2) using large copper electrodes

3) using large zinc electrodes 4) decreasing concentration of Cu^{2+} ions

38. On the basis of position in the electrochemical series, the metal which does not displace hydrogen from water and acids

1) Hg 2) Al 3) Pb 4) Ba

39. The cathode reaction in electrolysis of dilute H_2SO_4 with platinum electrodes is

1) Oxidation 2) reduction 3) both 4) neutralisation

40. Conductivity of a solution is directly proportional to

1) dilution 2) number of ions

3) current density 4) volume of the solution

41. Of the following metals that cannot be obtained by electrolysis of the aqueous solution of their salts are

1) Ag and Mg 2) Ag and Al 3) Mg and Al 4) Cu and Cr

42. If the number of moles of electrons involved in a reaction is doubled by multiplying all of the species appearing in the overall reaction by 2 then the

1) potential is halved 2) potential is doubled

3) potential is unchanged 4) potential is unchanged

43. Pure water does not conduct electricity because it

1) has low boiling point 2) is almost unionised

3) is neutral 4) is readily decomposed

44. Which of the following will form the cathode with respect to iron anode in an electrolyte cell?

1) Mg 2) Al 3) Cu 4) Zn

45. How many c.c of oxygen will be liberated by 2 ampere current flowing for 3 minutes and 13 seconds through acidulated water?

1) 11.2sec 2) 33.6sec 3) 44.8sec 4) 22.4sec

46. Assertion: Copper sulphate solution can be stored in a silver bowl

Reason: Metal having higher S.R.P value can displace another metal having lower S.R.P value from its salt solution

1) A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

47. Assertion: The conductivity of an aqueous solution of NaCl is greater than that of pure solvent

Reason: Conductivity depends upon the number of ions in solution

1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

48. Assertion: Iron is protected from corrosion by connecting magnesium metal with it.

Reason: Iron acts as a cathode and magnesium acts as anode which gradually disappears.

1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

49.

List –I	**List –II**
A) Cathode	1) Reference electrode
B) Anode	2) KCl, KNO_3 or NH_4NO_3 with gelatin
C) Standard hydrogen	3) Oxidation electrode
D) Salt bridge	4) Reduction electrode

The correct match is

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

50.

List –I	**List –II**
A) One faraday	1) Reduction
B) Anode	2) 96500coulomb
C) Cathode	3) 6.24×10^{18} electrons
D) 1 coulomb	4) Oxidation
	5) Z x 96,500

The correct match is

A B C D　　　　A B C D
1) 5 4 2 3　　　　2) 2 4 1 3
3) 2 4 1 5　　　　4) 5 2 1 3

KEY

1. 1	2. 4	3. 1	4. 3	5. 4	6. 4	7. 4	8.3	9.1	10.1
11. 2	12.4	13.3	14.3	15.4	16.2	17.2	18.1	19.2	20.3
21. 3	22. 3	23. 2	24. 2	25. 1	26.2	27.3	28. 1	29.1	30.4
31. 3	32.2	33.2	34.2	35.4	36.4	37. 2	38.1	39.3	40.2
41. 3	42. 3	43. 3	44. 1	45. 3	46.3	47.1	48.1	49.2	50.2

Question Bank - II

1. Which of the following has highest equivalent conductance
   (1) 0.5M NaCl (2) .05 M NaCl (3) .005 M NaCl (4) .02 M NaCl
2. Two electrodes are fitted in conductance cell at 1.5 cm apart while the area of cross section of each electrode 0.75 cm^2. The cell constant is
   (1) 1.125 cm (2) 0.5 cm (3) $2cm^{-1}$ (4) . $2cm^{-1}$
3. If x is the specific resistance of the solution and N is the normality of the solution then equivalent conductivity of the solution is
   (1) $\frac{1000x}{N}$ (2) $\frac{1000}{Nx}$ (3) $\frac{1000N}{x}$ (4) $\frac{Nx}{1000}$
4. The increase in the molar conductivity of acetic acid with dilution is due to
   (1) decrease in interionic forces (2) increase in degree of ionisation
   (3) increase in self ionization of water (4) decrease in interionic forces
5. The expression relating molar and equivalent conductivities is
   (1) $\lambda_m = \lambda_{eq} / v^+ z^+$ (2) $\lambda_m = v^+ z^+ \lambda_{eq}$
   (3) $\lambda_m = v + \lambda_{eq} / z^+$ (4) $\lambda_m = z^+ \lambda_{eq} / v^+$
6. If λ_c of NH_4OH is 115.52^{-1} cm^2 mole^{-1} its degree of dissociation would be
   $(\lambda^{\alpha} NH_4 = 73.4\ \Omega^{-1} cm^2\ mol^{-1}\ \lambda_{OH^-} = 197.6 \Omega^{-1} cm^2 mol^{-1})$
   (1) 0.157 (2) 0.58 (3) 0.424 (4) 0.0848
7. The correct order of equivalent conduct once at infinite dilution of Li Cl, NaCl & KCl is
   (1) $Li\,Cl > NaCl > KCl$ (2) $KCl > NaCl > Li\,Cl$
   (3) $NaCl > KCl > Li\,Cl$ (4) $Li\,Cl > KCl > NaCl$
8. The molar ionic conductors at infinite dilution of Ag^+ $61.92 \times 10^4\, S\, mol^{-1} m^2$ at $25^o C$ the ionic mobility of Ag$^+$ will be
   (1) 6.4×10^{-8} (2) 6.192 (3) 6.192×10^{-8} (4) 3.2×10^{-4}
9. Which expression can be used to calculate degree of ionization of weak electrolyte of type A^+B^-
   (1) $\sqrt{K} / C$ (2) $\lambda_m / \lambda^{\alpha}{}_n$ (3) Both 1 and 2 (4) Neither 1 and 2
10. Which lead accumulator is charged
    (1) Electrolytic cell (2) Galvanic cell (3) Daniel cell (4) None of the above
11. Hydrogen – oxygen fuel cells are used in space craft to supply
    (1) Power for heat and light (2) Power for pressure
    (3) Oxygen (4) Water
12. Corrosion is
    (1) Physical change (2) Neutralisation
    (3) Electro chemical change (4) None
13. In electrochemical corrosion of metals, the metal undergoing corrosion
    (1) becomes anode (2) becomes cathode
    (3) becomes inert (4) None is correct

14. Iron rod is immersed in KCl solution such that half its length is exposed to air and the other half immersed in KCl solution. The part corroded is
    (1) Part of the rod exposed to air (2) Part of the rod immersed in KCl solution
    (3) Both 1 and 2 (4) None

15. The hydrogen electrode potentials depends on
    (1) Nature of metal used as anode
    (2) The P^H of solution
    (3) Both nature of the metal used as anode and the P^H of the solution
    (4) Nature of the metal used as cathode and the P^H of the solution.

16. The specific conductivity of $\frac{N}{10}KCl$ solution at $20^o C$ is 0.212 $ohm^{-1}\,cm^{-1}$ and the resistance. The cell constant is $[K, \frac{1}{R}\,\frac{l}{a}]$
    (1) 4.616cm^{-1} (2) 1.166cm^{-1} (3) 2.173 cm^{-1} (4) 3.324 cm^{-1}

17. Molar conductivity of a solution $1.26\times10^2\ \Omega^{-1}cm^2mol^{-1}$ its molarity is 0.01 its specific conductivity will be $\left[\lambda_m = \frac{K\times1000}{M}\right]$
    (1) 1.26×10^{-5} (2) 1.26×10^{-3} (3) 1.26×10^{-4} (4) .0063

18. The molar ionic conductance at infinite dilution of Ag^+ $6.192\times10^4\,s\,mol^{-1}\,m$ at $25^o C$ the ionic mobility of Ag^+ will be
    (1) 6.4×10^{-8} (2) 6.192 (3) 6.192×10^{-4} (4) 3.2×10^{-4}

KEY

1) **3**	2) **3**	3) **2**	4) **2**	5) **3**	6) **3**	7) **2**	8) **1**
9) **2**	10) **1**	11) **2**	12) **3**	13) **1**	14) **2**	15) **4**	16) **2**
17) **2**	18) **1**						

Question Bank - III

Faraday's Laws

1. During the electrolysis of crolite, aluminium and fluorine4 are formed in ... molar ratio
   1) 1 : 2 2) 2 : 3 3) 1 : 1 4) 1 : 3

2. The Weight of copper (atomic mass 63.5) deposited when 2 Faradays of electricity is passed through cupric salt solution is
   1) 63.5g. 3) 31.15g. 3) 127g. 4) 2g.

3. By passing 0.1 Faraday of electricity through fused sodium chloride, the amount of chlorine liberated is
   1) 35.45 g 2) 70.9 g 3) 3.545 g 4) 17.77 g

4. The number of coulombs required to deposit 5.4 g. of Alunumum when the given electrode reaction is represented as Al^{3+} % + $3e^-$ $\xrightarrow{}$ Al
   1) 1.83×10^5 C 2) 57900 C
   3) 5.86×10^5 C 4) 3F

5. The number of electrons involved in the electro deposition of 63.5 g. of Cu from a solution of $CuSO_4$ is

1) 6.0×10^{23} 2) 3.011 10^{23} 3) 12.04 10^{23} 4) 6.02 10^{22}

6. The electrochemical equivalent of a metal is "*x*" g. coulomb^{-1}. The equivalent weight of metal is

1) x 2) x 96500 3) x/96400 4) 1.6 x 10^{-19} x

7. The electro chemical equivalent of an element is 0.00067.35 g/C. Its equivalent weight is

1) 65 2) 67.35 3) 130 4) 32.5

8. The current strength required to displace 0.1 g. of H_2 in sec is

1) 9.65 amp 2) 1.988 amp 3) 198 amp 4) 965 amp

9. On electrolysing a sample of acidified water, 22.4 ml of hydrogen was obtained. The volume of oxygen in ml obtained is

1) 22.4 2) 44.8 3) 11.2 4) 2.24

10. One coulomb of charge passes through solutions of $AgNO_3$, and $CuSO_4$. The ratio of the amounts of silver and copper deposited on platinum electrodes used for electrolysis is

1) 108 : 63.5 2) 54 : 31.75 3) 108 : 31.75 4) 215.8 : 31.75

11. When electricity is passed through molten $AlCl_3$, 13.5 g. of Al is deposited. The number of Faradays must be

1) 0.5 2) 1.0 3) 1.5 4) 2.0

12. The weight in grams of O_2 formed at Pt anode during the electrolys of aq. K_2SO_4 solution during the passage of one coulomb of electricity is

1) 2) $\frac{8}{96500}$ 3) $\frac{32}{96500}$ 4) $\frac{64}{96500}$

13. How many coulombs of electricity are required for the reduction of 1 mol of MnO_4^- to Mn^{2+}?

1) 96.500 C 2) 1.93 x 10^5 C 3) 4.83 x 10^5 C 4) 9.65 x 10^6 C

14. Electric charge on lgm ion of N^{3-} is

1) 4.8 x 10^{-19} C 2) 10 x 1.6 x 10^{-19} C

3) 1.6 x 10^{-19}C 4) 2.89 x 10^5 C

15. Time required to deposit one millimole of aluminium metal by the passage of 9.65 amperes through aqueous solution of aluminium ions is

1) 30 s 2) 10 s 3) 30,000 s 4) 10,000 s

16. On passing current through molten *KCl*, 19.5 g of K is deposited. The amount of A*l* deposited by the same quantity of electricity when passed through molten AZC*l*, is

1) 4.5 g 2) 9 g 3) 13.5 g 4) 2.7 g

17. When an electric current is passed through acidulated water, 112 ml of hydrogen gas at NTP is collected at the cathode in 965 seconds. The current passed in amperes is

1) 1.0 2) 0.5 3) 0.1 4) 2.0

18. The amount of chlorine evolved when 2 amperes of current is passed for 30 minutes in an aqueous solution of NaC*l*

1) 66 g 2) 1.32 g 3) 33 g 4) 99 g

Electrolytic conductance

19. The conductivity of 0.001 M acetic acid is 5×10^{-5} S cm^{-1} and ^{0} is 390.5 S cm^2 mol^{-1} then the calculated value of dissociation constant of acetic acid would be (H.P.P.M.T)

1) 81.78 10^{-4} 2) 81.78 10^{-5}

3) 18.78 10^{-6} 4) 18.78 10^{-5}

20. The distance between two electrodes of a cell is 2.5 cm and area of each electrode is 5 cm^2 the cell constant (in cm^{-1}) is

` 1) 2 2) 12.5 3) 7.5 4) 0.5

21. The limiting molar conductivities ($_0\vee$) for NaC*l*, KBr an *KCl* are 126, 152 and 150 S. cm^2 mol^{-1} respectively. Then A^0 for NaBr is

1) 128 S cm^2 mol^{-1} 2) 302 S cm^2 mol^{-1}

3) 278 S cm^2 mol^{-1} 4) 176 S cm^2 mol^{-3}

22. Which of the following solutions of NaC*l* has the higher specific conductance ?

1) 0.00IN 2) 0.01N 3) 0.1 N 4) 1 N

23. Molar conductivity of a solution is $1.26 \times 10^2 \Omega^{-1} cm^2 mol - 1 \cdot$ Its molarity is 0.01M. Its specific conductivity will be

1) 1.26 x 10^{-5} 2) 1.26 x 10^{-3} 3) 1.26 x 10^{-4} 4) 0.0063

24. The values of equivalent conductivity at inflate dilutions for NH$_4$C*l* , NaOH and NaC*l* are respectively 149.74. 248.1 and 126.4 ohm^{-1} cm^2 equi^{-1}. The value of λ_{eq}^{∞} of NH$_4$OH is

1) 371.44 2) 271.44

3) 71.44 4) It cannot be calculated from the data given

25. Specific conductance, of 0.1 M Nitric acid is 6.3 x 10^{-2} ohm^{-1} cm^{-1}. The molar conductance of the solution is

1) 630 ohm^{-1} cm^2 2) 315 ohm^{-1} cm^2

3) 100 ohm^{-1} cm^2 4) 6300 ohm^{-1}cm^2

e) 63.0 ohm^{-1} cm^2

26. For an electrolytic solution of 0.05 mole litre^{-1}. the conductivity has been found to be 0.0110 Scm^{-1}. The molar conductivity (in Scm^{2}mole^{-1}) is

1) 0.055 2) 550 3) 0.22 4) 220

27. Molar ionic conductivities of a bivalent electrolyte are 57 and 73. The molar con-ductivity of die solution will be

1) 130 S cm^2 mol^{-1} 2) 65 S cm^2 mol^{-1}

3) 260 S cm^2 mol^{-1} 4) 187 S cm^2 mol^{-1}

Nernst equation and EMF

28. At a certain temperature and at infinite dilation, the equivalent conductances of sodium benzoate. hydrochloric acid and sodium chloride are 240, 349 and 229 ohm^{-1} *cm^2* $cquiv^{-1}$ respectively. The equivalent conductance of benzoic acid in ohm^{-1} cm^2 equiv at the same conditions is

1) 80 2) 328 3) 360 4) 408

29. EMF of a cell in terms of reduction potential of its left and right electrodes is

1) $E = E_{left} - E_{right}$ 2) $E = E_{left} + E_{right}$

3) $E = E_{right} - E_{left}$ 4) $E = -(E_{right} + E_{left})$

30. E^0 for the half ceil Zn^{2+}/zn *is* -0.76V, emf of the cell $Zn/Zn^{2+}(1M)//H^+(1M)/H_2$ at 1 atm is

1) -0.76 V 2) + 0.76 V 3) -0.38 V 4) + 0.38 V

31. If the standard electrode protenlial of *$Cu^{2+}/$* Cu electrode is 0.34 V, what is the electrode potential at 0.01 M concentration of Cu^{2+} ? (T = 298^0K)

1) 0.399 V 2) 0.281 V 3) 0.222 V 4) 0.176 V

32. The potential of hydrogen electrode is-118 mV. The H^+ concentration of the solution is

3) 0.01M 2) 2M 3) 10^{-4}M 4) 1M

33. The standard potentials (E°) for the half reactions are as

$Zn \quad Zn^{2+} + 2e$, $E^0 = + 076V$

$Fe \quad Fe^{2+} + 2e^-$ $E° = + 0.41$ V

the emf for the cell reaction

Fe^{2+} Zn $\quad Zn^{2+}$ + Fe is

1) –0.35 V 2) + 0.35 V 3) + 1.17 V 4) –1.17 V

34. E° for $F_2+2e^- \quad 2F^-$ is 2.8 V

E° for 1/2 $F_2+2e^- \quad 2F^-$ is

1) 2.8 V 2) 1.4 V 3) –2.8 V 4) –1.4 V

35. Consider the fallowing E° values

E° Fe^{2+} / Fe^{2+} = + 0.77 V

E°Sn^{2+}/Sn = –0.14 V

under standard conditions the potential for the reaction

$Sn_{(s)} + 2Fe^{3+}_{(aq)} \quad 2Fe^{2+}_{(aq)} + Sn^{2+}_{(aq)}$ is

1) 1.68 V 2)0.63 V 3) 0.91 V 4) 1.40 V

36. E^0 for the reaction Fe + Zn^{2+} + Zn + Fe^{2+} is –0.35 V. The given cell reaction is

1) feasible 2) not feasible 3) explosive 4) slow

37. E.M.F of the cell reaction.

$2Ag^+ + Cu \quad 2Ag + Co^{2+}$ is 046 V.

If is + 0.34 V, $E^0_{Ag^+/Ag}$ is

1) 0.80 V 2) 0.12 V 3) 0.40 V 4) 1.60 V

38. The EMF of the cell Ni/Ni^{2+}/ (0.01M) // Cl^-(0.0lM)Cl_2, pt is --- V if the SRP of nickel and chlorine electrodes are –0.25V and +I.36V respectively

1) +1.61 2) –1.61 3) +1.79 4) –1.79

39. The standard electrode potential of the two half cells are given below :

$Ni^{+2} + 2e^- \rightarrow Ni$; $E^o = -0.25$ Volt

$Zn^{+2} + 2e^- \rightarrow Zn$; $E^o = -0.77$ Volt

The voltage of cell formed by combining the two half cells would be

1) –1.02 2) +0.52 volt 3) +1.02 volt 4) –0.52 volt

40. Aluminium displaces hydrogen from dilute HC*l* whereas silver does not. The e.m.f. of a cell prepared by combining $A1/A1^{3+}$ and Ag/Ag^+ is 2.46 V. The reduction potential of silver electrode is + 0.80 V. The reduction potential of aluminium electrode is (K.C.E.T)

1) + 1.66 V 2) –3.26 V 3) +3.26 V 4) –1.66 V

41. A cell constructed by coupling a standard copper electrode and a standard magnesium electrode has emf of 2.7 volts. If the standard reduction potential of copper electrode is +0.34 volt, that of magnesium electrode is

1) +3.04 volts 2) –3.04 volts 3) +2.36 volts 4) –2.36 volts

42. The solution of nickel sulphate in which nickel rod is dipped is diluted 10 times. The potential of nickel

1) decreases by 60 mV 2) increases by 30V

3) decreases by 30 mV 4) decreases by 60V

43. The standard reduction potentials for the twol half-cell reactions are given below :

$Cd^{2}{}_{(aq)}\quad 2e\quad Cd_{(s)}$; $E^o\quad 0.40V$

$Ag^{+}{}_{(aq)} + e^- \rightarrow Ag_{(s)}$; $E^o = -0.80V$

The standard free energy change for the reaction $2Ag^{+}{}_{(aq)} + Cd_{(s)} \rightarrow Ag_{(s)} + Cd^{2+}{}_{(aq)}$ is given by

1) 115.8 kJ 2) -115.8 kJ 3) -231.6 kJ 4) 231.6 kJ

44. Normal aluminium electrode coupled with normal hydrogen electrode gives an emf of 1.66volts. So the standard electrode potential of aluminium is

1) –1.66 V 2) + 1.66 V 3) –0.83 V 4) +0.83 V

45. The standard EMF For the cell reaction, $Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}$ is 1.1 volt at 25°C. The EMF for the cell reaction, when 0.1 M Cu^{2+} and 0.1 M Zn^{2+} solutions are used, at 25°C is

1) 1.10 V 2) 0.10 V 3) –1.10 V 4) –0.110 V

KEY

1) 2	2) 1	3) 3	4) 2	5) 3	6) 2	7) 1	8) 4
9) 3	10) 3	11) 3	12) 2	13) 3	14) 4	15) 1	16) 1
17) 1	18) 2	19) 3	20) 4	21) 1	22) 4	23) 2	24) 2
25) 1	26) 4	27) 1	28) 3	29) 3	30) 2	31) 2	32) 1
33) 2	34) 1	35) 3	36) 2	37) 1	38) 3	39) 2	40) 4
41) 4	42) 3	43) 3	44) 1	45) 1			

3b. CHEMICAL KINETICS

Synopsis

1. When a chemical reaction is in progress, tne concentration of the reactants decreases and the concentration of the products increases with the progress of time.
2. There is a change in the macroscopic properties (detectable properties like colour, concentration M etc.,) of the system during a reaction.
3. The rate of a reaction is defined as the decrease in the concentration of the reactant or the increase in the concentration of the product in unit time.
4. The units of rate of a reaction are : mole lit^{4}s^{-1}. In gaseous reaction the units of rate of reaction are: atm s^{-1}.
5. Rate of reaction generally decreases non uniformly as time proceeds.
6. For a reaction $A \rightarrow B$

   The rate in terms of the concentration of rectant

   $$A = \frac{-d[A]}{dt}$$

   The rate in terms of the concentration of product

   $$B = \frac{+d[B]}{dt}$$
7. In the reaction $N_2 + 3H_2 \rightarrow 2NH_3$, the rate =

   $$\frac{-d[N_2]}{dt} = \frac{1}{3}\frac{d[H_2]}{dt} = +\frac{1}{2}\frac{d[NH_3]}{dt}$$
8. The slope of the tangent of the concentrati:n - time curve at any point gives the rate of the reaction at that time.
9. The rate of a reaction depends upon the nature of the reactants.
10. Ionic substances in aqueous solution contain free ions. Ions can directly participate in reaction as bends need not be broken. So ionic reactions are ere fast or instantaneous.
11. Reactions between covalent substances are slow because in such reactions breaking of old bonds and formation of new covalent bonds occurs.
12. With an increase in the concentration of the reactants, the rate of the reaction increases (except zero order reactions)
13. According to law of mass action, rate =K [Reactants]^n

    where K is rate constant or specific rate and n is order of the reaction
14. With an increase in temperature the rate of a reaction always increases, whether the reaction is exothermic or endothermic.
15. A catalyst increases the rate of reaction by carrying the rection in a new path

involving lower activation energy.

16. A catalyst alter rate of reacation, path of reaction, activation energy, threshold energy and rate constant.
17. Catalyst does not alter ΔH , ΔS, ΔG of reaction, energy of reactants and energy of products
18. A catalyst favours both forward and backward reactions equally. Hence it does not affect equilibrium constant.
19. For a chemical reaction to take place collisions between the reacting molecules are essential.
20. Number of binary collisions per unit time

$$Z = \pi\sigma_{AB}^{2}\sqrt{\frac{8KT}{\pi\mu}}n_A.n_B$$

σ_{AB} is collision diameter, u is reduced mass, n_A and n_B are number of molecules of reactant A and reactant B.

21. Only a fraction of the total number of collisions lead to reaction. This fraction is known as effective or fruitful collisions.
22. The minimum energy which the molecules should possess so that their collisions lead to chemical reaction is called threshold energy [E_T].
23. The minimum extra energy which the molecules should possess, over and above the average energy, to enable them to react is called the energy of activation (Ea). $E_a = E_T - E_{Reactants}$
24. The greater the energy of activation of a reaction the lesser will be the rate constant and also the rate of the reaction.
25. The lesser the energy of activation of a reaction the higher will be the rate constant and also the rate of the reaction.
26. Molecules possessing the threshold energy are called activated molecules.
27. When activated molecules collide, an activated complex or a transition state is formed which changes into the products.
28. The energy of the activated complex is greater than the energy of the reactants and also the energy of the products.
29. The fraction of molecules which possess the energy of activation is given by the Boltzmann factor, $e^{-Ea/RT}$
30. With an increase in concentration, the number of activated molecules increases. The number of effective collisions increase due to which the rate of the reaction increases.
31. Heat of reaction $_\Delta E = (Ea)_f - (Ea)_b$, where $(Ea)_f$ is the energy of activation of the forward reaction and $(Ea)_b$is the energy of activation of the backward reaction.
32. In an exothermic reaction, the energy of activation of the backward reaction is greater than the energy of activation of the forward reaction.
33. In an endothermic reaction the energy of activation of the backward reaction is

less than the energy of activation of the forward reaction.

34. The relationship between the rate constant of a reaction and temperature is given by Arrhenius equation.

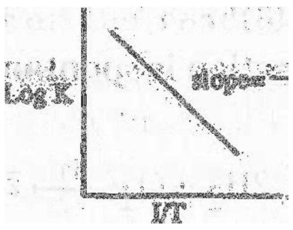
$k = A.e^{\frac{E_a}{RT}}$, where 'A' is frequency factor.

35. Frequency factor gives number of collisions per second per unit volume of reactant mixture.

36. The frequency factor and energy of activation are constant for a given reaction. They vary very slightly with temperature so that they are almost independent of temperature for a given reaction.

$$\log K = \log A - \frac{E_a}{2.303\,RT}$$

37. When a graph is drawn between log K and 1/T a straight line (linear) is obtained with negative slope.



$$\frac{E_a}{2.303\,RT}$$

38. At two temperatures Tj and T_2, the rates constants K, and K_2 are given by

$$\log\frac{K_2}{K_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

39. The mathematical dependance of the rate of a reaction on the molar concentrations of the reactants is called the rate law or rate equation. For a reaction, $aA + bB \rightarrow cC + dD$,

rate = $K[A]^x[B]^y$, where K is rate constant or specific rate, x is order of reaction w.r.t, A and y is order of reaction w.r.t B.

40. The rate constant of a reaction becomes equal to the rate of the reaction when the concentration of all the reactants are unity. Flence the rate constant is also known as the specific reaction rate.

41. Rate constant does not change with change of concentration of reactants, products, volume of vesel, and coefficients of reactants.

42. The rate constant of a reaction is always a charecterstic value at a given temperature.

43. The units of the rate constant of nth order reaction are: $lit^{(n-1)}mole^{(1-n)}sec^{-1}$

44. The ratio between the rate constants of a reaction at two temperatures which differ by 10° is called the temperature coefficient of the reaction

45. Temperature coefficient = $\frac{K_{(t+10)}}{K_t}$

where K_t is the rate constant of the reaction at t^oC.

46. For most of the reactions the value ofthe temperature coefficient was found to be 2 to 3. This means that the rate constant of a reacdom increases by 100 to 200% with 10°C raise in temperature.
47. The slowest of different steps in the reaction mechanism is called rate limiting or rate determining step of a reaction,
48. Molecularity of a reaction is sum of number of atoms or ions or molecules in the rate determinin g step of the reaction.
49. Molecularity may be 1 or 2 or 3. It can be neither zero nor fractional.
50. The sum of the powers of the concentration terms of the reactants in the rate equation of the reaction is known as the order of the reaction.
51. The rate equation is determined experimentally from which we can know the order of the reaction.
52. Rate is independent on the concentration of reactant in a zero order reaction.
53. For a zero order reaction, rate = rate constant.
    Units of rate constant are : $\text{mol L}^{1}\ \text{s}^{-1}$
54. Rate is dependent on single concentration term
    in a first order reaction.
    rate = K x Concentration
    Units of rate constant are : s^{-1}.
55. Rate is dependent on two concentration terms in a second order ration,
    rate = K x $(\text{Concentration})^2$
    Units of rate constant are : $\text{L mol}^{-1}\ \text{s}^{1}$
56. If 'a' is initial concentration of the reactant, reduced to (a - *x)* in time t, the rate constant of a first order reaction, $\text{K} = \frac{2.303}{t}\log\frac{a}{a-x}$
57. Time taken for 50% completion of a reaction is called half- life ($t_{J/2}$).
58. Half life of a first order reaction is independent on the initial concentration, $t_{1/2} = \frac{0.693}{K}$
59. Time required for 75% completion of a first order reaction is 2 half lives, for 87.5% completion is 3 half -lives and 99.9% completion is 10 half-lives.
60. Half life of a reaction is directly proportional to a^{1-n}, where 'a' is initial concentration and 'n' is order or reaction.
61. For a zero order reaction $t_{1/2}$ = a/2K.
62. For a second order reaction $t_{1/2}$ = 1/K .
63. Rate Vs Concentration (C):

	Order	X-axis	Y-axis	Nature of graph
i)	Zero	C	Rate	Straight line ll^{el} to X-axis
ii)	1st	C	Rate	Straightline passing through origin
iii)	nth	$[C]^n$	Rate	Straightline passing through origin

64. Concentration Vs time:

	Order	X-axis	Y-axis	Nature of graph
i)	Zero	time	C	Straight line with -Ve slope
ii)	1st	time	log C	Straight line with –Ve slope
iii)	nth	time	1/C	Straight line not (n>1) passing through origin

65. Initial concentration Vs half life :

	Order	X-axis	Y-axis	Nature of graph
i)	Zero	C	$t_{1/2}$	Straight line passing through origin
ii)	1st	C	$t_{1/2}$	Straight line parallel to X-axis
iii)	n^{th}	1/C	$t_{1/2}$	Straight line passing through origin

66. The order of reaction is experimentally determined by Integrated equation method, Half - life method, Van't Hoff differential method and Ostwald's isolation method.

67. Molecularity is obtained for the reaction mechanism and not from stoichiometry.

68. Molecularity and order of a reactions are one and the same for an elementary reaction.

Question Bank

1. Wrong statement of the following is
The rate of reaction
1) Decreases with time
2) Decreases with decrease in concentration of reactant
3) Decreases with increase in time and decreases with concentration of reactant
4) Is always zero at the beginning and after infinite time

2. A catalyst accelerates the reaction, because
1) it brings the reactants closer
2) it lowers the activation energy
3) it changes the heat of reaction
4) it increases the activation energy

3. The expression $\frac{-d(H_2O_2)}{dt}$ indicates
1) rate of formation of H_2O_2
2) rate of decomposition of H_2O_2
3) increases in rate of reaction
4) decrease in the rate of formation of H_2O_2

4. The order of a reaction can be obtained from
1) Chemical equation		2) Thermo chemical equation
3) Chemical equilibrium		4) Rate expression

5. Which of the following is correct?
1) Molecularity of a reaction is always same as the order of reaction
2) In some cases molecularity of the reaction is same as the order of reaction

3) Molecularity of the reaction is always more than order of reaction
4) All the three are correct

6. Equation for the time of half change of a first order reaction is
1) $t_{1/2} = 0.693/k$ 2) $t_{1/2} = 0.602/k$
3) $t_{1/2} = k/0.693$ 4) $t_{1/2} = k/0.602$

7. If concentration of reactants is made 'x' times, the rate constant k becomes
1) $e^{k/x}$ 2) k/x 3) unchanged 4) x/k

8. For a hypothetical reaction A+ B → products, the rate law is $R = K [B][A]^0$, the order of the reaction is
1) 1 2) 2 3) 3 4) 0

9. The time of completion of 90% of a first order reaction is nearly ------ times that of half life
1) 10 2) 5 3) 6.6 4) 3.3

10. The velocity constant of a reaction at 290K was found to be 3.2×10^{-3}. At 310K it will be about
1) 1.28×10^{-2} 2) 9.6×10^{-3} 3) 6.4×10^{-3} 4) 3.2×10^{-4}

11. For a chemical reaction A → B, it is observed that the rate of reaction doubles when the concentration of A is increased four times. The order of reaction in A is
1) Half 2) Zero 3) One 4) Two

12. 50% completion of a first order reaction take place in 16 minutes. Then fraction that would react in 32 minutes is
1) 1 /2 2) 1 /4 3) 1 /8 4) 3 /4

13. A chemical reaction was carried out at 300k and 280k. The rate of constants were found to be K_1 and K_2 respectively. Then
1) $K_2 = 4K_1$ 2) $K_2= 2K_1$ 3) $K_2 = 0.25K_1$ 4) $K_2 = 0.5K_1$

14. The rate of reaction is doubled for every 10^0 rise in temperature. The increase in reaction rate as a result of temperature rise from 10^0 to 100^0 is
1) 112 2) 512 3) 400 4) 614

15. The reaction $2N_2O_5 \rightarrow 2N_2O_4+O_2$ is
1) Bimolecular and second order 2) Unimolecular and first order
3) Bimolecular and first order 4) Bimolecular and zero order

16. For a first order reaction a plot of log (a-x) against time is a straight line with a negative slope equal to
1) K/2.303 2) –2.303k 3) –Ea/2.303 4) –Ea/2.303R

17. In Arrhenius plot, intercept is equal to
1) –Ea/R 2) ln A 3) ln K 4) $\log 10^a$

18. For a reaction involving solid, decrease in which of given below will increase the rate of reaction
1) Particle size 2) Concentration
3) Temperature 4) Pressure

19. In respect of the equation $K = Ae^{-Ea/RT}$ in chemical kinetics which one of the following statement is correct
1) A is adsorption of activation 2) E is energy of activation
3) R is Rydberg constant 4) K is equilibrium constant

20. The time taken for the completion of 3 /4 of a first order reaction is
1) (2.303 /k) log 3 /4 2) (2.303/k) log 4

3) (2.303/k) log 1 /4 4) (2.303/0.75) log k

21. The rate of reaction has the dimension of
1) Moles lit^{-1} 2) Moles lit sec^{-1} 3) Moles lit^{-1} sec^{-1} 4) $Moles^{-1}$ lit^{-1} sec^{-1}

22. The unit of rate constant depends on
1) number of reactants 2) concentration terms
3) order of reaction 4) molecularity of reaction

23. After three half lives, the percentage fraction of amount left is
1) 6.25 2) 75 3) 12.5 4) 50

24. The overall kinetics of a reaction is governed by
1) the main reaction
2) the fastest step in the reaction mechanism
3) the slowest step in the reaction scheme
4) the step involving the maximum number of reactant species

25. The order of a reaction whose rate is determined by only one concentration variable is
1) Zero 2) One 3) Two 4) Three

26. The powers to which the concentration of a substance appears in the rate expression is known as
1) Order of reaction 2) Molecularity of reaction
3) Rate of reaction 4) Order of reaction with respect to that substance

27. The inversion of cane sugar into glucose and fructose is
1) 1st order 2) 2nd order 3) 3rd order 4) zero order

28. If the rate for the chemical reaction is expressed as Rate = $K [A][B]^n$, then
1) order of reaction is one 2) order of reaction is n
3) order of reaction is 1+n 4) order of reaction is 1-n

29. The Arhenius equation expressing the effect of temperature on the rate constant of reaction is
1) $K = E^{a/RT}$ 2) $K = Ae-E^{a/RT}$ 3) $K = \log_e \frac{E_a}{RT}$ 4) $K = e-E^{a/RT}$

30. The minimum energy required for molecules to enter into chemical reaction is called
1) Kinetic energy 2) Potential energy
3) Threshold energy 4) Activation energy

31. In a reaction $2A+B \rightarrow A_2B$, the reactant 'A' will disappear at
1) half the rate at which B will decrease
2) the same rate at which B will decrease
3) the same rate at which A_2B will form
4) twice the rate at which B will decrease

32. Chemical kinetics is a branch of chemistry which deal with
1) heat changes in a reaction 2) rate of reaction
3) bonding 4) electronic structure

33. For a reaction to be spontaneous, the free energy change (ΔG) of the reaction is
1) negative 2) positive 3) zero 4) infinity

34. The rate of a chemical reaction
1) increases as the reaction proceeds
2) decreases as the reaction proceeds

3) may increase or decrease during the reaction
4) remains constant as the reaction proceeds

35. The effect of a catalyst in a chemical reaction is to change the
1) heat of reaction 2) final product
3) equilibrium concentration 4) activation energy

36. The graph drawn between log k and 1/T gives
1) a straight line with positive slope
2) a straight line with negative slope
3) a straight line passing through the origin
4) hyperbola

37. The threshold energy of a chemical reaction depends upon
1) temperature 2) nature of reactants
3) concentration 4) pressure

38. The acid hydrolysis of ethyl acetate is
1) bimolecular 2) 1st order 3) pseudo unimolecular 4) all

39. The product of half life ($t_{1/2}$) and the initial concentration of the reactant (a) is constant. Then the ratio of reaction is
1) 2 2) 3 3) 0 4) 1

40. The units of rate of reaction are same as the rate constant of ---- order reaction
1) 1st 2) 2nd 3) 3rd 4) 0

41. The rate of a chemical reaction depends upon
1) temperature 2) conc. of reactants
3) nature of reactants 4) all the above

42. Half life of first order chemical reaction is independent of
1) nature of reactants 2) temperature
3) catalyst 4) initial concentration

43. Which of the following statements are same as the rate constant of ---- order reaction
1) first order reaction should be bimolecular
2) order reaction must be positive
3) order depends upon stiochiometry
4) order is based on experimental results

44. In general the rate of a given reaction can be increased by all the factors except
1) Increasing the temperature
2) Increasing the concentration of reactants
3) Increasing the activation energy
4) Using a catalyst

45. If the rate of gaseous reaction is independent of pressure, the order of reaction is
1) 0 2) 1 3) 2 4) 3

46. Assertion: Order of reaction is evaluated from the mechanism of a reaction
Reason: Order of reaction can be zero
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

47. Assertion: Decomposition of H_2O_2 is a first order reaction
Reason: For the decomposition of H_2O_2, the rate of reaction = $K[H_2O_2]$
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

48. Assertion: Base catalysed hydrolysis of ester is a second order reaction
Reason: Units for second order rate constants are $lit.mol^{-1}.sec^{-1}$
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

49.

List-I (Rate constant)	List-II (Unit)
A) Zero order	1) $mole^{-1/2}$ $litre^{½}$ sec^{-1}
B) 3/2 order	2) litre $mole^{-1}$ sec
C) 1st order	3) moles $litre^{-1}$ $time^{-1}$
D) 2nd order	4) sec

The correct match is

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

50.

List-I	List-II
A) Rate	1) J/mole
B) Rate constant	2) 0.5
C) Order	3) 1
D) Molecularity	4) mol. $Lit^{-1}sec^{-1}$
	5) Lit $mol^{-1}.sec^{-1}$

The correct match is

	A	B	C	D
1)	4	2	1	5
2)	4	5	2	3
3)	2	1	5	4
4)	1	2	5	3

Keys

1.4	2.2	3.2	4.4	5.2	6.1	7.3	8.1	9.4	10.1
11.1	12.4	13.3	14.2	15.3	16.1	17.2	18.1	19.2	20.2
21.3	22.3	23.3	24.3	25.2	26.4	27.1	28.3	29.2	30.3
31.4	32.2	33.1	34.2	35.4	36.2	37.2	38.4	39.1	40.4
41.4	42.4	43.4	44.3	45.1	46. 4	47. 1	48. 2	49. 4	50. 2

Question Bank - II

REACTION RATES AND INFLUENCING FACTORS

1. Consider the following reaction

$N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$

The rate of the reaction in terms of N_2 at T (k) is $-\frac{d[N_2]}{dt} = 0.02$ mole.lit^{-1}. sec^{-1}. What is the $-\frac{d[H_2]}{dt}$ (in mole.lit^{-1}. sec^{-1}) at the same temperature ?

1) 0.02 2) 50 3) 0.06 4) 0.04

2. What is the rate of the following reaction tor $2A \rightarrow B$

1) $-\frac{d[A]}{dt}$ 2) $-\frac{1}{2}\frac{d[A]}{dt}$ 3) $-\frac{d[B]}{dt}$ 4) $-\frac{1}{2}\frac{d[B]}{dt}$

3. For the reaction $4NH_3+5G_2 \rightarrow 4NO$ *4* $6H_2O$, the rate of reaction with respect to NH_3 is $2\times10^{-3} Ms^{-1}$. Then the rate of the reaction with respect to oxygen is _ Ms^{-1}

1) 2×10^{-3} 2) 1.5×10^{-3} 3) .5 x 10-^{3} 4) 3×10^{-3}

4. Concentration off a reactant 'A' is changed from 0.044 M to 0.032M in 23 minutes, the average rate of the reaction during this interval is

1) 0.0048 mole/lit/min 2) 0.00048 mole/lit/sec

3) 4.8×10^{-4} mole/lit/min 4) 0.0048 mole/lit/sec

5. In the reaction A $\rightarrow$2B, the concentration of A falls from 1.0M to 0.9982M in one minute what is the rate iu moles litre^{-1} sec^{-1}

1) 1.8×10^{-3} 2) 3.0×10^{-5} 3) 3.6×10^{-3} 4) 6.0X10"^{5}

6. The rate of formation of SO_3 in the reaction $2SO_2 + O_2 \rightarrow 2SO_3$, is 100 g min^{-1}. Hence, rate of disappearance of O_2 is

1) 50 g min^{-1} 2) 100 g min^{-1} 3) 20 g min^{-1} 4) 40 g min^{-1}

7. 1dm^3 of 2 M CH_3COOH is mixed with 1 dm^3 of 3 M ethanol to form ester. The decrease in the initial rate if each solution is diluted with an equal volume of water would be

1) 2 times 2) 4 times 3) 0.25 times 4) 0.5 times

8. The rate law of the reaction.

RC*l* + NaOH $\rightarrow$ ROH + NaC*l* is given by

Rate - k [RC*l*], The rate of this reaction

A) is doubled by doubling the concentration of NaOH

B) is halved by reducing the -concentration of RC*l* to half

C) is increased by increasing the temperature of the reaction

D) is unaffected by change in temperature

Which is correct ?

1) A & B 2) B & C 3) C & D 4) B & D

9. The rate of reaction becomes 2 times for every 10°C rise in temperature. How many times the rate of reaction will increase when temperature is increased from 30^0C to 80^0C

1) 16 2) 32 3) 64 4) 28

10. An endothennic reaction A $\rightarrow$ B has an activation energy 15 kcal/mole and the heat of reaction is 5 kcal/mole. The activation energy of the reaction B $\rightarrow$ A is

1) 20 kcal/mole 2) 15 kcal/mole

3) 10 kcal/mole 4) zero

11. The activation energy of a reaction is 58.3 kJ/mole. The ratio of the rate constants at 305K and 300K is about ; $R=8.3JK^{-1}mol^{-1}$)

(Antilog 0.1667=1.468)

1) 1.25 2) 1.75 3) 1.5 4) 2.0

12. Decomposition of NH_3 on gold surface follows zero order kinetics . If rate constant K is $5\times10^{-3}M-s^{-1}$, rate of formation of N_2 will be

1) $10^{-3}M-s^{-1}$ 2) $2.5\times10^{-4}M-s^{-1}$

3) 280 K 4) Zero

13. $X\rightarrow Y,\frac{k_{1+10}}{k_t}=3$. If the rate constant at 300 k is '9Q' min^{-1}, at what temperature rate constant becomes '9Q' min^{-1}?

1) 47°C 2) 320°C 3) 280 K 4) $\sqrt{9x300}$K

14. At 300K rate constant for A $\rightarrow$ products at t = 50 min is 0.02 S^{-1}, then rate constant at t = 75 min & 310 k will be (in s^{-1})

1) $\frac{0.04}{25}$ 2) 0.04×25 3) 0.04 4) $\left(\frac{0.02}{25}\right)$

15. The rate constant of a first order reaction at 27°C is $10^{-3}min^{-1}$. The temperature coefficient of this reaction is 2. What is the rate constant (in min^{-1}) at 17°C for this reaction ?

1) 10^{-3} 2) 5×10^{-4} 3) 2×10^{-3} 4) 10^{-2}

Collision theory

16. The minimum energy required for molecules to enter into chemical reaction is called

1) Kinetic energy 2) Potential energy

3) Threshold energy 4) Activation energy

17. In the equilibrium reaction A + B $\Leftrightarrow$ C + D, the activation energy for the forward reaction is 25 kcals. $mole^{-1}$ and that of the backward reaction is 15 kcals. $mole^{-1}$. Which one of the following statements is correct ?

1) it is an exothermic process 2) it is an endothermic process

3) it is a reaction for which $\Delta H = 0$ 4) it is a sublimation process

Order, molecularity, Half life

18. Sucrose decomposes in acid solution into glucose and fructose according to the first order rate law, with $t_{1/2}$ = 3.00 hours. What fraction of sample of sucrose remains after 8 hours?

1) 1.158M 2) 0.518M 3) 0.158M 4) 3.182M

19. For an elementary reaction, $2A+B \rightarrow C+D$, the active mass of B is kept constant but that of A is tripled. The rate of reaction will

1) decrease by 3 times 2) increase by 9 times
3) increase by 3 times 4) decrease by 6 times

20. For a chemical reaction $Y_2 + 2Z \rightarrow$ Product, rate controlling step is $Y + 1/2\,Z \rightarrow Q$. If the concentration of Z is doubled, the rate of reaction will

1) Remain the same 2) Become four times
3) Become 1.414 times 4) Become double

21. In a reaction $A \rightarrow B$, when the concentration of reactant is made 8 times, the rate got doubled. The order of reaction is

1) 1/3 2) 1 3) 1/2 4) 2

22. The rate of reaction $A + 2B \rightarrow$ Products is given by $-\frac{d[A]}{dt} = k[A][B]^2$. If B is present in large excess, the order of reaction is

1) 3 2) 2 3) 1 4) zero

23. For the reaction $2A + B \rightarrow$ Products, it is found that doubling the concentration of both reactants increases the rate by a factor of 8. But doubling the concentration of B alone, only doubles the rate. What is the order of the reaction w.r.t to A ?

1) 2 2) 3 3) 0 4) 1

24. The increase in rate constant of a reaction is more when the temperature increases from

1) 290K - 300K 2) 300K - 310K
3) 310K - 320K 4) 320K - 330K

25. The initial rates for gaseous reaction? $A + 3B \rightarrow AB$, are given below

[AJ] (M)	[B] (M)	Rate (M sec^{-1})
0.1	0.1	0.002
0.2	0.1	0.002
0.3	0.2	0.008
0.4	0.3	0.018

order of reaction is

1) zero 2) three 3) one 4) two

26. Based on the following data for a reaction what is its order ($A \rightarrow$ products)

Conc.A	2M	0.2M	0.02M	0.00
Time in min.	0	10	20	$\propto$

1) 1st 2) 2nd 3) 3rd 4) zero

27.

[A] (M)	[B] (M)	Initial rate (Ms^{-1})
0.4	0.3	2×10^{-3}
0.8	0.3	0.8×10^{-2}
1.2	0.9	0.54×10^{-1}

From the above data the rate law for the equation A+B → products is equal to

1) K[A][B] 2) $K[A]^2[B]^2$ 3) $K[A]^2[B]$ 4) $K[A][B]^2$

28. If the initial concentration is reduced to 1/4 th of the initial value of a zero order reaction, the half lite of the reaction

1) remain constant 2) Becomes 1/4 th
3) becomes double 4) Becomes fourfold

29. If $\frac{dx}{dt} = k[H_3O^+]^n$ and rate become 100 times when pH changes form 2 to 1. Hence order of reactions is

1) 1 2) 2 3) 3 4) 0

30. The initial concentration of cane sugar in presence of an acid was reduced from 0.20 to 0.10M in 5 hours and to 0.05M in 10 hours, value of K ? (in hr^{-1})

1) 0.693 2) 1.386 3) 0.1386 4) 3.465

31. 50% completion of a first order reaction takes place in 16 minutes. Then fraction that would react in 32 minutes from the begining

1) 1/2 2) 1/4 3) 1/8 4) 3/4

32. The time needed for the completion of 2/3 of a 1st order reaction, when rate constant is 4.771×10^{-2} min^{-1} is

1) 23.03 min 2) 2.303 min 3) 6.93 min 4) 69.3 min

33. The rate constant of a first order reaction is 0.0693 $mini^{-1}$. What is the time (in minits) required for reducing an initial concentration of 20 mole.lit^{-1}, to 2.5 mole. lit^{-1}. ?

1) 40 2) 10 3) 20 4) 30

34. The half-life of a first order reaction : 100 seconds. What is the time required for 90% completion of the reaction ?

1) 100 sec. 2) 200 sec. 3) 333 sec. 4) 500 sec.

35. For the reaction $2N_20_5 \rightarrow 4NO_2+O_2$, rate & rate constant are 1.02×10^{-5} mol lit^{-1} sec^{-1} & 3.4×10^{-5} sec^{-1} respectively. Then the cone of N_2O_5 at that time will be

1) 3M 2) 4M 3) 1M 4) 1.5M

36. The half life periods of four reactions labelled by A.B.C & D are 30 sec, 4.8 min, 180 sec and 16 min, respectively. The fastest reactiot is

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

37. 3/4 th of first order reaction was completed in 32min, 15/16 the part will be completed in

1) 24 min 2) 64 min 3) 16 min 4) 32 min

38. Initial concentration of the reactant is 1.0M. The concentration becomes 0.9M. 0.8M and 0.7M in 2 hours, 4 hours and 6 hours respectively. Then the order of reaction is

1) 2 2) 1 3) zero 4) 3

39. Half-life periods for a reaction at initial concentration of 0.1M and 0.01 M are 5 and 50 minutes respectively. Then the order of reaction is

1) zero 2) 1 3) 2 4) 3

40. For a first order reaction $t_{0.75}$ is 138.6 sec. Its specific rate constant is (in s^{-1})

1) 10^{-2} 2) 10^{-4} 3) 10^{-5} 4) 10^{-6}

41. 20% first order reaction is completed in 50 minutes. Time required for the completion of 60% of the reaction is......min

1) 100 2) 150 3) 262 4) 205

42. In a first order reaction. 20% reaction is completed in 24 minutes. The percentage of reactant remaining after 48 nunutes is

1) 60 2) 64 3) 81 4) 80

43. A first order reaction is half-completed in 45 minutes. How long does it need for 99.9% of the reaction to be completed ?

1) 20 hours 2) 10 hours 3) $7\frac{1}{2}$ hours 4) 5 hours

44. For a first order reaction A → B, the reaction rate at reactant concentration of 0.01 M is found to be 2.0 x 10^{-5} mol L^{-1} s^{-1}. The half life period of the reaction is

1) 220s 2) 30 s 3) 374 s 4) 347 s.

45. 99% of a first order reaction was completed in 32 rain. When will 99.9% of the reaction complete ?

1) 50 min 2) 46 min 3) 49 min 4) 48 min

46. For a first order reaction with half-life of 150 seconds, the time taken for the concentration of the reactant to fall from M/10 to M/100 will be approximately

1) 1500 s 2) 500 s 3) 900 s 4) 600 s

47. A reaction which is of first order w.r.t reactant A, has a rate constant is 6 min^{-1}. If we start with [A| = 0.5 mol.L^{-1} when would |A] reach the value of 0.05 mol.L^{-1}.

1) 0.384 min 2) 15 min 3) 20 min 4) 3.84 min

48. 99% of a 1st order reaction completed in 2.303 minutes. What is the rate constant and half-life of the reaction

1) 2.303 and 0.3010 2) 2 and 0.3465

3) 2 and 0.693 4) 0.3010 and 0.693

49. In the case of a first order reaction, the ratio of the time required for 99.9% completion of the reaction to its half life is nearly

1) 1 2) 10 3) 20 4) 8

50. Out of 300g substance [decomposes as per l^{sl} order], how much will remain after 18 hr? ($t_{0.5}$= 3hr)

1) 4.6 gm 2) 5.6 gm 3) 9.2 gm 4) 6.4 gm

51. 75% of a first order process is completed in 30 min. The time required for 93.75% completion of same process (in hr) '?

1)1 2) 120 3) 2 4) 0.25

52. For a first order reaction at 27°C, the ratio of time required for 75% completion to 25% completion of reaction is ;

1) 3.0 2) 2.303 3) 4.8 4) 0.477

53. The half life period of a first order chemical of a reaction is 6.93 minutes. The time required for the completion of 99 % of the chemical reaction will be (log 2 = 0.301)

1) 23.03 minutes 2) 46.06 minutes

2) 460.6 minutes 4) 230.3 minutes

54. In a first order reaction, the concentration of the reactant. decreases from 0.8M to 0.4M in 15 minutes. Then, 0.1M becomes 0.025M in

1) 7.5 minutes 2) 15 minutes

3) 30 minutes 4) 60 minutes

KEY

1) 3	2) 2	3) 1	4) 3	5) 2	6) 3	7) 3	8) 2
9) 2	10) 3	11) 3	12) 3	13) 1	14) 3	15) 2	16) 3
17) 2	18) 3	19) 2	20) 3	21) 1	22) 3	23) 1	24) 1
25) 4	26) 1	27) 3	28) 2	29) 2	30) 3	31) 4	32) 1
33) 4	34) 3	35) 1	36) 1	37) 2	38) 3	39) 3	40) 1
41) 4	42) 2	43) 3	44) 4	45) 4	46) 2	47) 1	48) 2
49) 2	50) 1	51) 1	52) 3	53) 2	54) 3		

4. SURFACE CHEMISTRY

Synopsis:

1. A layer of thickness of about l00nm from the outer surface of substance is considered as surface.
2. The phenomenon by which the molecules of a substance are attracted and uniformly distributed into the bulk of another solid or liquid substance is called absorption.
3. Ink gets absorbed into the bulk of a piece of chalk. Water molecules are absorbed into anhydrous calcium chloride.
4. Absorption of hydrogen into the bulk of palladium is called occlusion.
5. The molecules present on the surface of a substance are of greater energy than the molecules present in the bulk of the substance.
6. The phenomenon of attracting and subsequently accumulating the molecules of a substance by a liquid or solid on its surface is called adsorption.
7. The surface molecules show greater tendency to attract the molecules of other substances and allow them to settle on its surface overcome unbalanced forces .
8. The substance getting adsorbed on the surface of other substance is called adsorbate. Adsorbate can be solid or liquid or gas
9. The substance providing its surface for the phenomenon of adsorption is called adsorbent. Adsorbent can be solid or liquid but not gas
10. Important adsorbents are activated charcoal, silica gel, alumina gel, clay, colloidal particles.
11. During adsorption there is a decrease in the forces on the surface as a result heat is liberated.
12. AH is negative and Δ S is negative for the adsorption process.
13. The process of removal of impurities from the surface of the catalyst in called activation.
14. Charcoal is activated by heating it at 573K – 1273K in vaccum (or) in presence of inert gas.
15. Concentration of a substance on the surface and in the bulk of another substance is known as sorption.
16. The phenomenon by which the adsorbed substance leaves the surface of the adsorbent is called desorption.
17. The adsorption that occurs due to weak. Van der waal forces between adsorbate and adsorbent is called physical adsorption or physisorption.
18. The adsorption that occurs due to chemical bonding between adsorbent and adsorbate is called chemisorption. Chemisorption involve high energy of activation. Therefore it is referred to as activated adsorption.
19. Adsorption is spontaneous and during adsorption AS becomes negative. Hence to make AG negative, AH must be negative.

20. Easily liquifiable gases like HCl, CO_2 , NH_3 and SO_2 with higher critical temperature can be more easily adsorbed than gases like H_2, N_2, O_2 etc which have lower critical temperature.

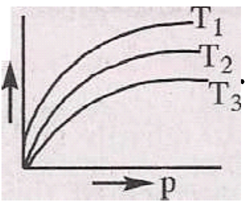
21. One gram of activated charcoal can adsorb 400 ml of SO_2, 20ml of CH_4 and 5ml of H_2 because T_c values are in the order : $SO_2 > CH_4 > H_2$

22. Greater the specific area of adsorbent greater will be its capacity to adsorb the molecules of adsorbate.

23. The graphs drawn by taking "$x/_m$" on y -axis and 'pressure' on x - axis at constant temperature are called adsorption isotherms.

24. Freundlich adsorption Isotherm is given by : $\frac{k}{m} \cdot$ K. essure only) (n >1) m

25. Freundlich adsorption Isotherm gives a graph as



$T_1 \cdot T_2 \cdot T_3$

26. The logarithmic expression of Freundlich adsorption isotherm is $\log\frac{x}{m} \cdot \log K \cdot \frac{1}{n}\log P$.

27. The factor '1/n' can have values between 0 to 1. Thus the equation holds good over a limited range of pressure.

28. At high pressure, *x/m* = constant. Adsorption is independent of pressure. At low pressure, *x/m* = K.P. Adsorption varies directly with pressure.

29. Freundlich adsorption isotherms cannot explain adsorption at high pressures.

30. Physical adsorption is generally favourable at low temperature.

31. In case of chemisorption high temperature supports adsorptions to certain extent.

32. In some cases at low temperature, adsorption is physical and at high temperature it is chemical.

33. At 463K N_2 is physically adsorbed on Fe, where as at 723K it is adsorbed chemically.

34. The variation of magnitude of adsorption with temperature (t) for both the physical and the chemical adsorption is shown below. They are called adsorption isobars.

35. The solute present in a solution may be adsorbed on the surface of a suitable adsorbent. Activated charcoal can adsorb coloured substance (dye stuff) from cane sugar juice and CH_3COOH from its solution

36. Freshly precipitated metal hydroxide can adsorb dye stuffs.

37. A catalyst is a substance that increases the rate of a chemical reaction to which it is added, without itself being consumed in the reaction.

38. The substance which destroys or reduces the activity of the catalyst is known as catalytic poison. The phenomenon is called catalytic poisoning.

39. As_2O_3 acts as a poison for platinum in the Contact process of manufacture of H_2SO_4. H_2S acts as a poison for Fe catalyst in Haber's process. Platinum is poisoned by CO in the oxidation reaction of $H_2$to H_2O

40. A substance which promotes the activity of the catalyst, to which it is added in small amounts is called a promoter or activator. The process is known as activation.

41. Molybdenum (Mo) is promoter to the catalyst iron in the Haber process.

42. The presence of a foreign substance which retards the rate of a reaction is called a negative catalyst or inhibitor. The pheno-menon is negative catalysis.

43.. In a homogeneous catalysis, the catalyst and the reactants are in the same phase. It is not possible in solid state.

44. Iu heterogeneous catalysis, the catalyst is in a different phase from that of the reactants.

45. The action of a catalyst is explained by two different theories: Intermediate compound formation theory and the adsorption theory.

46. A positive catalyst lowers the activation energy of the reaction by providing a new path way.

47. Wlien one of the intermediates formed in a reaction itself acts as a catalyst for the reactiomfhe catalysis is called autocatalysis.

48. Mn^{2+} in the oxidation of oxalic acid by acidified $KMnO_4$ and As in the decomposition of arsene are examples.

49. The nature of catalyst to speed up a reaction is called activity. The nature of a catalyst to lead the reaction towards a specific product. is called selectivity

50. Enzymes are complex nitrogeneous organic compounds produced by living plants and animals 6) enzymes function effectively at optimum temperature of 298-310 K and in between P^H value 5-7.

51. Activity of enzyme can be increased in presence of co-enzymes and activators

52. Enzyme catalysed reaction proceed in two
steps $E + S \rightarrow ES$ and $ES \rightarrow E + P$

53. Colloidal solution is a heterogeneous solution with size of solute particle in the range of one millimicron to a micron.

54. Colloidal solution contains two phase. Particles of disperse phase are distributed in continuous disparsion medium.

55. Smoke is a colloidal solution of solid in gas sol. It is an aerosol. It is a lyophobic colloid. Carbon particles are dispersed in air. Air (gas) is die dispersion medium.

56. Cloud is a colloidal solution of liquid gas sol.] It is an aerosol. It is a lyophobic colloid. It is a colloidal suspension of droplets of water (liquid) in air. Air (gas) is the ispersion medium.

57. Blood is a colloidal solution of solid in liquid. It is an aquasol or hydrosol. It is a colloidal suspension of albuminoid substances in water. Water containing some inorganic ions and organic molecules is the dispersion medium.

58. Impure blood is purified by kidneys through dialysis. Addition of $FeCl_3$ (or) alum to bleeding wound, causes coagulation of blood to form a clot.

59. Milk is liquid in a liquid colloidal solution. Droplets of liquid fat are dispersed in water. Milk is quite stable. Milk on coagulation gives emulsified fat (casein).

60. Starch solution is a solid in liquid sol. It is hydrophilic colloid. Starch sol is prepared by adding starch paste to hot water with constant stirring.

61. Gold sol is solid in liquid sol. It is an aquasol or hydrosol. It is lyophobic sol. It is a colloidal solution of gold particles (solid) in water. It is prepared by Bredig arc method. Gold sol is stabilised by the presence of an alkali.

62. Lyophobic solcan be protected from coagulation by an added electrolyte or by adding a lyophilic colloid to the lyophobic sol solution. This lyophilic sol added is called protective colloid.

63. Gold number is Introduced by Zsigmondy. Gold number is inverese to the efficiency of protective act!on.Gelatin is the most efficient protective colloid and starch is least.

64. Scattering of light on colloidal particles is called as Tyndal effect.

65. Conditions to exhibit tyndall effect are diameter of dispersed particles is not much smaller than 'λ' of wave length of light rays and refractive indices of dispersed phase and dispersion medium should differ greatly in magnitude.

66. Tyndal effect can be used to distinguish between a colloidal and true solution.

67. When we observe a colloidal solution under an ultramicroscope we can find that the particles keep on moving with zig - zag motion. This is called Brownian movement. It is a kinetic property.

68. If electrolyte is added to the colloidal solution, the charge on the colloidal particles is neutralised. Hie uncharged colloidal particles coagulated form bigger particles. These bigger particles settle down as precipitate. This phenomenon is known as coagulation.

69. Examples for positively charged sols are : Hydrated metallic oxides like $Al_2O_3 . xH_2O$, Fe_2O_3 , x H_2O. Basic dye stuffs, methylene blue sol. Haemoglobin and Oxides like TiO_2 sol.

70. Examples for negatively charged sols are : Metal sols like, Cu. Ag, Au Sb, As_2S_3 Sb_2S_3, CdS sol and acidic dye stuff congo red, starch, gelatin, clay sols.

71. Hardy - Schulze laws : The ion with charge opposite to the charge of the colloidal particle js very effective. Greater the charge of the ion greater is the ability for coagulation.

72. Positive colloids are coagulated by negative ions and decreasing order of effect vieness is $[Fe(CN)_6]^{4-} > PO_4^{3-} > SO_4^{2-} > Cl^-$

73. Negative colloids are coagulated by positive ions.The decreasing order of effectiveness is $Al^{3+} > Ba^{2+} > K^+$.

74. The minimum concentration in milli moles/ litre of an electrolyte required for complete coagulation of a sol in two hours is called the coagulation value or precipitation value of that electrolyte.

75. Coagulation of lyophilic sol is done, by adding an electrolyte or by adding a suitable solvent.

76. When solvents like alcohol and acetone ar added to hydrophilic sols, dehydration of dispersed phase takes place which facilitate coagulation.

77. An emulsion is a colloidal system in which both the dispersed phase and the dispersion medium are liquids.

78. Emulsions are classified into two classes : Oil in water (O/W) emulsion and water in oil (W/O) emulsion.

79. The emulsifying agent is usually a soap or a sulphate detergent (or) a hydrophilic colloid (like gelatin, egg albumin, carbon powder or graphite powder.

80. Soap emulsifies kerosene in water emulsion. Egg albumin emulsifies an olive oil in water emulsion. Solid mercuric iodide emulsifies water in benzene emulsion. Caesin emulsifies oil in water (milk) emulsion.

81. Emulsions are used in washing process of clothes and crockery, in the digestion of fats in intestines, in metallurgy, as lotions, creams and ointments in pharmaceuticals and cosmetics, as drugs of oily type in the form of emulsions to facilitate their easy absorption.

82. Freezing, boiling, centrifugation or addition of chemicals make the emulsion separate into the constituent liquids. This is called deemulsification. Churning of curd is an example.

83. Emulsions are used in the conversion of cream into butter by churning. This is breaking of emulsion of fats in water. In natural oil wells, oils and water form emulsions which requires separation of oil from water.

Question Bank - I

1) The process of removal of an adsorbed substance from the surface on which it is adsorbed is called as

1) sorption 2) adsorption 3) desorption 4) accumulation

2) In adsortion of oxalic acid to activated charcoal, the activated charcoal is called

1) adsorbent 2) adsorbate 3) adsorber 4) absorber

3) If a poisonous gas is adsorbed on activated charcoal. Then that gas is termed as

1) absorber 2) adsorbate 3) adsorbent 4) absorbs

4) The bond between the adsorbate and absorbent in chemisorption is

1) ionic bond 2) covalent bond

3) either ionic or covalent bond 4) all of these

5) On increase of temperature, physical adsorption

1) decreases 2) increases

3) neither decrease nor increase 4) first increase and then decreases

6) Physical adsorption changes to chemisorption at

1) high temperature 2) low temperature

3) low pressure 4) moderate temperature

7) The rate of chemisorption
decreases with decrease of temperature
increase with increase of pressure
is independent of pressure
is independent of temperature

8) The Tyndall effect is not observed in
1) emulsions 2) lyophobic sols 3) true solution 4) starch solution

9) The colloidal system in which the dispersed phase and dispersion medium are both liquids is known as
1) a gel2) an aerosol 3) an emulsion 4) a foam

10) Blood is a colloidal solution of water containing
1) liquid fat as dispersed phase 2) albuminoid as dispersed phase
3) butter as disperssed phase 4) proteins as dispersed phase

11) Micelles contain
1) Discrete particles 2) Discrete ions
3) Aggregate of particles 4) Associated water molecules

12) The emulsifier for olive oil in water emulsion is
1) soap2) egg albumin 3) mercuric iodide 4) kerosene

13) A substance which altes the rate of reaction is known as
1) promoter 2) catalyst 3) activator 4) initiator

14) In contact process of manufacture of H_2SO_4, the substance which acts as catalytic poison
1) Fe_2O_3 2) As_2O_3 3) CO_2 4) H_2S

15) A catalytic poison
1) increases the rate of reaction
2) increases the amount of the catalyst
3) decreases the energy of activation of the catalytic reaction
4) decreases the catalytic activity of the catalyst

16) Activated charcoal readily absorbs
1) H_2 2) CO_2 3) Cl_2 4) N_2

17) Amount of gas adsorbed per gram of adsorbent increases with pressure but after certain limit is reached, adsorption becomes constant. It is when
1) multi layers are formed 2) desorption takes place
3) temperature is increased 4) adsorption also starts

18) Weak tyndall effect can be observed with
1) Gold sol 2) Super sol 3) Smoke 4) Starch sol

19) Which of the following is not a colloidal solution
1) smoke 2) ink 3) air 4) blood

20) A dispersion of ferric hydroxide in water is
1) a hydrophilic colloid 2) an emulsion
3) a hydrophobic colloid 4) a reversible colloid

21) Gold sol is
1) aerosol 2) aquasol 3) lyophilic sol 4) emulsion

22) The catalyst used in the dehydration of ethylalcohol to ethene is
1) Al_2O_3 2) Sb_2O_3 3) As_2O_3 4) Cu

23) The efficiency of a catalyst depends on

1) solubility 2) size of the particle

3) molecular weight 4) all of these

24) Which of the following is not correct?

1) Physical adsorption decreases in the increase in temperature
2) Physical adsorption is multi layered
3) Activaties energy of physical adsorption is very high
4) enthalpy change of physical adsorption is about 20Kj mol^{-1}

25) Which of the following is a lyophobic solution?

1) aqueous starch solution 2) aqueous protein solution

3) gold sol 4) polymer solutions in some organic solvents

26) In the hydrogenation of oils, the catalyst used is

1) Iron 2) Platinum 3) Nickel 4) Moyebdenum

27) When a colloidal solution is observed under an ultra microscope, we can see

1) light scattered by colloidal particles
2) size of colloidal particles
3) shape of the colloidal particles
4) relative size of the colloidal particles

28) An inhibitor is essentially

1) a negative catalyst 2) an auto catalyst

3) a homogeneous catalyst 4) a heterogeneous catalyst

29) In colloidal state particle size ranges from

1) 1-100A^0 2) 20-50A^0 3) 10-1000A^0 4) 1-280A^0

30) A colloidal system in which solid is dispersed in a liquid is called

1) precipitate 2) sol 3) emulsion 4) gel

31) Cow milk is an example of natural emulsion stabilized by

1) fat 2) water 3) casein 4) Mg^{++} ions

32) On the surface of metallic iron at 500^0C, Nitrogen is

1) Chemically adsorbed 2) Physically adsorbed

3) Absorbed 4) Desorbed

33) Jelly is a colloid in which

1) A solid dispersed in liquid 2) A liquid dispersed in liquid

3) A gas is dispersed in liquid4) A liquid is dispersed in solid

34) The size of particle of dispersed phase in colloidal solution is

1) 1 to 10A^0 2) 20-50A^0 3) 10-100A^0 4) 200-500A^0

35) Adsorption is the phenomenon in which a substance

1) accumulates on the surface of other substance
2) goes into the body of the other substance
3) remains close to the other substance
4) does not accumulates on the surface of the other substance

36) Sorption is
1) adsorption 2) adsortion
3) chemisorption 4) adsortion followed by adsorption

37) Charcoal is activated
1) by heating it from 623^0C to 127^0C in vacuum
2) by cooling it to 23K in vacuum
3) by heating it from 573K to 1273K in vacuum
4) by heating upto 300K.

38) The temperature above which a gas can not be liquefied even on application of high pressure is called
1) boiling point 2) freezing point
3) critical temperature 4) Boyle's temperature

39) Which gas can be adsorbed more?
1) gas with high critical temperature 2) gas with low critical temperature
3) gas which can be liquefied easily 4) both 1and 3

40) Which of the following is a clear solution
1) colloid 2) true solution
3) suspension 4) suspensions of precipitate

41) The tyndall effect in colloidal solutions is due
1) scattering of light 2) reflection of light
3) adsorption of light 4) electrically charge of particles

42) Assertion: A reaction cannot become fast by it self unless a catalyst is added.
Reason: A catalyst always increases the speed of a reaction
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

43) Assertion: Adsorption is a surface phenomenon
Reason: Adsorption is an exothermic process
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

44) Assertion: Soap and detergent are macro molecular colloids
Reason: Soap and detergent are molecules of large size
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

45)

List-I	**List-II**
A) Liquid gas	1) Milk
B) Solid in gas	2) Boot polish
C) Liquid in liquid	3) Smoke
D) Solid in liquid	4) Cloud
	5) Gold sol

The correct match is

	A	B	C	D		A	B	C	D
1)	4	3	1	2	2)	2	1	5	4
3)	4	3	2	5	4)	1	4	3	2

46) Assertion: Small quantity of soap is used to prepare a stable emulsion.
Reason: Soap lowers the interfacial tension between oil and water.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

47) Assertion: Heat of physical adsorption is low while that of chemical adsorption is high.
Reason: Physical adsorption is weak while chemical adsorption is strong.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

48) Assertion: Colloidal solutions are stable but the colloidal particles do not settle down.
Reason: Colloidal sols are homogeneous.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

49) The disperse phase, dispersion medium and nature of colloidal solution. lyophillic (or) lyophosic of gold sol respectively are
1) Solid, solid, lyophobic 2) Liquid, liquid, lyophobic
3) Solid, liquid, lyophobic 4) Solid, liquid, lyophilic

50) Which of the following is not correct?
1) Enthalpy of physical adsorption is less compared to enthalpy of chemical adsorption.
2) Milk is an example of emulsion.
3) Physical adsorption increases with increase of temperature
4) Smoke is a aerosol

KEY

1. 3	2.1	3.2	4.3	5.1	6.1	7.1	8.4	9.3	10.2
11.3	12.2	13.2	14.2	15.4	16.2	17.1	18.4	19.3	20.3
21.2	22.1	23.2	24.3	25.3	26.3	27.1	28.2	29.3	30.2
31.3	32.1	33.4	34.3	35.1	36.4	37.3	38.3	39.4	40.2
41.1	42. 4	43.2	44.4	45. 1	46. 1	47. 1	48.3	49.3	50.3

Question Bank - II

1. Gold number is associated with
   (1) electrophoresis (2) pruple of cassius
   (3) protective colloids (4) amount of pure gold
2. Gold number is used to show
   (1) protective power of lyophilic colloids (2) protective power of lyophobic colloid
   (3) preptisation power of a colloid (4) precipitation power of a colloid
3. The cause of Brownian movement is
   (1) heat changes in liquid
   (2) conventional currents
   (3) impact of molecules of the dispersion medium of colloidal particles
   (4) attractive forces between colloidal particles and molecules of dispersion medium.
4. In Brownian movement, the path followed by particles is
   (1) Linear (2) Zig-Zig (3) Uncertain (4) curved
5. Gelatin protects
   (1) gold sol (2) AS_2S_3Sol (3) $Fe(OH)_3Sol$ (4) All

KEY

1) **3** 2) **1** 3) **3** 4) **2** 5) **4**

Question Bank - III

1. In an adsorption experiment a graph between log x/m vs. log p is round to be linear with a slope of 45°. The intercept on the log x/m axis was found to be 0.3010. What is x/m if pressure is 0.6 bar (tan 45° = 1)
   1) 0.6 2) 1.2 3) 2.4 4) 0.3
2. Which are of the following is a case of adsorption ?
   1) Anhydrous $CaCl_2$ in contact with water vapour
   2) Silica gel in contact with water vapours
   3) Ammonia gas in contact with water
   4) Cotton clothes dipped in a dye solution
3. The volumes of gases H_2,CH_4, CO_2 and NH_3 adsorbed by Igr of charcoal at 288K are in the order
   ` 1) $H_2 > CH_4 > CO_2 > NH_3$
   2) $CO_2 > NH_3 > H_2 > CH_4$
   3) $NH_3 > CO_2 > CH_4 > H_2$
   4) $CH_4 > CO_2 > NH_3 > H_2$

4. Which one of the following is not an application of adsorption ?

1) Ion exchange process in softening of hard water

2) Chromotographic analysis

3) Clarification of sugar

4) Theory of homogeneous catalysis

5. Which of the following is less than zero during adsorption?

2) ΔG 2) ΔS 3) ΔH 4) All the above

6. Arsenic (III) sulphide forms a sol with a negative charge which of the following ionic substances should be most effective in coagulating the sol

1) KC1 2) $MgCl_2$ 3) $Al_2(SO_4)_3$ 4) Na_2PO_4

7. A negatively charged suspension of clay in water needs for precipitation the minimum amount of

1) $AlCl_3$ 2) K_2SO_4 3) NaOH 4) HC1

8. A colloidal sol of $Fe(OH)_3$ in water is

1) A hydrophilic colloid 2) A hydrophobic colloid

3) An emulsion 4) Not a colloid

9. Ultra microscope works on the principle of

1) Light reflection 2) Light absorption

3) Light scattering 4) Light polarization

10. Ferric chloride on rubbing to a bleeding wound causes

1) coagulation 2) peptisation

3) emulsification 4) de-emulsification

11. Hardy - Schulz rules are based on of electrolyte ions coagulating the colloid

1) Size 2) Charge 3) Magnetic nature 4) Molar mass

12. Which of the following is a kinetic property of sols?

1) Electrophoresis 2) Brownian movement

3) Tyndal effect 4) Peptisation

13. Brownian movement is mainly is due to

1) Attraction between dispersion medium and dispersed phase particles

2) Unbalanced impact of the dispersion medium on colloidal particles

3) Scattering of light on sol particles

4) Repulsion of colloidal particles by protective colloids

14. When an electrolyte is added to a colloidal sol it

1) Gets coagulated 2) Is ionised 3) Becomes stable 4) Gets purified

15. The coagulation power of an effective ion carrying the charge opposite to the sol particles has been illustrated by

1) Brownian movement 2) Gold number

3) Tyndal effect 4) Hardy-Schulz rule

16. Which electrolyte is least effective in causing coagulation of +ve ferric hydroxide sol?

1) KBr 2) K_2SO_4 3) K_2CrO_4 4) $K_3[Fe(CN)_6]$

17. The capacity of an ion to coagulate a colloidal sol depends on

1) Its shape 2) Magnitude of its charge

3) The sign of charge 4) Both magnitude and sign of the charge

18. Lyophilic sols are more stable than lyophobic sols because

1) The colloidal particles have positive charge

2) The colloidal particles have negative charge

3) The colloidal particles are solvated

4) There are strong electrostatic repulsions between the negativley charged colloidal particles

19. A liquid is found to scatter a beam of light but leaves no residude when passed through the filter paper. The liquid can be described as

1) A suspension 2) Oil 3) A colloidal sol 4) True solution

20. Cellulose dispersed in ethanol is called

1) emulsion 2) micelle 3) collodion 4) hydrophilic sol

21. At CMC the surfactant molecules

1) decomposes 2) becomes completely soluble

3) associates 4) dissociates

22. Alum helps in purifying water by

1) forming Si complex with clay particles

2) sulphate part which combines with dirt and removes it

3) aluminium which coagulates the mud particle

4) making mud water soluble.

23. On addition of 1ml solution of 10% NaCl to 10ml gold sol in the presence of 0.0250gm of starch, the coagulation is just prevented Starch has the following gold number

1) 0.025 2) 0.25 3) 2.5 4) 25

24. Gelatin protects

1) Gold sol 2) As_2S_3 sol 3) $Fe(OH)_3$ 4) All the above

25. The coagulation of colloidal particles of the sol can be caused by

1) Heating 2) Adding oppositly charged sol

3) Adding electrolyte 4) All the above

26. Gelatin is used as an ingredient in the manu facture of ice creame for

1) Causing the mixture to solidly 2) Improving the flavour

3) Stabilising the colloidal solution and preventing the crystal growth

4) preventing formation of colloid

27. Gold number is minimum in case of

1) Egg albumin 2) Gelatin

3) Heamoglobin 4) Starch

28. Gold number of a lyophilic solution is such property that

1) The larger its value, the greater is the peptising power
2) The lower its value, the greater is the peptising power
3) The lower its value, the greater is the protecting power
4) The lower its value, the greater is the protecting power

29. In the coagulation of a positive sol, floccula-tion powers of Cl^-, SO_4^{-2} and PO_4^{-3} are in the order

1) $Cl^- > S0_4^{-2} > PO_4^{-3}$ 2) $Cl^- > PO_4^{-3} > SO_4^{-2}$
3) $PO_4^{-3} > SO_4^{-2} > Cl^-$ 4) $PO_4^{-3} > Cl^- > SO_4^{-2}$

30. A colloidal solution is subjected to an electrical field. The particles move towards anode. The coagulation of same sol is studied using NaCl, $BaCl_2$ and $A1C_3$ solutions. Their coasgulating power should be

1) $NaCl > BaCl_2 > A1C1_3$ 2) $BaCl_2 > A1C1_3 > NaCl$
3) $AlCl_3 > BaCl_2 > NaCl$ 4) $BaCl_2 > NaCl > A1C1_3$

31. Which is used for ending charge on colloidal solution

1) Electrons 2) Electrolytes 3) The Charged ions 4) Compounds

32. The coagulating power of an electrolyte for arsenious sulphide decreases in the order

1) Na+ > Al^{3+} > Ba^{2+} 2) $PO_4^{3-} > SO_4^{2-} > Cl^-$
3) $Cl^- > SO_4^{2-} > PO_4^{3-}$ 4) $Al^{3+} > Be^{2+} > Na^+$

33. Which of the following forms cationic micellus

1) Sod - stearate 2) Urea
3) Cetyl trimethyl ammonium bromide
4) Sod. dodecyl sulphate

34. “Lock-keyrlt theory is for

1) homogeneous catalysis 2) heterogenous catalysis
3) enzyme action 4) none of these

35. Which of the following is correct about lyophillic sol ?

1) They are irreversible
2) They are formed by inorganic susbstances
3) They are readily co-ogulated by addition of electrolytes.
4) They are self stablised.

36. The dispersed phase in colloidal iron (iii) hydroxide and colloidal gold positively and negatively charged respectively which of the following statement is not correct

1) $MgCl_2$ soltuion can coagulate the gold sol more readily than the iron (III) hydroxide sol
2) Na_2SO_4 causes coagulation in both sols.
3) Mixing the two sols has no effect
4) Coagulation of both the sols can be brought about by electrophresis

37. The Magnetic moment of Autocatalyst formed in the reaction between Acidified oxalic acid and potassiumpermanganate

1) 5.9 B.M 2) 4.9 B.M 3) 3.9 B.M 4) 2.8 B.M

38. Colloidal sols are not purified by

1) Dialysis 2) Electro dialysis 3) Electrophoresis 4) Ultra filtration

39. The zeolites have shape selectivity depending on

1) Atomic structure 2) Pore structure 3) Molecular structure 4) None

40. Which of the following is an example of zeolite

1) $MgCl_2$ 2) $Ca(OH)_2$ 3) ZSM - 5 4) CAN

41. The process of removing dissolved impurities from a colloidal system, by means of diffusion through suitable membrane under the influence of an electric field is called

1) Electro osmosis 2) Electrophoresis
3) Electrodialysis 4) Peptisation

42. Peptization denotes

1) Digestion of food 2) Hydrolysis of proteins
3) Breaking and dispersion into the colloidal state
4) Precipitation of solid from colloidal dispersion

43. The migration of colloidal solute particles in a colloidal solution, when an electric current is applied to the solution is known as

1) Brownian movement 2) Electro osmosis
3) Electrophoresis 4) Electrodialysis

44. Sols of metals like Cu, Ag, Au are prepared by

1) Peptisation 2) Oxidation
3) Bredig's arc method 4) Mechanical grinding

45. Blue colour of sky is due to

1) Scattering of blue light by dust particles
2) Scattering of blue light by water
3) scattering of blue light by dust particles and water
4) None of the above

KEY

1) 2	2) 2	3) 3	4) 4	5) 4	6) 3	7) 1	8) 2
9) 3	10) 1	11) 2	12) 2	13) 2	14) 1	15) 4	16) 1
17) 4	18) 3	19) 3	20) 3	21) 3	22) 3	23) 4	24) 4
25) 4	26) 3	27) 2	28) 3	29) 3	30) 3	31) 2	32) 4
33) 3	34) 3	35) 4	36) 3	37) 1	38) 3	39) 2	40) 3
41) 3	42) 3	43) 3	44) 3	45) 3			

5. GENERAL PRINCIPLES OF METTALURGY

Synopsis:

1. Elements like carbon, sulphur, iron, copper, silver, gold, platinum, palladium and nobel gases can occur in free state.
2. Gold and Platinum are called noble metals. Most of the reactive elements occure in combind state.
3. A1 and Fe are the first and second most abundant metals in earth crust.
4. The compound of a metal occuring in nature is called a mineral.
5. The mineral from which a metal can be extracted econimically and conveniently is called ore.
6. All ores are minerals but all minerals are not ores. Among all minarels of Al, bauxite is the ore of Al. For Iron, haematite (Fe_2O_3) is considered as ore instead of iron pyrites.
7. Suitablity of a mineral for extraction of metal depends on : Percentage of metal in the ore. Nature and magnitude of impurities in the mineral. The expenditure involved in the extraction. The industrial utility of the by products in the extraction.
8. Extraction of metals from ores involves there major steps : Concentration of ore, isolation of metal from its concentrated ore and refining of crude metal.
9. External substance added to the ore to lower its melting point is known as flux.
10. Flux combines with the gangue impurities in the ore) chemically and forms easily fusible products, called slag.
11. Acidic flux like SiO_2, P_2O_5 is used to remove basic impurities like FeO, CaO etc. Basic flux like CaO, $CaC0_3$, $MgCO_3$ are used to remove acidic impurities like SiO_2.
12. Partial purification of ore by removing the gangue from the ore is called ore concentration.
13. Methods of ore concentration are : Hand picking, Gravity separation, Froth flotation, Electromagnetic method, Liquation and Leaching. Except leaching, remaining ore concentration methods are physical methods only.
14. Sand and small stones are removed in hand picking.
15. Hydraulic washing or gravity separation or levigation is used if the ore particle and gangue particles differ in denisty. Wilfley tables are specially made table for washing of ores.
16. Froth flotation method is used for concentration of sulphide ores, based on the difference in wetting properties of ore and gangue.

17. Magnetic separation is useful if the ore and gangue differ in their magnetic properties. Tinstone (cassiterite, SnO_2) a non magnetic ore, is separated from magnetic wolframite, $FeWO_4$.
18. Liquation is useful for such ores which contain easily fusible mineral particles and high melting gangue. This method is used with stibinite, an antimony mineral.
19. Leaching is useful if the gangue and ore particles differ in their solubilities in a specific substance. Silver and gold ores are purified by leaching with a dilute solution of NaCN.
20. Substances which can withstand at high temperature are called refractory materials. Examples are : SiO_2, MgO, Graphite, SiC, etc.
21. Reverboratory furnace, Muffle furnace, Electric furnace, Blast furnace, Open hearth furnace are used in industry.
22. Mixture of ore, fuel, reductant and flux introduced into the furnace is called charge.
23. The principle involved in reverboratory furnace is indirect heating. Heat efficiency of reverboratory furnace is less because hot waste gases leave the furnace through the chimney.
24. Reverboratory furnace used in the metallurgy of copper, steel and lead.
25. Blast furnace is made of wrough iron. It is mainly divided into 3 zones depending on the temperature attained; zone of combustion (bottom), zone of fusion (middle) and zone of reduction (upper part).
26. The process of heating ore just below its melting point in absence of air to remove volatile compounds in it is called calcination.
27. Carbonate and bicarbonate ores are subjected to calcination. During calcination, mass becomes porous, volatile impurities are removed and carbonate ores decompose to oxides
28. The process of heating ore alone or by mixing with some other substances just below its melting point in a current of air is called roasting. Generally sulphide ores are subjected to roasting.
29. Oxidizing roasting is used for sulphide ores. At high temperatures of roasting, the sulphides change to oxides.
30. Sulphatizing roasting takes place under controlled conditions. If sulphide ores are used, sulphates will be formed under these conditions.
31. In chloridizing roasting the sulphide mineral is converted into a chloride.
32. Both calcination and roasting are performed in a reverberatory furnace.
33. Smelting is the thermochemical reaction in which the ores are converted into the metals directly or a mixture of sulphides in the molten state.
34. Smelting is performed in blast furnace. Ore is heated with reducing agent and flux durig smelting

35. The commonly used reducing agents in metallurgy are : H_2, CO, water gas, coke, Al, Ca, etc.
36. When aluminium is used as reducing agent, the process is referred as Goldschmidt alumino thermic process. Since this reduction is highly exothermic, metals formed in the reaction are in molten state.
37. Metals like Fe, Cr, Mn are obtained by thermite process
38. Alkali metals and aluminium can be extracted by the electrolysis of their molten chlorides.
39. Purification of metals is called refining of crude metals.
40. Various methods used for refining of metals are : Liquation, poling, Cupellation, Electrolysis and Zone refining
41. Poling method is used when metal has metai oxide as impurities. Metals purified by poling are Cu, Sn.
42. Cupellation is used when the metal has easih oxidisable impurities. Metal purified by cupellation is Ag.
43. Distilation is very useful for the purification of metals with low boiling point like Zn, Cc and Hg.
44. Liquation method is based on difference in melting points of metal and its impurities. Sr and Pb can be purified by liquation.
45. Metals of highest purity can be obtained in large quantities by electrolysis method.
46. In electrolytic refining, anode is impure metai which is to be purified, cathode is pure metai and solution of the metal ions acts as electrolyte.
47. Zone refining method is based on the difference in solubility of impurities in molten and solic state of the metals. Ge, Si, B, Ga and In can be purified by this method.
48. Commercially most important ore of copper for its extraction is copper pyrites or chalcopyrite- ($CuFeS_2$).
49. Copper pyrites is purified or concentrated b; froth floatation process.
50. During roasting of copper pyrites a part of the sulphide ore is converted to oxide.
51. The roasted ore is subjected to smelting with *a* little coke and slilica in a blast furnace.
52. The gangue present in copper glance is main/ FeS. During smelting FeS is converted to FeO and then converted to slag ($FeSiO_3$) using SiC - as flux.
53. The molten mixture of cuprous sulphide and small amount of ferrous sulphide obtained a smelting is called as matte.
54. Matte is subjected to bessemerisation, to variety of copper obtained after bessemerisaticc of matte is called blister copper which is a 98% pure copper.
55. The blisters of blister copper are caused by- escape of SO, from molten metal

56. Copper is purified by poling and electrolysis. The electrolyte used in the electrolytic purification of Cu is $CuSO_4$ and dil. H_2SO_4.
57. The principal ore of zinc is zinc blende, which is chemically zinc sulphide.
58. Zinc blende ore is crushed to a fine powder in ball mills and partially concentrated in gravity separation process by using wilfley's table.
59. The partially concentrated ore is further concentrated by froth flotation process.
60. Roasting zinc blende gives zinc oxide.
61. If calamine ($ZnCO_3$) is the starting material, the ore is calcined to get zinc oxide.
62. In Belgian process ZnO is reduced by coke.
63. 98 % pure zinc metal is called spelter.
64. Crude zinc metal can be purified by distillation or electrolytic process.
65. Cast iron is prepared from haematite or magnetite.
66. Roasted ore, coke (free from sulphur) and lime stone are mixed in the weight ratio 8 :4:1. It is called charge and it is fed into the blast furnace.
67. Iron obtained in the blast furnace is pig iron. It is the most impure form of iron.
68. Cast iron is prepared by melting the pig iron and solidify in the moulds. Cast iron contains 3% of carbon.
69. Wrought iron is the purest form of iron containing about 0.2% of carbon. It is prepared by heating cast iron in a reverboratory furnace.
70. Steel contains a lower percentage of carbon and $_v$ other impurities than the pig iron, Pig iron contains carbon as Fe_3C.
71. Steel can be prepared by purification of pig iron by bessemer converter process and open-hearth furnace process.
72. Silver is extracted from argentite ore by Mac Arthur forest cyanide process.
73. Concentrated ore is agitated with a dilute solution of NaCN. Silver in the ore goes into solution in the form of soluble complex, sodium dicyanoargentate (I)
74. The soluble silver complex is treated with zinc dust, then silver get precipitated and is fused with KNO_3 to oxidise any zinc impurity.
75. The impure silver thus obtained is purified by electrolysis of a solution of $AgNO_3$ containing dil.HNO_3 using impure Ag as the anode and pure Ag as the cathode.
76. Alkali metals can not be extracted from aqueous solutions by displacement reactions, since they are highly electropositive metal compounds are thermally most stable.
77. In the extraction of "Na" metal by Down's process, $CaCl_2$ (or) KCl and KF are added to the electrolyte $NaCl$ to decrease the melting point.
78. In the Cashier's process, the cell is continuously heated to keep the electrolyte NaOH in fused state.
79. "Mg" can not be extracted from hydrated $MgCl_2$, because it hydrolyses to form MgO and $Mg(OH)Cl$.

80. Carnallite on strong heating loses 4 water molecules forming $MgCl_2.2H_2O$. This on heating in a current of dry HCl gas at 350°C gives anhydrous $MgCl_2$.

81. Anhydrous $MgCl_2$ is mixed with KCl (or) NaCl to prevent hydrolysis and to increase electrical conductivity of the electrolyte.

82. Magnesium is extracted by the electrolysis of fused anhydrous $MgCl_2$ or of fused MgO.

83. Mg metal can also be obtained by reducing MgO with Si or Fe-Si or CaC_2.

84. Sea water contains small quantities of $MgCl_2$ and $MgSO_4$. Sea water is treated with slaked lime to precipitate the dissolved salts as $Mg(OH)_2$. It is then converted to $MgCl_2$ or MgO and Mg is extracted.

85. Bauxite containing FeO and Fe_2O_3 impurities is known as red bauxite. It can be concentrated either by Bayer's process (or) by Hall's process.

86. Bauxite containing silica (SiO_2) impurity is known as white bauxite. It can be purified by Serpeck's process.

87. A1 metal can be extracted by the electrolysis of alumina by Hall-Heroult's process. Alumina is mixed with cryolite to increase the conductivity and a little amount of flourspar to reduce the fusion temperature of alumina.

88. A1 metal containing the impurities like Si, Cu, Mn etc., can be refined by Hoope's process to get 99.99% pure metal.

Thermodynamic Principles of Metallurgy

Some basic concepts of thermodynamics help understanding the theory of metallurgical transformations. Gibbs energy is the most significant factor. The change in Gibbs energy, (ΔG) for any process at any specified temperature, is described by the equation:

$$\Delta G = \Delta H - T\Delta S \qquad (1)$$

where, ΔH is the enthalpy change and ΔS is the entropy change for the process. For any reaction, this change ($\Delta G^{\ominus}$) could also be explained through the equation:

$$\Delta G^{\ominus} = - RT\ln K \qquad (2)$$

where, K is the equilibrium constant of the 'reactant - product' system at the temperature,T. A negative ΔG implies a +ve K in the equation 2. And this can happen only when reaction proceeds towards products. From these facts we can make the following conclusions:

1. The reaction proceeds forward if the value of ΔG is negative in equation 1, only then the reaction will proceed. If ΔS and ΔH are positive, on increasing the temperature (T), the value of $T\Delta S$ would increase greatly and then ΔG will become –ve ($\Delta H < T\Delta S$).

2. If two reactions are occuring together in a system and the net sum of ΔG of the two reactions is –ve, the overall reaction will occur. So the process involves coupling of the two reactions, getting the sum of their ΔG values and arriving at its magnitude and *sign*.

Such coupling is easily understood through Gibbs energy ($\Delta G^{\ominus}$) vs T plots for formation of the oxides (Fig.).

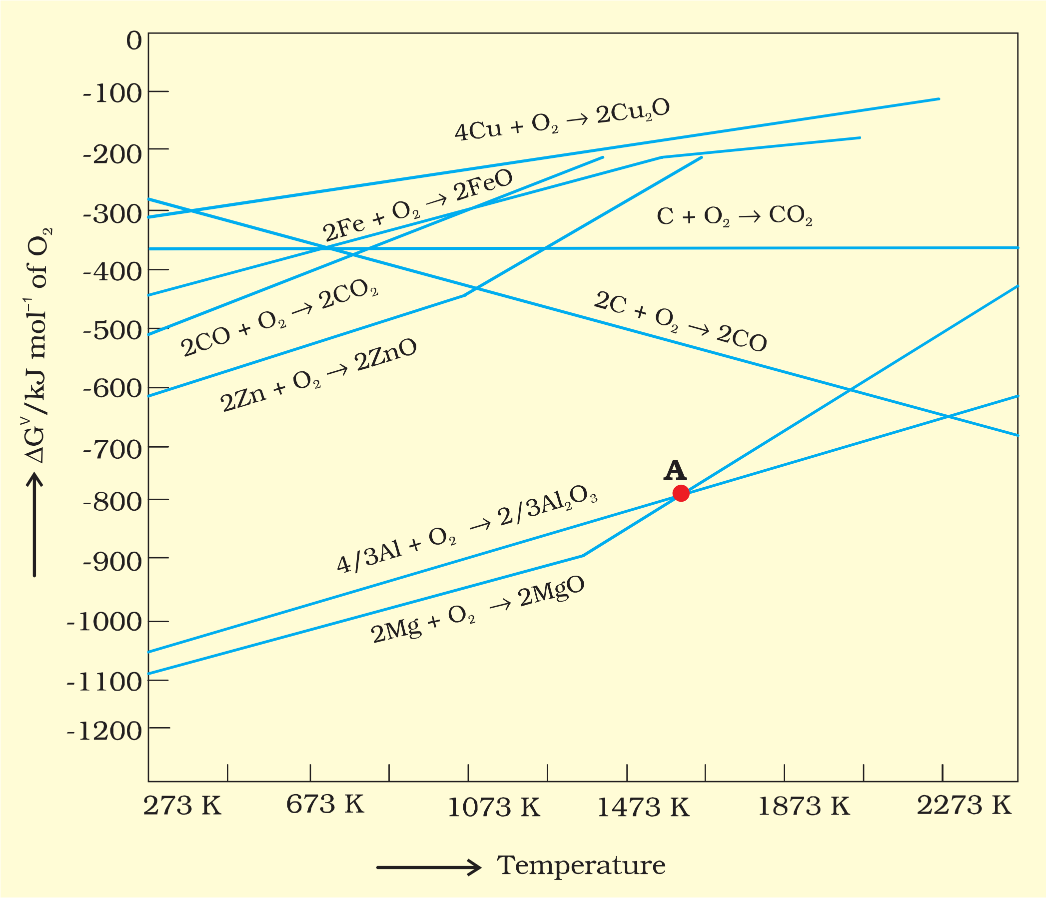


Fig. : *Gibbs energy ($\Delta G^{\ominus}$) vs T plots (schematic) for formation of some oxides (Ellingham diagram)*

The reducing agent forms its oxide when the metal oxide is reduced. The role of reducing agent is to make the sum of $\Delta G^{\ominus}$ values of the two reactions (oxidation of the reducing agent and reduction of the metal oxide) negative.

During reduction, the oxide of a metal decomposes first to give O_2 gas:

$M_xO(s) \rightarrow xM$ (solid or liq) $+ O_2$ (g) (3)

The reducing agent takes away the oxygen. The reaction of equation 5.3 can be visualised as reverse of the oxidation of the metal. And then, the $\Delta_f G^{\ominus}$ value is written in the usual way:

$xM(s \text{ or } l) + O_2(g) \rightarrow M_xO(s)$ $[\Delta G^{\ominus}(M, M_xO)]$ (4)

If reduction is being carried out through equation 3, the oxidation of the reducing agent (e.g., C or CO) will be there:

$C(s) + O_2(g) \rightarrow CO(g)$ $[\Delta G(C, CO)]$

$CO(g) + O_2(g) \rightarrow CO_2(g)$ $[\Delta G(CO, CO_2)]$

If carbon is taken, there may also be complete oxidation of the element to CO_2:

$C(s) + O_2(g) \rightarrow CO_2(g)$ $[\Delta G(C, CO_2)]$

On subtracting equation 5.4 [it means adding its negative or the reverse form as in equation 3] from each of the above three equations respectively, we get:

$M_xO(s) + C(s) \rightarrow xM(s \text{ or } l) + CO(g)$

$M_XO(s) + CO(g) \rightarrow xM(s \text{ or } l) + CO_2(g)$
$M_XO(s) + C(s) \rightarrow xM(s \text{ or } l) + CO_2(g)$

These reactions describe the actual reduction of the metal oxide, M_XO that we want to accomplish. The $\Delta_r G^\ominus$ values for these reactions in general, can be obtained by similar subtraction of the corresponding $\Delta_f G^\ominus$ values.

As we have seen, heating (i.e., increasing T) favours a negative value of $\Delta_r G^\ominus$. Therefore, the temperature is chosen such that the sum of $\Delta_r G^\ominus$ in the two combined redox process is negative. In $\Delta_r G^\ominus$ vsT plots, this is indicated by the point of intersection of the two curves (curve for M_XO and that for the oxidation of the reducing substance). After that point, the $\Delta_r G^\ominus$ value becomes more negative for the combined process including the reduction of M_XO. The difference in the two $\Delta_r G^\ominus$ values after that point determines whether reductions of the oxide of the upper line is feasible by the element represented by the lower line. If the difference is large, the reduction is easier.

Question Bank - I

1. Which is a hydrated oxide mineral.
   (1) Zincite (2) Cassiterite (3) bauxite (4) haematite
2. Hand picking method is used for the concentration of
   (1) Cassiterite (2) Haematite (3) Calamine (4) Gelone
3. Method used for concentration of tin stone is
   (1) Hand picking (2) Froth loatation (3) Magnetic separation (4) Leaching
4. The magnetic impurity present in Cassiterites.
   (1) Silice (2) Wolframite (3) SnO_2 (4) Clay
5. The process of heating on ore in the absence of air below in melting point is known as
   (1) calcination (2) roasting (3) smelting (4) poiling
6. Galene on heating in limited supply of air gives lead metal known as
   (1) smelting (2) calcination (3) self reduction (4) sulphating roasting
7. Copper matte is a mixture of
   (1) $Cu_2S + FeS(little)$ (2) $Cu_2S + FeO$ (3) $Cu_2O + FeO$ (4) $Cu_2o + FeS$
8. In blast furnace haematite is reduced to iron by
   (1) Coke (2) H_2 gas (3) Co gas (4) water gas
9. Metal refined by cupellation process is
   (1) Ag (2) Fe (3) Zn (4) Sn
10. A metal contains metal oxide as impurity. The method is used to refine is
    (1) Poiling (2) Liquation (3) Cupellation (4) Distillation
11. Formula of ruby copper is
    (1) Cu_2O (2) Cu_2S (3) $CuCo_3(OH)_2$ (4) $Cu\,FeS_2$
12. The belion process is used for extraction of
    (1) Cu (2) Ag (3) Zn (4) Fe

13. Spelter is impure form of

(1) Zn (2) Ag (3) Cu (4) Fe

14. The most impure form of iron is

(1) wrought iron (2) mild steel (3) hard steel (4) cast iron

15. Mac Arthur Forrest process is used for extraction of

(1) Cu (2) Ag (3) Fe (4) Zn

16. Cast iron contains phosphorus as impurity in bessemrisation of cast iron, the slag formed is

(1) $Fe\,Po_4$ (2) $Ca_3(Po_4)_2$- (3) $Mn\,Po_4$ (4) $Zn_3(Po_4)_2$

17. In the blast furnace the reaction that occur in the zone of heat adsorption is

(1) $Co_2 + C \rightarrow 2Co$ (2) $Fe_2O_3 + 3Co \rightarrow 2Se + 3Co_2$-

(3) $C + O_2 \rightarrow Co_2$ (4) $Feo + Sio_2 \rightarrow Fe\,SiO_3$

18. Which is a wrong statement.

(1) Wrought iron is fibrous due to the slag in it

(2) The loss of iron is due to $Fe\,Sio_3$ formation in Bessemer process-

(3) In blast furnace Fe_2O_3 is reduced to iron by coke

(4) In Bessemer process Co burns with blue flame at the mouth.

19. Parkes process is used to separate silver form

(1) Ag_2S (2) AgCl- (3) Argenti ferrous lead (4) Alluvial soil

20. 100% copper obtained from crude copper by

(1) An Arkel method (2) Liquation- (3) Electro refining (4) Poling

KEY

1)	**3**	2)	**2**	3)	**1**	4)	**2**	5)	**1**
6)	**1**	7)	**1**	8)	**1**	9)	**1**	10)	**1**
11)	**1**	12)	**3**	13)	**1**	14)	**4**	15)	**2**
16)	**2**	17)	**2**	18)	**3**	19)	**3**	20)	**2**

Question Bank - II

Occurance and general principles

1.

List - I (mineral)	List - II (type of mineral)
1) Zircon	a) Sulphate
2) Monite	b) Silicate
3) Pentlandite	c) Sulphide
4) Anglesite	d) Phosphate

Correct match is

	1	2	3	4		1	2	3	4
1)	b	d	c	a	2)	a	b	c	d
3)	b	c	d	a	4)	a	d	c	b

2. ‘X’ is substance which combines chemically with impurities associated with the ore to form easily fusible mass ‘Y’ Here X and Y are

1) Flux, slag   2) Slag, flux   3) Gangue, slag   4) Reductant. flux

3. In Goldsmith thermite process reductant is

1) Coke   2) Aluminium   3) Water gas   4) Carbonmonoxide

4. In which of the following proodućts are in the molten state

1) Calcination   2) Oxidizing roasting 3) Sulphatizing roasting 4) Smelting

5. Match the following

List - I	List - II
1) liquation	a) Volatile metals with non volatile impurity
2) Poling	b) Metal with its metal oxides as impurity
3) Cupellation	c) Metal with easily oxidisable impurities
4) Distillation	d) Metal and impurities differ in M.P.

	1	2	3	4		1	2	3	4
1)	a	b	c	d	2)	d	c	b	a
3)	d	b	c	a	4)	a	b	d	c

6. Various types of zone in the blast furnace are given in the list and reactions take place in the extraction of iron are given in list - II.

List -1	List - II
1) Zone of reduction	a) $C + O_2 \rightarrow CO_2$
2) Zone of heat absorption	b) $CO_2 + C \rightarrow 2CO$
3) Zone of fusion	c) $Fe_2O_3 + 2Fe \rightarrow 3CO_2$

	1	2	3		1	2	3		1	2	3		1	2	3
1)	a	b	c	2)	c	b	a	3)	b	c	a	4)	c	a	b

7.

List -I	List -II
A) vanArkel method	1) Manufacture of caustic soda
B) Solvay process	2) Purification of Titanium
C) Cupellation	3) Manufarure of Na_2CO_3
D) Poling	4) Purification of copper
	5) Refining of silver

The correct match is

	A	B	C	D		A	B	C	D
1)	2	1	3	4	2)	3	3	2	5
3)	2	3	5	4	4)	5	1	3	4

8.

List -I (Type of mineral.)	List - II
1) Oxide	a) Kaolinite
2) Carbonate	b) Calamine
3) Sulphide	c) Copper glance
4) Silicate	d) Cuprite

The correct match is

	1	2	3	4		1	2	3	4
1)	d	b	c	a	2)	b	d	a	c
3)	a	b	c	d	4)	b	a	c	d

9\.

List -I	Ust-II
1) Argentite	a) KCl
2) Horn silver	b) AgCl
3) Ruby silver	c) Ag_2S
4) Sylvine	d) $3Ag_2S.Sb_2S_3$

The correct match is

	1	2	3	4		1	2	3	4
1)	c	a	d	b	2)	d	b	c	a
3)	c	d	b	a	4)	d	c	b	a

10\. Match the following :

List - I	List - II
I. Cyanide process	a) Ultrapure Ge
II. Floatation proces	b) Pine oil
III. Electrolytic reduction	c) Extraction of Al
IV. Zone refining	d) Extraction of Au

1) I - (c), II - (a), III - (d), IV - (b) 2) I - (d), II - (b), III - (c), IV - (a)

3) I - (c), II - (b), III - (d), IV - (a) 4) I - (d), II - (a), III - (c), IV - (b)

15\. Which of the following is not a characteristic of open - hearth process

1) The quality of steel obtained is very high

2) Composition of steel can be controlled

3) A blast of air is used in the furnace

4) Iron scrap and lower grade pig iron can be used

16\. Formation of metallic copper from the sulphide ore in the normal thermo-metallurgical process essentially involves which one of the following reaction?

1) $\mathrm{CuS}+\frac{3}{2}\mathrm{O}_2 \longrightarrow \mathrm{CuO} \bullet \mathrm{SO}_2;\ \mathrm{CuS} \bullet \mathrm{C} \longrightarrow \mathrm{Cu} \bullet \mathrm{CO}$

2) $\mathrm{CuS}+\frac{3}{2}\mathrm{O}_2 \longrightarrow \mathrm{CuO} \bullet \mathrm{SO}_2;\ 2\mathrm{CuO} \bullet \mathrm{CuS} \longrightarrow 3\mathrm{Cu} \bullet \mathrm{SO}_2$

17\. Which of the following reagent is used to seperate the impurity from red bauxite

1) Conc. HCl 2) H_2SO_4 3) NaOH 4) HNO_3

18\. A mixture of Al_2O_3 and Fe_2O_3 can be separated by using

1) Sodium hydroxide 2) Cold water

3) Ethyl alcohol 4) Boiling water

19\. Percentages of copper and zinc present in a alloy brass are respectively

1) 60 % and 40% 2) 40% and 60%

3) 0 % and 100%   4) 100 % and 0%

20. In the blast furnace, the reaction that is taking place at the temperature zone of 900K to 1500K is

1) $FeO + CO \longrightarrow Fe + CO_2$ 2) $Fe_2O_3 + CO \longrightarrow 2FeO + CO_2$

3) $Fe_3O_4 + CO \longrightarrow 3Fe + CO_2$ 4) All the above reactions

21. Metal used in the extraction of Mn and Cr from their oxides is

1) Ag   2) Cu   3) Al   4) Fe

22. Impurity present in red bauxite is

1) ZnO   2) Fe_2O_3 3) SiO_2 4) Al_2O_3

23. Metal extracted from molten cryolite is

1) Al   2) Fe   3) Zn   4) Ag

Uses of metals

24. Metal commonly present in bronze, brass and German silver is

1) Cu   2) Ag   3) Zn   4) Fe

25. Nickel steel is used in making

1) Cycles   2) utensils   3) Cutting tools   4) Cables

KEY

1) 1	2) 1	3) 2	4) 4	5) 3	6) 2	7) 3	8) 1
9) 3	10) 2	11) 4	12) 3	13) 1	14) 2	15) 3	16) 2
17) 3	18) 1	19) 1	20) 1	21) 3	22) 2	23) 1	24) 1
25) 4							

6. p-BLOCK ELEMENTS

(a) GROUP-15 ELEMENTS

Synopsis:

1. Nitrogen (N); Phosphorus (P), Arsenic (As), Antimony (Sb) and Bismuth (Bi) are the elements of group VA.
2. These elements are called pnicogens. The percentage abundance in the earth crust is: P > N > As > Sb > Bi.
3. The valency shell configuration of VA group elements is ns^2 np^3.
4. Nitrogen is diatomic. P, As and Sb are tetra-atomic. Bismuth is monoatomic.
5. Nitrogen can form two $P^{\pi} - P^{\pi}$ bonds due to small size and greater overlaping character, while others can't due to their large size.
6. In P_4 molecule, all the four atoms lie at the corners of a tetrahedron. The P-P-P bond angle is 60°, oxidation state of P is zero and covalency of P is 3.
7. Most abundant gas in the earth's atmosphere is nitrogen. About 75% by mass and 78% by volume in air is nitrogen. In combined state 'N' is available as KNO_3 (Indian salt petre) and $NaNO_3$ (Chile salt petre)
8. Phosphorous is the eleventh most abundant element in the earth's crust and the most abundant in the VA group.
9. Sources of phosphorus minerals in the earth's crust are: Phosphorite $Ca_3(PO_4)_2$, Fluorapatite $3Ca_3(PO_4)_2.CaF_2$ and Chlorapatite $3Ca_3(PO_4)_2$. $CaCl_2$. Hydroxyaptite is $3Ca\ (PO_4)_2.Ca(OH)_2$.
10. Asm Sb and Bi are abundant and are available as sulphide minerals. Realgar - As_4S_4 - red colour. Orpiment-As_2S_3 -Yellow colour, Sribimte – Sb_2S_3 and Bismuth glance – Bi_2S_3
11. Except Bi. all elements of VA group exhibit allotropy.
12. Nitrogen has two allotropes in the solid state, a) a - nitrogen and b) β - nitrogen
13. Allotropes of phosphorus are yellow or white phosphorus, red phosphorus, scarlet phosphorus, α, β - black phosphorus and violet phosphorus.
14. White phosphorous molecule has a regular tetrahedral structure. It has 6 P-P bonds. White phosphorus is more reactive, due to high bond angle strain.
15. Metallic character of the VA group elements increases as the atomic number increases. N and P are non metals! As and Sb are metalloids. Bi is a true metal.
16. Electronegativity decreases from N to Bi. As and Bi have same electronegativity values.
17. The common oxidation states of these elements are-3,+3 and+5.

18. Nitrogen exhibits a wide range of oxidation states. NH_3(−3), N_2H_4 (−2) , NH_2OH (−1), N_3H (-X), N_2(O), N_2O(+1), NO(+2), $HN0_2$(+3), NO_2(+4) and HNO_3(+5)

19. The exhibition of -3 oxidation state decreases from N to Bi, due to decreasing non metallic character and electronegativity.

20. The tendency of exhibiting +5 oxidation state decreases from N to Bi, due to inert pair effect. Due to inert pair effect, Bismuth has more stable +3 oxidation state.

21. Nitrogen is gas and other elements are solids. Dinitrogen is inert due to high bond dissociation energy, 945.4 kJ/mol. 1 σ and 2 π bonds present in N_0 molecule.

22. Catenation power decreases from N to As with decreasing bond energies from N to As.

23. Catenation of nitrogen is observed in azide. Tetrazenes having organic substitutents give chains with 8 atoms of nitrogen.

24. Group VA elements form MH_3 type hydrides. They are prepared by the action of water or dil.acid on Mg_3N_2, Ca_3P_2, Zn_3As_2 and Mg_3Sb_2.

25. Shape of MH_3 is pyramidal with one lone pair on the central atom. From NH_3 to BiH_3 ease of formation of hydrides, stability, ease of replacing hydrogen atom by C*l* or methyl group decrease.

26. Basic nature, bond angle, water solubility and ionic character decrease from NH_3 to BiH_3.

27. The basic character of hydrides can be increased by replacing the hydrogen atoms with alkyl groups. $P(CH_3)_3$ is more basic than PH_3.

28. NH_3 and PH_3 are volatile and colourless gases. The boiling points of VA group hydrides is in the order : $SbH_3 > NH_3 > AsH_3 >$ PH,. The volatility is in the reverse order of their boiling points. The order of melting points is : $NH_3 > SbH_3 > AsH_3 > PH_3$.

29. As the atomic size of the central atom increases the lone pair is spread over a large surface area, as the result electron density decreses. Hence basic nature decreases. Order of Basic nature is : $NH_3>PH_3>AsH_3$.

30. Ammonia is the only VA hydride which has hydrogen bonds in liquid state.

31. Ammonia is more readily formed and more stable than PH_r Ammonia forms co-ordinate bonds readly. PH_3 acts as an electron pair donor and can form complexes.

32. Due to decrease in M-H bond energy the thermal stability of these hydrides decreases from NH_3 to BiH_3.

33. The central atom in NH_3 molecule undergoes sp^3 hybridization, a lone pair of electrons present at one of the vertices.

34. The bond angles in the hydrides of group VA decrease from NH_3 to BiH_3 due to increase in size of central atom and pure 'p' orbitals are involved in the formation of other hydrides except in NH.

35. Other hydrides formed by nitrogen are : hydrazine (N_2H_4) and hydrazoic acid (N_3H). N_3H is the acidic hydride of nitrogen.

36. Other hydride of phosphorus is, P_2H_4 diphosphine. Polyphosphines are unstable.

37. Reducing property of hydrides increases from NH_3 to BiH_3 due to decrease in M-H bond energy. PH_3 catches fire on heating to 150°C because it is contaminated with traces of P_9H_4.

38. Group VA elements form M_2O_3, M_2O_4 and M_2O_5 type oxides.

39. Nitrogen alone forms many oxides. This is due to pp -pp multiple bonding between N and O atoms.

40. Pentoxides are more acidic than trioxides. The oxide of an element with higher oxidation state is more acidic. Among VA oxides, N_9O_5 is the most acidic oxide.

41. Acidic nature of oxides decreases with increase in atomic number. The oxides of As and Sb are amphoteric.

42. N_2O_3 is more acidic than Bi_2O_3. The basic nature increases from N_2O_3 to Bi_2O_3 because of increase in the size of central atom, which influences the metallic properties.

43. Trioxides dissolve in water to form -ous acids. Pentoxides dissolve in water to form -ic acids. The -ic acids are more acidic than -ous acids

44. The oxidising nature of oxides decreases from N_2O_3 to Bi_2O_3

45. The VA oxide which acts as dehydrating agent is P_2O_5. The oxides of nitrogen and phosphorus " are chemically similar although their structures are different.

46. Trioxide of P_4, As_4, Sb_4 and Bi are prepared by direct action with air (or) oxygen. P_4O_{10} is prepared by burining P_4 in excess of air.

47. The stability of pentoxides decreases down the group and basic nature increases.

48. The oxides nitrogen and bismuth can exist only as monomers (except NO and NO_2, which can exist also as dimers).

49. Trioxides and pentoxides of P. As and Sb are dimeric. P_40_6, As_40_6 and Sb_40_6 -Trioxides. P_4O_6, As_4O_6 and Sb_4O_6 -Pentoxides.

50. Oxides of nitrogen

Name	Formula	Oxidation state of Nitrogen	Nature
Nitrous oxide	N_2O	+1	Neutral
Nitric Oxide	N O	+2	Neutral
Nitrogen sesquioxide	N_20_3	+ 3	Acidic
Nitrogen dioxide	$N\ o_2$	+ 4	Acidic
Dinitrogen tetroxide	N_2O_4	+ 4	Acidic
Nitrogen pentoxide	N_2O_5	+ 5	Acidic

51. Nitrous oxide N_2O is colourless and odourless is called laughing gas. It is prepared by heating a mixture of NH_4Cl and $NaNO_3$. It is stable, relatively unreactive and neutral.

52. Nitric oxide (NO) is formed as an intermediate in the manufacture of nitric acid by the catalytic oxidation of ammonia. It is a colourless gas, paramagnetic and very reactive.

53. Nitric oxide readily reacts with O_2 to form reddish brown NO_2 gas. NO is absorbed by cold $FeSO_4$ solution to form brown coloured $FeSO_4NO$.

54. Nitrogen sesquioxide or dinitrogen trioxide (N_2O_3) is the anhydride of nitrous acid. It is prepared by cooling a mixture of NO and NO, to 250 K. In the pure state N_2O, exists only as a pale blue solid that melts to a deep blue liquid.

55. Nitrogen dioxide (NO_2) is reddish brown gas and paramagnetic. It is obtained by heating lead nitrate. It is an odd electron molecule and very reactive.

56. N,0$_4$ is a mixed anhydride of HNO_2 and HNO_3 N_2O_4 has no unpaired electron and hence it is colourless and diamagnetic.

57. Nitrogen pentoxide (N_2O_5) is obtained by dehydration of HNO_3 by P_4O_{10}. It is the anhydride of nitric acid

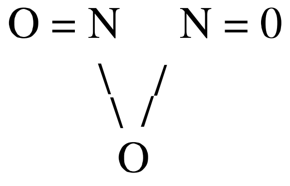
58. N_2O molecule is linear

$$:\underset{\cdot\cdot}{\overset{-}{N}}::\overset{+}{N}::\underset{\cdot\cdot}{O}:\leftrightarrow:N::\overset{-}{N}::\overset{+}{N}:\underset{\cdot\cdot}{\overset{\cdot\cdot}{O}}\overset{-}{:}$$

59. NO is linear with ood electron bonding

$$:\underset{\cdot\cdot}{\overset{\cdot}{N}}=\underset{\cdot\cdot}{\overset{\cdot\cdot}{O}}\text{or}:\overset{\cdot}{N}:\ \ :\underset{\cdot\cdot}{\overset{\cdot\cdot}{O}}\text{ or }\overset{-}{:}\overset{\cdot\cdot}{N}=\underset{\cdot\cdot}{\overset{\cdot}{O}}\overset{+}{:}$$

60. N_2O_3 has only covalent bonds and exists as



61. NO_2 is trigonal planar molecule. It is stable due to resonating structures.

62. In N_2O_5 each nitrogen atom is surrounded by three oxygen atoms. N_2O_5 has both covalent and dative bonds.

63. P_4O_6andP_4O_{10} are dimers. Oxygen atoms act as bridges in both the oxides. In both the oxides, number of bridge oxygen atoms is six. Number of oxygen atoms surrounded by 'P' atom in P_4O_6 is three and in P_4O_{10} is four. P$_4$0$_6$ and P_4O_{10} both have no P-P bonds.

64. Group VA elements form trihalides MX_3 and pentahalides MX_5.

65. M is sp^3 hybridised in MX_3 and is sp^{3}d hybridised in MX_3. Shape of MX_3 is trigonal pyramidal and MX_5 is trigonal bipyramidal

66. Hydrolysis of MX_3 gives -ous acids and MX_5 gives -ic acids.

67. The elements react directly (except N) with required quantity of the halogen forming trihalide. Trihalides hydrolyse easily except PF_3.

68. NCl_3 is not formed due to the absence of d- orbitals in the valency shell of 'N'.

69. Hydrolysis of NCl_3 gives NH_3 and $HOCl$. Hydolysis of PCl_3 gives HCl and H_3PO_3. PCl_5 on hydrolysis gives HCl and $H_3 PO_4$. The extent of hydrolysis decreases from NCl_3 to $BiCl_3$. $BiCl_3$ hydrolysis to give pearl white $BiOCl$.

70. Nitrogen differs from other VA group elements due to high electronegativity high bond dissociation energy and absence of vacant d - orbitals.

71. Oxides of VA group except those of Sb and Bi dissolve in water and form oxyacids.

72. HNO_2 is unstable except in dilute cold conditions. It is prepared by the action of dil H_2SO_4 on nitrites. On long standing it undergoes auto oxidation auto reduction to give HNO_3 and NO.

73. With stronger oxidants nitrous acid functions as reductant. With stronger reductants if function as oxidant.

74. With aromatic primary amines nitrous acid gives diazonium compounds at ice temperature.

75. Oxyacids of nitrogen

Name	Formula	Oxidation state of N
Hyponitrous acid	HNO (or) $H_2N_20_2$	+1
Nitrous acid,	HNO_2	+3
Nitric acid	HNO_3	+ 5
Pernitric acid	HNO_4	+5

76. Phosphorus forms two series of oxoacids. In all oxoacids phosphorous atom is tetrahedrally surrounded by other atoms. In these acids at least one P-OH bond is present. These ionisable 'H' are responsible for basicity of the the acid.

77. Phosphorous series of acids have P - H bonds, these H atoms are responsible reducing properties.

78. Orthophosphorous acid H_3PO_3 is prepared by dissolving P_40_6 in water. It gives two series of salts primary phosphites ($H_2PO_3^-$) and secondary phosphites ($HP0_3^{2-}$). Primary phosphite are acidic salts.

79. Phosphorus acid and orthophosphites are strong reducing agents in basic solution. These can reduce Hg^{2+}, Ag^+ and Cu^{2+} to give metals. In these reaction H_3P0_3 is oxidised to H_3P0_4.

80. Metaphosphorous acid (HPO_2) normally exists as cyclic compound.

81. Phosphoric series of acids not contain P - H bonds in their structure. The oxidation state of principal element 'P' in these acids is + 5.

82. Orthophosphoric acid (H_3PO_4) is prepared by dissolving P_4O_{10} in water. Solid acid absorbs water and forms a colourless syrupy liquid. It forms 3 series of salts :

$H_2PO_4^{-3}$ dihydrogen phosphates. HPO_4^{-2} monohydrogen phosphates and PO_4^{-3} phosphates.

83. Orthophosphoric acid loses water readily on heating.

$$H_3PO_4 \xrightarrow[\text{heat}]{\text{gentle}} > H_4P_2O_7 \xrightarrow[\text{heat}]{\text{strong}} > HPO_3$$

Ortho phosphates are identifed in qualitative analysis by ammonium phosphomolybdate test ^{L} where a canary yellow precipitate is formed.

84. Metaphosphoric acid (HPO_3) is obtained by heating H_3PO_4 (or) $H_4P_2O_7$ to red hot. It is also called glacial phosphoric acid. It is a transparent glassy solid.

85. Pyrophosphoric acid ($H_4P_2O_7$) is prepared by the action of H_2PO_4 and HPO_3 at 100°C. Pyrophosphates also will respond to molybdate test. Basicity is 4, but has only two common types of salts.

86. Hypophosphoric acid ($H_4P_2O_6$) has P - P linkage. Basicity is 4. Peroxyphosphoric acid (H_3PO_5) has peroxy bond. Basicity is 3.

87. Heating an ammonium salt with NaOH gives NH_3. In laboratory NH_3 gas is identified by its smell (or) with a glass rod dipped in H*Cl* solution. On large scale NH_3 is prepared from coal, by Haber's process and by cyanamide process

88. Haber synthesised ammonia from elements. It is a reversible exothermic process. The reaction proceeds with a decrease in volume. According to Lechatlier principle the favourable conditions are low temperature and high pressure.
For Habers process

89. Optimum conditions are : Temperature 725 - 775 K, Pressure 200 - 300 atm. Finely divided iron as catalyst and molybdenum as promoter.

90. Raw materials in the cyanamide process are lime stone, coke and N_9 gas. The catalyst is powdered anhydrous $CaCl_2$.

91. Mixture of $CaCN_2$ and graphit e i s nitrolim and is used as fertilizer. Hydrolysis of nitrolim using steam at high pressure gives CaCO, and NH_3.

92. Ammonia is used as refrigerant. It is used to produce fertilisers and for the manufacture of HNO_3. Liquid NH_3 is a good solvent for both ionic and covalent compounds. It is used in the manufacture of Na_2CO_3 by Solvay process and in the preparation of rayon and artificial silks.

93. The only stable and most important oxyacid of 'N^1 is nitric acid. It is called aqua fortis. In the laboratory nitric acid is prepared by heating $NaNO_3$ and cone. H_2SO_4. in a glass retort.

94. On a large scale, nitric acid is manufactured by Ostwald's process, which is based on oxidation of NH_3 by atmospheric oxygen, Pt or Rh is used as catalyst.

95. HNO_3 obtained by ostwald's process is about 61 %. If is further concentrated by distillation until 68 % is obtained distillation by mixing with cone. H_2SO_4 to get 98 % and cooling in freezing mixture to get 100% acid.

96. HNO_3 is also prepared by Brikland and Eyde process from air at an electric arc.

97. Nitric acid is a colourless liquid. It exists as a planar molecule in gaseous state. In aqueous solutions, it behaves as a strong acid giving hydronium and nitrate ions.

98. A mixture of cone HNO_3 and cone H_2SQ_4 in 1 : 1 volume ratio is called nitration mixture. It is used to convert benzene to nitrobenzene.

99. HNO_3 is a plannar molecule with N - O bond length of 1.22 Å ; ONO_t bond angle is 115°& O_tNO_t bond angle is 130°.

100. HNO_3 is used in manufacturing of fertilizers like {CaO. $Ca(NO_3)_2$}, manufacturing of explosives like T.N.T. nitroglycerine etc, perfumes, dyes and drugs.

101. Nitric acid is used as an oxidant to oxidise cyclohexanol or cyclohexanone to adipic acid and p - Xylene to terepthalic acid. It is used in the preparation of cellulose nitrate from where artificial silk is prepared.

SYNOPSIS - II

1. Nitrogen (N); Phosphorus (P), Arsenic (As), Antimony (Sb) and Bismuth (Bi) are the elements of group VA.
2. These elements are called pnicogens. The percentage abundance in the earth crust is : P > N > As > Sb > Bi.
3. The valency shell configuration of VA group elements is $ns^2\ np^3$.
4. Nitrogen is diatomic. P, As and Sb are tetra-atomic. Bismuth is monoatomic.
5. Nitrogen can form two p^π _ p^π bonds due to small size and greater overlaping character, while others can't due to their large size.
6. In P_4 molecule, all the four atoms lie at the corners of a tetrahedron. The P-P-P bond angle is 60°, oxidation state of P is zero and covalency of P is 3.
7. Most abundant gas in the earth's atmosphere is nitrogen. About 75% by mass and 78% by volume in air is nitrogen. In combined state 'N' is available as KNO_3 (Indian salt petre) and $NaNO_3$ (Chile salt petre)
8. Phosphorus is the eleventh most abundant element in the earth's crust and the most abundant in the VA group.
9. Sources of phosphorus minerals in the earth's crust are : Phosphorite $Ca_3(PO_4)_2$, Fluorapatite $3Ca_3(PO_4)_2$. CaF_2 and Chlorapatite $3Ca_3(PO_4)_2.CaZ_2$.
10. Except Bi, all elements of VA group exhibit allotropy.
11. Allotropes of phosphorus are yellow or white phosphorus, red phosphorus, scarlet phosphorus, α, β – black phosphorus and violet phosphorus.
12. White phosphorus molecule has a regular tetrahedral structure. It has 6 P-P bonds. White phosphorus is more reactive, due to high bond angle strain.
13. Metallic character of the VA group elements increases as the atomic number increases. N and P are non metals, As and Sb are metalloids. Bi is a true metal.
14. Electronegativity decreases from N to Bi. As and Bi have same electronegativity values.
15. The common oxidation states of these elements are -3, +3 and +5.
16. Nitrogen is gas and other elements are solids. Dinitrogen is inert due to high bond dissociation energy, 945.4 kJ/mol. 1, 2 and 3 bonds present in N_2 molecule.

17. Catenation power decreases from N to As with decreasing bond energies from N to As.
18. Catenation of nitrogen is observed in azide. Tetrazenes having organic substitutents give chains with 8 atoms of nitrogen.
19. Group VA elements form MH_3 type hydrides. Shape of MH_3 is pyramidal with one lone pair on the central atom.
20. From NH_3 to BiH_3 ease of formation of hydrides, stability, ease of replacing hydrogen atom by Cl or methyl group decrease.
21. Basic nature, bond angle, water solubility and ionic character decrease from NH_3 to BiH_3.
22. NH_3 and PH_3 are volatile and colourless gases. The boiling points of VA group hydrides is in the order : $SbH_3 > NH_3 > AsH_3 > PH_3$. The volatility is in the reverse order of their boiling points.
23. As the atomic size of the central atom increases the lone pair is spread over a large surface area, as the result electron density decreases. Hence basic nature decreases. Order of Basic nature is : $NH_3 > PH_3 > AsH_3$.
24. Ammonia is the only VA hydride which has hydrogen bonds in liquid state.
25. Ammonia is more readily formed and more stable than PH_3. Ammonia forms co-ordinate bonds readly. PH_3 acts as an electron pair donor and can form complexes.
26. The central atom in NH_3 molecule undergoes sp^3 hybridization, a lone pair of electrons present at one of the vertices.
27. The bond angles in the hydrides of group VA decrease from NH_3 to BiH_3 due to increase in size of central atom and pure 'p' orbitals are involved in the formation of other hydrides except in NH_3.
28. Group VA elements form M_2O_3, M_2O_4 and M_2O_5 type oxides.
29. Nitrogen alone forms many oxides. This is due to $p\pi$- $p\pi$ multiple bonding between N and O atoms.
30 Pentoxides are more acidic than trioxides. The oxide of an element with higher oxidation state is more acidic. Among VA oxides. N_2O_5 is the most acidic oxide
31. Acidic nature of oxides decreases with increase in atomic number. The oxides of As and Sb are amphoteric.
32. N_2O_3 is more acidic than Bi_2O_3. The basic nature increases from N_2O_3 to Bi_2O_3 because of increase in the size of central atom, which influences the metallic properties.
33. Trioxides dissolve in water to form 'ous' acids. Pentoxides dissolve in water to form -ic acids. The -ic acids are more acidic than -ous acids
34. The oxidising nature of oxides decreases from N_2O_3 to Bi_2O_3
35. The VA oxide which acts as dehydrating agent is P_2O_5. The oxides of nitrogen and phosphorus are chemically similar although their structures are different.
36. Trioxides and pentoxides of P. As and Sb are dimeric. P_4O_6. As_4O_6 and Sb_4O_6 -Trioxides. P_4O_{10}. As_4O_{10} and Sb_4O_{10} -Pentoxides.
37. Nitrous oxide N_2O is colourless and odourless is called laughing gas. It is prepared by

heating a mixture of NH_4Cl and $NaNO_3$. It is stable, relatively unreactivc and neutral.

38. Nitric oxide (NO) is formed as an intermediate in the manufacture of nitric acid by the catalytic oxidation of ammonia. It is a colourless gas. paramagnetic and very reactive.
39. Nitric oxide readily reacts with O_2 to form reddish brown NO_2 gas. NO is absorbed by cold $FeSO_4$ solution to form brown coloured $FeSO_4NO$.
40. Nitrogen dioxide (NO_2) is reddish brown gas and paramagnetic. It is obtained by beating lead nitrate. It is an odd electron molecule and very reactive,
41. N_2O_4 is a mixed anhydride of HNO_2 and HNO_3. N_2O_4 has no unpaired electron and hence it is colourless and diamagnetic.
42. Nitrogen pentoxide (N_2O_5) is obtained by dehydration of HNO_3 by P_4O_{10}. It is the anhydride of nitric acid
43. N_2O_4 molecule is linear. NO is linear with odd electron bonding
44. NO_2 is trigonal planar molecule. It is stable due to resonating structures.
45. In N_2O_5 each nitrogen atom is surrounded by three oxygen atoms. N_2O_5 has both covalent and dative bonds.
46. P_4O_6 and P_4O_{10} are dimers. Oxygen atoms act as bridges in both the oxides. In both the oxides, number of bridge oxygen atoms is six. Number of oxygen atoms surrounded by 'P' atom in P_4O_6 is three and in P_4O_{10} is four.
47. Group VA elements form trihalides MX_3 and pentahalides MX_5.
48. M is sp^3 hybridised in MX_3 and is sp^3d hybridised in MX_5. Shape of MX_3 is trigonal pyramidal and MX_5 is trigonal bipyramidal
49. Hydrolysis of MX_3 gives -ous acids and MX_5 gives -ic acids.
50. NCl_5 is not formed due to the absence of d-orbitals in the valency shell of 'N'.
51. Hydrolysis of NCl_3 gives NH_3 and HOCl. Hydolysis of PCl_3 gives HCl and H_3PO_3. PCl_5 on hydrolysis gives HCl and H_3PO_4.
52. Phosphorus forms two series of oxoacids. In all oxoacids phosphorous atom is tetrahedrally surrounded by other atoms. In these acids at least one P-OH bond is present. These ionisable 'H' are responsible for basicity of the acid.
53. Phosphorous series of acids have P - H bonds, these H atoms are responsible for reducing properties.
54. Metaphosphorous acid (HPO_2) normally exists as cyclic compound.
55. Phosphoric series of acids not contain P - H bonds in their structure. The oxidation state of principal element P in these acids is + 5.
56. Heating an ammonium salt with NaOH gives NH_3. In laboratory NH_3 gas is identified by its smell (or) with a glass rod dipped in HCl solution. On large scale NH_3 is prepared from coal, by Haber's process and by cyanamide process
57. Haber synthesised ammonia from elements. It is a reversible exothermic process. The reaction proceeds with a decrease in volume. According to Lechatlier principle the favourable conditions are low temperature and high pressure.

58. For Habers process, Optimum conditions are : Temperature 725 - 775 K, Pressure 200 - 300 atm. Finely divided iron as catalyst and molybdenum as promoter.

59. Ammonia is used as refrigerant. It is used to produce fertilisers and for the manufacture of HNO_3. Liquid NH_3 is a good solvent for both ionic and covalent compounds. It is used in the manufacture of Na_2CO_3 by Solvay process and in the preparation of rayon and artificial silks.

60. On a large scale, nitric acid is manufactured by Ostwald's process, which is based on oxidation of NH_3 by atmospheric oxygen. Pt or Rh is used as catalyst.

61. HNO_3 obtained by ostwald's process is about 61 %. If is further concentrated by distillation until 68 % is obtained distillation by mixing with conc. H_2SO_4 to get 98 % and cooling in freezing mixture to get 100% acid.

62. Nitric acid is a colourless liquid. It exists as a planar molecule in gaseous state. In aqueous solutions, it behaves as a strong acid giving hydronium and nitrate ions.

63. A mixture of conc HNO_3 and conc H_2SO_4 in 1 : 1 volume ratio is called nitration mixture. It is used to convert benzene to nitrobenzene.

64. HNO_3 is used in manufacturing of fertilizers like {CaO. $Ca(NO_3)_2$}, manufacturing of explosives like T.N.T. nitroglycerine etc, perfumes, dyes and drugs.

Question Bank - I

1. The element with more catenation power is

1) N 2) P 3) As 4) Bi

2. The number of unpaired electrons present in excited state of Phosphorous atom are

1) 3 2) 5 3) 10 4) 2

3. The stable oxidation state of Bismuth is

1)+1 2) +5 3) –3 4) +3

4. Thermally most stable hydride is

1) NH_3 2) PH_3 3) AsH_3 4) BiH_3

5. The oxide involved in the formation of brown ring in the test for the nitrate

1) N_2O 2) NO 3) NO_2 4) N_2O_3

6. The arrangement of oxygen atoms around each phosphorous in P_4O_{10}

1) Pyramidal 2) Octahedral 3) Tetrahedral 4) Square planar

7. Aqueous solution of PCl_3 conducts electricity due to the presence of

1) HOCl 2) HCl 3) H_3PO_4 4) H_2O

8. Lead nitrate on strong heating gives

1) PbO, NO_2, O_2 2) PbO_2, PbO, NO_2

3) PbO, NO, O_2 4) PbO, NO, NO_2

9. White phosphorous reacts with caustic soda to give phosphine and sodium hypophosphite. In this reaction phosphorous undergoes

1) Oxidation 2) Reduction 3) Both 4) None of these

58. For Habers process, Optimum conditions are : Temperature 725 - 775 K, Pressure 200 - 300 atm. Finely divided iron as catalyst and molybdenum as promoter.

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1) Oxidation 2) Reduction 3) Both 4) None of these

10. The number of oxygen atoms bonded to one phosphorous atom is P_4O_6 is
1) 4 2) 3 3) 6 4) 5

11. Which one of the following elements occur free in nature?
1) Nitrogen 2) Phosphorous 3) Arsenic 4) antimony

12. Which of the following oxides of nitrogen is a brown colured gas?
1) NO_2 2) NO 3) N_2O 4) N_2O_5

13. The reddish brown coloured gas formed when nitric oxide is oxidised by air is
1) N_2O_5 2) N_2O_4 3) NO_2 4) N_2O_3

14. Which one has the lowest boiling point?
1) NH_3 2) PH_3 3) AsH_3 4) SbH_3

15. Which of the following fluorides does not exist?
1) NF_5 2) PF_5 3) AsF_5 4) SbF_5

16. Which of the following oxides of nitrogen is the anhydride of nitrous acid?
1) NO 2) N_2O_3 3) N_2O_4 4) N_2O_5

17. The formula of complex ion produced when Ag^+ is treated with NH_3 is
1) $[AgNH_3]^+$ 2) $[Ag(NH_3)_2]$ 3) $[Ag_2(NH_3)]^+$ 4) $[Ag(NH_3)_2]^+$

18. The oxide of nitrogen which is solid at room temperature and its composition is :
1) N_2O_5 and $NO_2^+NO_3^-$ 2) N_2O_4 and $NO_2 + NO_2$
3) N_2O_3 and NO and NO_2 4) none

19. The form of P that is highly reactive due to strained tetrahedral structure is
1) red 2) white 3) black 4) scarlet

20. Nitrogen is produced by heating a mixture of
1) $CaCN_2 + C$ 2) $(NH_4)_2Cr_2O_7$ 3) $NH_3 + CuO$ 4) all the above

21. Nitric oxide has unpaired electron and hence it is
1) Paramagnetic 2) Ferromagnetic 3) Anti ferromagnetic 4) all the above

22. The form of P that is semiconductor
1) red 2) white 3) black 4) all the above

23. Aquafortis is the name given to
1) phosphorus acid 2) nitrous acid 3) nitric acid 4) phosphoric acid

24. The oxy acid of phosphorous, which contain peroxy linkage is
1) metaphosphoric acid 2) pyrophosphoric acid
3) orthophosphoric acid 4) phosphorous acid

25. Iron gets passive in
1) Conc. HNO_3 2) HNO_2 3) Dil HNO_3 4) Fuming HNO_3

26. The decrease in tendency of catenation from Nitrogen to Bismuth is due to
1) Atomic radius increase 2) increasing M.P
3) increasing metallic nature 4) decrease in M-M bond energy

27. The total number of electrons in the oxide of Nitrogen with molecular weight 30 is
1) 22 2) 23 3) 15 4) none

28. Which of the following is least stable?
1) NH_4^+ 2) SbH_4^+ 3) PH_4^+ 4) AsH_4^+.

29. Only 68% Nitric acid is possible because of
1) High acid nature 2) azeotropic mixture
3) strong oxidising nature 4) Volatility

30. Phosphorous forms PCl_5 but nitrogen cannot form NCl_5 because nitrogen
1) has high electro negativity 2)has low size
3) doesn't contain d-orbitals 4) is less reactive

31. Aqueous solution of PBr3 conducts electricity due to the presence of
1) HOBr 2) HBr 3) H_3PO_4 4) H_2O

32. The bonds present in P_4O_{10} are
1) ionic and covalent 2) ionic and dative
3) covalent and dative 4) only covalent bonds

33. In VA group ______ has the maximum electron affinity.
1) nitrogen 2) phosphorous 3) arsenic 4) antimony

34. Mg_3N_2 on hydrolysis produce a mixture of
NH_3 and $Mg(OH)_2$ 3) $Mg(OH)_2$, N_2 and H_2
3) NH_3 and MgO 4) NH_3, Mg and O_2

35. NCl_3 on hydrolysis produce a mixture of
1) NOCl and NH_3 2) HOCl and N_2
3) HOCl and NH_3 4) $NOCl_2$ and HCl

36. Phosphorous on burning in excess oxygen gives
1) PO_3 2) P_2O_3 3) PO_5 4) P_2O_5

37. In Ostwald's process for the preparation of nitric acid catalyst is
1) Fe 2) Pt gauze 3) NO 4) Ni gauze

38. A tribasic acid with peroxy bond is
1) H_3PO_2 2) H_3PO_3 3) H_3PO_4 4) H_3PO_5

39. One of the following pairs of oxyacids is tribasic
1) H_3PO_2 ; H_3PO_3 2) H_3PO_2 ; H_3PO_4 3) H_3PO_3 ; H_3PO_4 4) H_3PO_4 ; H_3PO_5

40. Which of the following is thermally most stable?
1) NH_3 2) PH_3 3) AsH_3 4) SbH_3

41. Assertion: N_3^- is isostructural with I_3^-
Reason: The E.N of N is greater than I
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

42. Assertion: PH_3 is more basic than NH_3.
Reason: EN of N is more than that of P
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

43. Assertion: N_2O_5 is obtained on dehydration of HNO_3.
Reason: P_4O_{10} acts dehydrating agent.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

44. Assertion: Catenation capacity of nitrogen is more than phosphrous.
Reason: In nitrogen N-N bond energy is less than P-P bond energy in P.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A

3) A is true but R is false 4) A is false but R is true

45. Assertion: White Phosphorous is more reactive than red.

Reason: White Phosphorous possesses high bond angle strain of 60^0.

1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

46.

List-I	List-II
A) H_3PO_2	1) Tribasic
B) H_3PO_3	2) Monobasic
C) H_3PO_4	3) Tetrabasic
D) $H_4P_2O_6$	4) Dibasic
	5) Zero Basicity

The correct match is

	A	B	C	D
1)	3	2	1	5
2)	2	4	1	3
3)	2	5	3	4
4)	1	2	3	4

47. Assertion: HNO_3 is a stronger acid than HNO_2.

Reason: Both are monobasic acids.

1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

48.

List-I	List-II
A) N_2O	1) sp2 and planar triangle
B) HNO_2	2) Nitrite and nitro form
C) NO_3^-	3) sp3 and tetrahedron
D) HNO_4	4) Laughing gas.
	5) Peroxy bond

The correct match is

	A	B	C	D
1)	4	2	1	5
2)	2	4	1	3
3)	2	5	3	4
4)	1	2	3	4

49.

List-I	List-II
A) Haber's process	1) Nitric acid
B) Ostwald process	2) $N_2 + 3H_2 \rightarrow 2NH_3$
C) Contact process	3) $NH_3 + CaCO_3$
D) Cyanamide process	4) H_2SO_4
	5) Perdisulphuric acid

The correct match is

	A	B	C	D
1)	3	2	1	5
2)	2	4	1	3
3)	2	1	4	3
4)	1	2	3	4

1. Assertion: HPO_3 is a monobasic acid..

Reason: The salts of meta phosphoric acid are metaphosphates..

1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

KEY

1.1	2. 2	3. 4	4. 1	5. 2	6. 3	7. 2	8.1	9. 3	10. 2
11. 1	12. 1	13. 3	14. 2	15. 1	16. 2	17. 4	18. 1	19. 2	20. 4
21. 1	22. 3	23. 3	24. 2	25. 1	26. 4	27. 3	28. 2	29. 2	30. 3
31. 4	32. 3	33. 2	34. 1	35. 3	36. 4	37. 2	38. 4	39. 4	40. 1
41. 1	42. 4	43. 1	44. 3	45. 1	46. 4	47.2	48.1	49.3	50.2

Question Bank - II

General

1. The valence shell electronic configuration of VA group elements is

1) ns^2np^2 2) ns^2np^1 3) ns^2np^3 4) ns^2np^5

2. The most abundant gas in atmosphere is

1) O_2 2) N_2 3) F_2 4) Ar

3.

LIST - 1	List - 2
A) Phosphorite	1) KNO_3
B) Indian salt petre	2) $Ba(NO_3)_2$
C) Fluoroapatite	3) $NaNO_3$
D) Chile salt petre	4) $3Ca_3(PO_4)_2.CaF_2$
	5) $Ca_3(PO_4)_2$

The correct match is

	A	B	C	D		A	B	C	D
1)	1	2	3	5	2)	2	4	3	1
3)	4	3	5	2	4)	5	1	4	3

4. The most abundant VA group element in the earth's crust is

1) Nitrogen 2) Phosphorous 3) Arsenic 4) Bismuth

5. The following can exist as a diatomic molecule

1) N 2) P 3) As 4) Bi

6. The following VA group element occurs even in free state

1) Bi 2) As 3) Sb 4) N

7. The VA group element having same number of allotropes is

1) N 2) P 3) Bi 4) Sb

8. The following element doesn't have allotropes

1) N 2) P 3) As 4) S

9. Most reactive allotropic form of Phosphorous is

1) Yellow 2) Red 3) Black 4) Scarlet

10. In nitrogen molecule, the two atoms of nitrogen are joined by

1) One sigma bond and one pi bond 2) Two sigma bonds and one pi bond

3) One sigma bond and two pi bonds 4) Three sigma bonds

11. The chemical inertness of nitrogen is due to

1) half-filled '2p' orbitals of Nitrogen 2) high bond dissociation energy

3) completely filled d-orbitals 4) its gaseous nature

12. The maximum covalency of nitrogen is

1) 2 2) 3 3) 4 4) 5

13. The VA group element which exhibits wide range of oxidation states is

1) P *2)* As 3)Bi 4) N

14. The oxidation state of nitrogen in hydrazine is

1) -1 2) -2 3) +1 4) +2

15. The stable oxidation state of Bismuth is

1) + 1 2) -5 3) -3 4) + 3

16.

Substance	Oxidation state of N
A) HNO_3	1) -3, +5
B) NH_4NO_3	2) -1/3
C) N_3H	3) + 5
D) H_3PO_3	4) + 3
	5) + 1/3

The correct match is

	A	B	C	D		A	B	C	D
1)	3	1	2	4	2)	5	2	3	4
3)	1	2	3	4	4)	4	3	2	5

17. The atomicity of white Phosporous is 'x' and the $P-\hat{P}-P$ bond angle in the molecule is 'y'. What are 'x' and 'y'?

1) $x = 4$; $y = 90^0$ 1) $x = 4$; $y = 60^0$

3) $x = 3$; $y = 120^0$ 4) $x = 2$; $y = 180^0$

Hydrides

18. Acidic hydride of nitrogen is

1) NH_3 2) N_2H_4 3) N_2H_2 4) N_3H

19. In Ostwald's process, nitric oxide is prepared by the oxidation of

1) NH_3 2) N_2 3) Air 4)) Nitrousoxide

20. Thermally more stable hydride is

1) NH_3 2) PH_3 3) AsH_3 4) BiH_3

21. Which one of the following statements is correct with respect to basic character ?

1) $PH_3 > P(CH_3)_3$ 2) $PH_3 = NH_3$ 3) $PH_3 > NH_3$ 4) $P(CH_3)_3 > PH_3$

22. The hydride with more basic nature is

1) PH_3 2) NH_3 3) BiH_3 4) AsH_3

23. A stronger reducing agent is

1) NH_3 2) PH_3 3) SbH_3 4) BiH_3

24 The shape and bond angle of ammonia are

1) Tetrahedral and $109° 28^1$ 2) Tetrahedral and $107° 48^1$

3) Pyramidal and $107° 18^1$ 4) Pyramidal and $109° 28^1$

25. More volatile hydride is

1) PH_3 2) NH_3 3) BiH_3 4) AsH_4

26. VA group hydrides are Lewis bases due to the presence of

1) unpaired electrons 2) high electron affinity values

3) low electronegativity 4) lone pair of electrons

27. The correct order of reducing abilities of VA group hydrides is

1) $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$. 2) $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$.

3) $NH_3 < PH_3 > AsH_3 > SbH_3 > BiH_3$. 4) $SbH_3 > BiH_3 > AsH_3 > NH_3 > PH_3$.

28. Which is in the decreasing order of boiling points of hydrides ?

1) $NH_3 > PH_3 > AsH_3 > SbH_3$ 2) $SbH_3 > AsH_3 > PH_3 > NH_3$

3) $PH_3 > NH_3 > AsH_3 > SbH_3$ 4) $SbH_3 > NH_3 > AsH_3 > PH_3$

Oxides

29. Chemical formula of laughing gas is

1) N_2O 2) NO 3) N_2O_2 4) N_2O_5

30. Ammonium nitrate on heating gives

1) NO 2) N_2 3) N_2O 4) N_2O_4

31. Which of the following exists as dimer

1) N_2O_5 2) N_2O 3) P_2O_2 4) Bi_2O_3

32. The basic oxide among the following is

1) N_2O_3 2) AS_2O_3 3) Sb_2O_3 4) Bi_2O_3

33. Paramagnetic oxide is

1) N_2O 2) N_2O_3 3) NO 4) N_2O_4

34. The oxide of nitrogen existing in the solid state at room temperature is

1) NO 2) NO_2 3) N_2O_3 4) N_2O_5

35. The neutral oxide of nitrogen is

1) NO 2) N_2O 3) NO_2 4) Both 1 and 2

36. The sesqioxide of nitrogen is

1) N_2O 2) NO 3) N_2O_3 4) N_2O_5

37. Which is a mixed anhydride?

1) NO_2 2) N_2O_3 3) N_2O_5 4) N_2O

38. Formula of metaphosphoric acid is

1) H_2PO_4 2) HPO_3 3) $H_4P_2O_6$ 4) H_3PO_2

39. Which one of the following elements does not form the compound M_4O_{10}. (M = element of group VA) ?

1) P 2) Sb 3) As 4) Bi

40. The number of Oxygen atoms present around Nitrogen in N_2O_3 is

1) 2 2) 1 3) 3 4) 4

41. P_4O_6 is the anhydride of the following

1) H_3PO_2 2) H_3PO_3 3) H_3PO_4 4) H_3PO_5

42. P_4O_{10} is the anhydride of the following

1) H_3P0_2 2) H_3PO_3 3) H_3PO_4 4) H_3PO_5

43.

LIST -1	LIST-2
A) $4NH_3 + 5O_2 \rightarrow$	I) $PbO + NO_2 + O_2 \rightarrow$
B) $P_4 + 3NaOH + 3H_2O \rightarrow$	II) $N_2O + H_2O \rightarrow$
C) $NH_3NO_3 \rightarrow$	3) $N_2O_5 + H_2O \rightarrow$
D) $Pb(NO_3)_2 \xrightarrow{\Delta}$	4) $4NO + 6H_2O \rightarrow$
	5) $3NaH_2PO_2 + PH_3 \rightarrow$

The correct match is

A B C D A B C D

1) 4 2 3 1 2) 1 3 2 5

3) 4 5 2 1 4) 3 4 1 5

Halides

44. Which does not form a Pentahalide?

1) P 2) As 3) Sb 4) N

45. PCl_5 on hydrolysis gives

1) H_3PO_2 2) H_3PO_3 3) HCl 4) Both (2) and (3)

46. The shape and hybridisation of PCl_5 molecule

1) Tetrahedral and sp^3 2) Pyramidal and sp^3

3) Angular and sp^3 4) Planar trigonal and sp^3

47. PCl_3 on hydrolysis gives

I) H_3PO_2 2) H_2PO_4 3) H_3PO_2 4) H_3PO_5

48. Which of the following is not correct?

1) Hydrolysis of NCl_3 gives NH_3 and HOCl 2) NH_3 is less stable than PH_3

3) NH_3 is a weak reducing agent compared to PH_3

4) Nitric oxide in solid state exhibits dia-magnetic property

Oxyurids

49. The existence of following ions have no evidence

l) H_2PO_4 2) HPO_4^{-2} 3) PO_3^{3-} 4) PO_4^{-3}

50. Salt of the following is used as a water softner

1) $H_4P_2O_6$ 2) $H_4P_2O_7$ 3) HPO_3 4) HPO_2

51. Covalency of phosphorus in peroxy phosphoric acid is

1) 6 2) 5 3) 4 4)3

52. Basicity of orthophosphoric acid is

1) 2 2) 3 3) 4 4)5

53. A tribasic acid with peroxy bond is

1) H_3PO_2 2) H_3PO_5 3) H_3PO_4 4) H_3PO_s

54. The starting material used for the manufacture of HNO_3 by Ostwald process is

1) Ammonia and N_2O 2) Ammonia

`3) Air only 4) Ammonia and nitrogen

55. Among the following an acidic salt is

I) NaH_2PO_2 2) NaH_2PO_3 3) Na_2HPO_3 4) Na_2PO_4

56. Anhydride of pyrophosphoric acid is

1) P_4O_6 2) P_4O_{10} 3) P_2O_4 4) P_2O_3

57. Anhydride of orthophosphoric acid is

1) P_4O_6 2) P_4O_{10} 3) P_2O_4 4) P_2O_3

58. Oxidation state of phosphorus is least in

1) Hypophosphoric acid 2) Hypophosphorus acid

3) Metaphosphoric acid 4) Pyrophosphoric acid

59. The following is a primary phosphate ion

1) $H_2PO_4^{2-}$ 2) $H_2PO_3^{-}$ 3) $H_2PO_4^{-}$ 4) PO_4^{3-}

60. P—P linkage is present in

1) Pyrophosphoric acid 2) Hypophosphoric acid

3) Peroxy phosphoric acid 4) Metaphosphoric acid

Ammonia

61. In the preparation of HNO_3 by Ostwald process ammonia is

1) reduced 2) oxidised 3) reduced and oxidised 4) hydrolysed

62. NH_4Cl on heating with NaOH liberates

1) NaCl 2) NH_3 3) HCl 4) NaOCl

63. Aqueous NaOH reacts with white Phospho-rous to form Phosphine and

1) NaH_2PO_2 2) P_2O_5 3) Na_3PO_3 4) P_2O_3

64. Ammonia gas is dried over

1) Quick lime 2) Conc. H_2SO_4 3) P_2O_5 4) $CaCl_2$

65. The catalyst used in the manufacture of ammonia by Haber's process is

1) V_2O_5 2) Fe 3) Ni 4) Co

66. Which of the following compound is not used as fertilizer

1) Ammonium sulphate 2) Urea

3) Calcium super phosphate 4) $Ca_3(PO_4)_2$

67. Which of the following can serve as a solvent for both ionic and covalent compounds?

1) Liquid ammonia 2) H_2O 3) Benzene 4) CCl_4

68. Which of the following is used as refrigerant

1) Liquid NH_3 2) C_2H_5Cl 3) CCl_2F_2 4) All

69. Which of the following reactions yield elementary gases like N_2, H_2, O_3 as the byproducts?

I) $CuO + NH_3 \longrightarrow$ II) $2NH_3 + 2Na \xrightarrow[300-400^{o}O]{Fe}$

III) $8NH_3 + 3Cl_2 \rightarrow$ IV) $2Pb(NO_3)_2 \xrightarrow{\Delta}$

1) I and II only 2) II, III and IV only

3) I, II and III only 4) All of these

Nitric acid

70. Catalyst in the Ostwald's process is

1) Pt 2) Fe 3) V_2O_5 4) Ni

71. Moles of oxygen that can oxidise one mole of NH_3 to NO

1) 1 2) 1.25 3) 2.5 4) 5

72. Which of the following is used in pyro- techniques

1) NH_3 *2)* HNO_3 3) PH_3 4) H_3PO_4

73. Percentage of nitric acid obtained in Ostwald's process is

1) 51% 2) 68% 3) 74% 4) 82%

KEY

1) 3	2) 2	3) 4	4) 2	5) 1	6) 4	7) 2	8) 1
9) 1	10) 3	11) 2	12) 3	13) 4	14) 2	15) 4	16) 1
17) 2	18) 4	19) 1	20) 1	21) 4	22) 2	23) 4	24) 3
25) 1	26) 4	27) 1	28) 4	29) 1	30) 3	31) 3	32) 4
33) 3	34) 4	35) 4	36) 3	37) 1	38) 2	39) 4	40) 3
41) 2	42) 3	43) 3	44) 4	45) 4	46) 2	47) 2	48) 2
49) 3	50) 3	51) 2	52) 2	53) 4	54) 2	55) 2	56) 2
57) 2	58) 2	59) 3	60) 2	61) 2	62) 2	63) 1	64) 1
65) 2	66) 4	67) 1	68) 4	69) 4	70) 1	71) 2	72) 2
73) 2							

(b) GROUP-16 ELEMENTS

SYNOPSIS

1. The elements Oxygen (O), Sulphur (S), Selenium (Se), Tellurium (Te) and Polonium (Po) belong to VI A group.
2. Group VIA elements are called chalcogens as they are mineral forming elements.
3. Pyrolusite (MnO_2), Haematite (Fe_2O_3) are oxide minerals. Copper pyrite ($CuFeS_2$). Zincblend (ZnS), Galena (PbS), Cinnabar (HgS) are sulphide minerals. Gypsum ($CaSO_4.2H_2O$), Barytes ($BaSO_4$) and Epsom salt ($MgSO_4.7H_2O$) are sulphate minerals.
4. Oxygen is the most abundant element in earth's crust. Sulphur is the 16th most abundant element in earth's crust. The order of abundance of VI A group elements is
   O > S > Se > Te > Po
5. Oxygen occurs as oxides, carbonates, sulphates, nitrates and borates. Sulphur mainly occurs as sulphides and sulphates. Oxygen and sulphur are available even in the native state.
6. All the group VIA elements have six electrons (ns^2np^4) in their outermost energy level and tend to attain nearest inert gas electronic configuration by gaining or sharing of two electrons.
7. The elements of group VIA are chemically more similar due to similar valence shell configuration.
8. Oxygen is diatomic. Sulphur. Selenium and Tellurium are octaatomic. Polonium is monoatomic. Tendency to form octaatomic rings is more in S and also in Se.
9. Due to its small size oxygen is capable of forming $p_\pi - p_\pi$ bonds. Hence it exists as a diatomic gas. The remaining elements are not capable of forming π bonds due to their large size and do not exist as diatomic molecules.
10. Atomic and ionic radii increase gradually with increase in atomic number.
11. Oxygen is a gas. but other elements are solids at room temperature.
12. The most common oxidation state of VI A group elements is -2.
13. Oxygen exhibits –2, –1, –1/2, +1 and +2 oxidation states. In oxides, the oxidation state of 'O' is – 2, in peroxides, – 1 and in super oxides, –1/2. in O_2F_2, +1 and in OF_2,+ 2.
14. Oxygen does not exhibit higher oxidation states due to lack of 'd' orbitals in its valency shell.
15. Other elements exhibit – 2, +2 in ground state, +4 in first excited state and +6 in second excited state. Tendency to form –2 state decreases down the group due to decrease in electronegativity.
16. Oxygen lias two allotropcs. both are non metallic gases. Oxygen is stable diatomic gas and paramagnetic. Ozone is unstable triatomic gas and diamagnetic.
17. Sulphur exists in several non-metallic allotropic forms. The different forms arise partly from the extent to which S has polymerized and partly from the crystal structures adopted.
18. Rhombic or octahedral or a-sulphur is the common crystalline form of sulphur. Pale yellow in colour. It consists of S_8 structural units packed together into octahedral shape. It is the stable variety at ordinary temperature.

19. Monoclinic or prismatic or β -sulphur is stable above 95.6°C. Thus 368.5K is the transition temperature of $S_{(R)} \rightarrow S_{(M)}$

20. α, β (i and γ -forms are all in puckered riug structures and differ in density. The atoms in the ring lie in two parallel planes with angle 105° and bond length equal to 2.12A^0.

21. The S_8 units break around 160°C. On further healing above it's melting point .S, units dissociates in to S_6, S_4, S_2 units.

22. Elements of VI A form H_2M type covalent hydrides. These hydrides are produced by the action of water or acid on metal chalcogenides.

23. H_2O and H_2S are exothermic compounds, while H_2Se and H_2Te are endothermic compounds.

24. Non-poisonous hydride of VI A group which exists in liquid state is H_2O. Other gases are poisonous and bad smelling.

25. H_2S is gas but H_2O is liquid, because of absence of molecular association in H_2S

26. The tendency of formation of hydrides decreases from O to Po. due to decrease in electronegativity.

27. Thermal stability and bond energy values of the hydrides decrease from H_2O to H_2Po. Reduction ability increases from H_2O to H_2Po.

28. Hydrides are weak acids. Acidic nature increases from H_2O to H_2Te due to increase in their K_a values.

29. Order of boiling points : $H_2O > H_2Te > H_2Se > H_2S$. Volatility is in reverse order.

30. Water has higher boiling point than other VIA hydrides due to inter molecular hydrogen bonding.

31. In H_2O molecule, sp^3 hybrid orbitals are involved in bonding. While in other hydrides, pure p-orbitals are involved in bonding. In H_2O the bond angle is $104^{o}2^{|}$.In other hydrides the bond angle is around 90°.

32. All elements of group VIA generally form dioxides and trioxides. MO_2 type are : SO_2, TeO_2 and PoO_2. MO_3, type are : SO_3, SeO_3 and TeO_3. Except SO_2 all other dioxides are solids.

33. Sulphur dioxide is produced by burning sulphur or roasting of metal sulphides in air.

34. Solubility of dioxides decreases from SO_2 to PoO_2. SO_2 is highly soluble in water.

35. Dioxides dissolve in water and form -ous acids.The strength of the oxy acids is in the order: $H_2SO_3 > H_2SeO_3 > H_2TeO_3$.

36. SO_2 can act as'reducing agent in acid and neutral media.

37. SO_2 reduces acidified yellow $K_2Cr_2O_7$ into green $Cr_2(SO_4)_3$

38. SO_2 bleaches by reduction in presence of moisture. It's bleaching action is temporary. During the bleaching action SO_2 is oxidised to H_2SO_4.

39. SO_2 forms addition compounds with halogens.
eg. SO_2Cl_2 (Sulphuryl chloride)

40. SO_2 is the anhydride of sulphurous acid. It is angular with bond angle 119^{o} 30'. It has one $P_\pi - P_\pi$ and one $P_\pi - d_\pi$ bond. Its bond length is 1.43A^{o}.

41. Liquid SO_2 is used as solvent for organic and inorganic chemicals.
42. VIA group elements form M_2X_2, MX_2, MX_4 and MX_6 type halides. Oxidation states of VI A group elements in these halides arc +1, +2, +4 and +6 respectively.
43. Compounds of oxygen with fluorine are called oxygen fluorides, because fluorine is more electronegative than oxygen.
44. Group VIA elements form MX_6 type of hexahalides. Among hexahalides. only hexa fluorides are stable. They have octahedral structures.
45. SF_4 is highly reactive gas. It is thermally Stable. It is fluorinating agent. SCl_4 is formed by direct reaction of sulphur with chlorine. SCl_4 is an unstable liquid.
46. Many oxyacids of sulphur are known as unions and salts. Oxo anions have strong π bonds which prevent polymerization.
47. Sulphurous acid series : Oxidation state of S

Sulphurous acid. H_2SO_3	+ 4
Thiosulphurous acid, $H_2S_2O_2$	+ 4, -2
hvdrosulpburous acid. $H_2S_2O_4$	
Pyrosulphurous acid. $H_2S_2O_5$	+ 5, + 3

48. Sulphuric acid series : Oxidation state of S

Sulphuric acid, H_2SO_4	+ 6
Thiosulphuric acid. $H_2S_2O_3$	+ 6,-2
Pyrosulphuricacid	
(or) Disulphuric acid, $H_2S_2O_7$	+ 6, + 6

Peroxo acid series : Oxidation state of S

Permouo sulphuric acid, $H_2S_2O_7$	+ 6
(Caro's acid)	
Perdisulphuric acid. $H_2S_2O_8$	+ 6, + 6
(Marshall's acid)	

50. H_2SO_5 is called Caro's acid and $H_2S_2O_8$ is called Marshall's acid.
51. In all oxyacids of sulphur the basicity is 2. sp^3 hybridisation takes place in all acids. All pi bonds are p_π-d_π bonds.
52. Ozone can be prepared by silent electric discharge on pure dry oxygen gas. Formation of ozone is reversible and endothermic process.
53. Ozone is heavier than air. poisonous and slightly soluble in water. It is highly soluble in turpentine oil or glacial acetic acid.
54. Ozone is thermodynamically unstable. The decomposition is exothermic. It is a powerful oxidizing agent, next to F_2. Ozone oxidises black lead sulphide to white lead sulphate. HCl to Cl_2 and iodide to I_2.
55. Nitric oxide can caue depptetion of ozone in the upper atmosphere.
56. Ozone acts as bleaching agent. Ozone bleaches by oxidation. Ozone is dry bleach for oils, ivory etc.

57. Ozone is used as an insecticide, bactericide, for purifying water and atmosphere, manufacture of potassium permanganate.

58. Sulphuric acid (H_2SO_4) is also called as oil of vitriol' or 'king of chemicals'.

59. Sulphuric acid is commercially prepared by Contact process. It involves three main steps : formation of SO_2 by burning of 'S' (or) iron pyrites in oxygen, catalytic oxidation of SO_2 into SO_3 and absorption of SO3 into H_2SO_4.

60. Pure SO_3 obtained is absorbed in 98% cone. ($H_2S_2O_7$) to form oleum (orj pyrosulphuric acid ($H_2S_2O_7$). Oleum is diluted with water to obtain H_2SO_4 of desired concentration.

61. Because of its low- volatility, sulphuric acid is used to prepare volatile acids from their corresponding salts

62. Sulphuric acid is a strong dehydrating agent and moderately oxidising agent.

Question Bank - I

General Characteristics

1. Which of the following set of atomic numbers belongs to group 16 elements ?
   1) 56, 37, 20 2) 52, 8, 84 3) 14, 32, 50 4) 36, 9, 17
2. Oxygen and Sulphur have same
   1) outer electronic configuration 2) Atomic size
   3) electronic configuration 4) electron affinity
3. Element with the lowest atomicity
   l) Te 2) S 3) Se 4) Po
4. The number of atoms present in one molecule of rhombic sulphur is
   1) 2 2) 4 3) 6 4)8
5. The total number of covalent bonds present in one S_8 molecule is
   1) 4 2) 6 3) 8 4) 10
6. The S - S - S bond angle in S_8 molecule is
   1) 109.5^0 2) 105^0 3) 120^0 4) 60^0
7. The decreasing tendency to exist in puckered 8 - membered ring structure is
   1) S > Se > Te > Po 2) Se > S > Te > Po
   3) S > Te > Se > Po 4) Te > Sc > S > Po
8. S_2 molecule in vapour state is paramagnetic due to the presence of unpaired electrons is
   1) Bonding orbitals 2) Anti bonding σ*orbitals
   3) Anti bonding π* orbitals 4) Bonding π orbitals
9. α, β and γ forms of sulphur differ in
   1) Overal packing of rings 2) Molecular weight
   3) Atomicities 4) Their ring sructure
10. The oxidation state of oxygen is zero in
    1) CO 2) O_3 3) SO_2 4) H_2O_2
11. In which of the following compounds, oxygen exhibits +2 oxidation state ?

1) H_2O 2) H_2O_2 3) OF_2 4) H_2SO_4

12. Which of the following element does not show an oxidation state of +4 ?

1) Oxygen 2) Sulphur 3) Selenium 4) Tellurium

13. Generally oxygen is convened into its ion by

1) Losing electrons 2) Increasing oxidation number

3) Decreasing atomic size 4) Gaining electrons

14. If X is a member of chalcogen family, the highest stability of X^{-2} is exhibited by

1) Oxygen 2) Selenium 3) Tellurium 4) Sulphur

15. Oxygen is always divalent while sulphur can form 2. 4 and 6 bonds because

1) Oxygen is more electronegative than sulphur

2) Sulphur has vacant d-orbitals while oxygen does not

3) Sulphur has large atomic radius than oxygen

4) Sulphur is more electronegative than oxygen.

16. In sulphate ion the oxidation state of sulphur is +6 and the hybridization state of sulphur is

1) sp 2) sp^2 3) sp^3 4) sp^2 or sp^3d^2

17. The second most electronegative element in periodic table is

1) F 2) O 3) Cl 4) N

18. Which of the following has higher IP

1) Oxygen 2) Sulphur 3) Selenium 4) Tellurium

19. Element with higher catenation capacity is

1) S 2) Se 3) Te 4) Po

20 The order of electron gain enthalpy of VI A group elements is

1) $S > Se > Te > Po > O$ 2) $S > Se > Te > 0 > Po$

3) $O > Sc > S > Te > Po$ 4) $O > Te > Se > S > Po$

21. The most common oxidution state of VI A group elements is

l) -2 2) 42 3) +4 4) +6

22. Chair form of S_6 rings are present in

1) α - sulphur 2) β - sulphur 3) Engle's sulphur 4) γ - sulphur

Hydrides

23. The pair of exothermic hydrides of VI A group are

1) H_2O, H_2S 2) H_2O, H_2Se 3) H_2Se, H_2Te 4) H_2S, H_2Te

24. Which is non poisonous hydride ?

1) H_2O 2) H_2S 3) H_2Se 4) H_2Te

25. Sulphuruses .... orbitals for bonding in H_2S

1) sp^5 2) sp^2 3) one s and one p 4) pure p orbitals

26. A stronger reducing agent is

1) H_2O 2) H_2S 3) H_2Se 4) H_2Te

27. Correct decreasing order of volatility is

1) $H_2O > H_2S > H_2Se$ 2) $H_2S > H_2O > H_2Se$
3) $H_2Se > H_2O > H_2S$ 4) $H_2S > H_2Se > H_2O$

28. Hie most acidic and thennally stable hydride of cbalcogens are respectively

1) H_2O, H_2Te 2) H_2Te,H_2S 3) H_2S, H_2Te 4) H_2Te,H_2O

29. In the hydrides of VIA elements largest bond angle and bond length is observed respectively in

1) H_2O, H_2O 2) H_2Po, H_2O 3) H_2O, H_2Po 4) H_2S, H_2Se

30. The effect of repulsion between the two lone pairs of electrons present on oxygen in H_2O molecule is

1) no change in H-O-H bond angle 2) increase in H-O-H bond angle
3) decrease in H-O-H bond angle 4) all atoms will be in one plane

31. Which of the following is a weakest acid in its aqueous solution ?

1) H_2Te 2) H_2Se 3) H_2S 4) H_2Po

32. Which of the following is least covalent hydride?

1) H_2O 2) H_2S 3) H_2Se 4) H_2Te

33. The bond angle in H,S is

1) 109°28’ 2) 104°51’ 3) 120° 4) 92.5°

Halides and oxides

34. The element of VI A group which cannot form hexahalides is

1) O 2) S 3) Se 4) Te

35. The hybridization of S in SF_4 is

1) sp^3d^2 2) sp^3d 3) sp^3d^3 4) sp^3

36. The least stable dioxide of group 16 elements is

1) SO_2 2) SeO_2 3) TeO_2 4) PoO_2

37. The oxide obtained in the roasting of ironpyrites

1) SO_2 2) SeO_2 3) FeO 4) SO_2 and SO_2

38. Among hexahalides of VIA group, the stable halides are

1) hexa iodides 2) hexa bromides 3) hexa chlorides 4) hexa fluorides

39. SO_2 bleaches by

1) Reduction 2) Oxidation 3) Hydrolysis 4) Acidic nature

40. The hybridization of sulphur in SO_2 is

1) sp 2) sp^3 3) sp^2 4) dsp^2

41. In SO_2 two oxygen atoms are linked to the sulphur atom through double bonds. The two π bonds ar

1) both $P\pi - P\pi$ 2) both $P\pi - d\pi$
3) both $d\pi - d\pi$ 4) one $d\pi - d\pi$, amt one $P\pi - P\pi$

42. SO_2 forms an addition compound sulphuryl chloride with Cl_2 in presence of

1) Charcoal 2) CCl_4 3) $H^+/K_2Cr_2O_7$ 4) H^+/KMO_4

Oxy Adds

43. In $HO-\overset{\overset{S}{\|}}{S}-OH$ the oxidation states of S are

1) + 4, -2 2) + 4, 0 3) +2, -2 4) + 4, -4

44. Acid that contains S-O-S linkage is

1) $H_2S_2O_7$ 2) $H_2S_2O_5$ 3) $H_2S_2O_6$ 4) $H_2S_2O_4$

45. Which of the following has S - S bond ?

1) $H_2S_2O_2$ 2) $H_2S_2O_7$ 3) mustard gas 4) $H_2S_2O_6$

46. Peroxy linkage is present in

1) $H_2S_2O_2$ 2) $H_2S_2O_3$ 3) $H_2S_2O_6$ 4) $H_2S_2O_8$

47. Pyrosulphurous acid is

1) $H_2S_2O_5$ 2) $H_2S_2O_2$ 3) $H_2S_3O_3$ 4) $H_2S_2O_4$

48. Basicity of any oxyacid of sulphur is

1) 3 2) 4 3) 2 4) l

49. Partial neutralisation of sulphuric acid gives

1) Sulphites 2) Bisulphates 3) Sulphates 4) Bisulphites

50. Hybridisation of central sulphur iti all oxo anions of sulphur is

1) sp^3d 2) sp^3 3) sp^3d^2 4) sp^3d

51. What is^the number of sigma and pi bonds present in H_2SO_4 molecule ?

1) 6_σ and 2_π 2) 6_σ and 0_π 3) 2_σ and 4_π 4) 2_σ and 2_π

52. Permonosulphuric acid is known as

1) Marshall's acid 2) Caro's acid 3) Sulphuric acid 4) Sulphurous add

Ozone

53. The formation of O_3 from O_2 is

1) exothermic and reversible 2) endothermic and irreversible
3) endothermic and reversible 4) exothermic and spontaneous

54. O_3 is prepared by subjecting O_2 to silent electric discharge. The favourable conditions for the formation of ozone according to Le-chatlicr's principle are

1) low temperature, low pressure 2) high temperature, high pressure
3) low temperature, high pressure 4) high temperature, low pressure

55. Mercury sticks to glass when it comes in contact with

1)H_2O 2) HNO_3 3) I_2 4) O_3

56. Decomposition of Ozone into Oxygen has

I) $\Delta G = -$ ve 2) $\Delta S = -$ ve 3) $\Delta H = \bullet$ ve 4) All of these

57. Dry bleaching agent is

l)O_3 2) SO_2 3) Cl_2 4) H_2O_2

58. A black compound 'X' when treated with O_3 turned white. The compound 'X' is

1) ZnS 2) PbS 3) CuS 4) Ag_2.S

59. The O-O bond length in Ozone is
1) $1.33A^0$ 2) $1.2\ 8A^0$ 3) $1.48A^0$ 4) $1.39A^0$

60. With respect to both oxygen and ozone, which one of the following statements is not correct?
1) They are allotropes together 2) oxygen is colourless w'hile ozone is coloured
3) valency of oxygen is 2 in both 4) oxygen has 2 bonds and ozone has 3 bonds

61. In which of the following reactions, ozone acts as a reducing agent
1) $BaO_2 + O_3 \rightarrow BaO + 2O_2$ 2) $2HCl+O_3 \rightarrow Cl_2+H_2O+O_2$
3) $PbS+4O_3 \rightarrow PbSO_4 +4O_2$ 4) $2KI + O_3 + H_2O \rightarrow 2KOH + I_2+ O_2$

62. Which one of the following reactions docs not occur ?
1) $BaO + O_3 \rightarrow BaO_3 + O_2$ 2) $PbS + 4O_3 \rightarrow PbSO_4 + 4O_2$
3) $H_2O_2 + O_3 \rightarrow H_2O + 2O_2$ 4) $2Hg + O_3 \rightarrow Hg_2O + O_2$

Sulphuric acid

63. Oil of vitriol is
l) H_2SO_4 2) H_2SO_3 3) $H_2S_2O_7$ 4) $H_2S_2O_3$

64. The catalyst used in the manufacture of H_2SO_4 by contact process is
1) $A1_2O_3$ 2) Cr_2O_3 3) V_2O_5 4) MnO_2

65. In the preparation of H_2SO_4
1) SO_2 is dissolved in H_2SO_4 2) SO_2 is dissolved in water
3) SO_3 is dissolved in cone. H_2SO_4 4) SO_3 is dissolved in dilute H_2SO_4

66. Poison for platinum, a catalyst in Contact process is
1) S 2) P 3) As 4) C

67. In Contact process impurities of arsenic are removed by :
1) $Al(OH)_3$ 2) $Fe(OH)_3$ 3) $Cr(OH)_3$ 4) Fe_2O_3

68. Oleum or fuming H_2SO_4 is
1) A mixture of conc. H_2SO_4 and oil
2) Sulphuric acid which gives fumes of sulphur dioxide
3) Sulphuric acid saturated with sulphur trioxide, i.e, $H_2S_2O_7$
4) A mixture of sulphuric acid and nitric acid

69. The common impurity in sulphur dioxide used in contact process
l) SO_2 2) CO_2 3) As 4) As_2O_3

70. Practical pressure utilised in contact tower
1) 2 bar 2) 0.2 bar 3) 20 bar 4) 200 bar

71. Hypo is a salt of the oxyacid
1) thiosulphuric acid 2) Thiosulphurous acid
3) dithionous acid 4) dithionic acid

KEY

1) 2	2)1	3)4	4)4	5) 3	6) 2	7) 1	8) 3
9) 1	10) 2	11) 3	12) 1	13) 4	14) 1	15) 2	16) 3
17)2	18)1	19)1	20)1	21) 1	22) 3	23) 1	24) 1
25)4	26) 4	27) 4	28) 4	29) 3	30) 3	31) 3	32) 1
33) 4	34) 1	35) 2	36) 4	37) 1	38) 4	39) 1	40) 3
41) 4	42) 1	43) 1	44) 1	45) 4	46) 4	47) 1	48) 3
49) 2	50) 2	51) 1	52) 2	53) 3	54) 2	55) 4	56) 1
57) 1	58) 2	59) 2	60) 3	61) 1	62) 1	63) 1	64) 3
65) 3	66) 3	67) 2	68) 3	69) 4	70) 1	71) 1	

Question Bank - II

General Characteristics

1. Most abundant element in earth crust is

1) O 2) Se 3) S 4) Te

2.

LIST-1	List-2
A) Gypsum	1) PbS
B) Baryts	2) ZnS
C) Galena	3) $BaSO_4$
D) Zinc blende	4) $CaSO_4.2H_2O$
	5) Fe_3O_4

The correct match is

	A	B	C	D		A	B	C	D
1)	4	5	1	3	2)	3	5	1	2
3)	4	3	1	2	4)	3	4	1	2

3. Oxygen exhibits least oxidation state in

1) OF_2 2) KO_2 3) H_2O 4) H_2O_2

4. Polyanion formation is maximum in

1) Nitrogen 2) Oxygen 3) Sulphur 4) Boron

5. In a compound of sulphur, the sulphur atom is in second excited state. The possible hybridisation of sulphur is

1) sp^2 2) sp^3

3) sp^3d^2 4) sp^2 (or) sp^3 (or) sp^3d^2

6. Which of the following has strong metallic interactions ?

1) O 2) S 3) Se 4) Te

Hydrides

7. Among the following, the weakest conjugate base is

1) OH^- 2) SH^- 3) SeH^- 4) TeH^-

8. The geometry of H_2S and its dipole moment are

1) Angular and non zero 2) Angular and zero

3) Linear and non zero 4) Linear and zero

9. In which of the following bond angle can not be explained by Valence Bond Theory ?

1) H_2O 2) H_2Po 3) H_2 S 4) H_2Te

Halides and oxides

10. Which among the following compound cannot be prepared by direct union of elements ?

1) SF_6 2) Se_2Br_2 3) S_2Cl_2 4) SF_4

11. The shape of sulphur hexafluoride molecule is

1) Tetrahedral 2) Square planar

12. Which of the following can give an oxy acids when dissolved in H_2O ?

l) Cl_2O 2) SO_3 3) SO_2 4) All

13. Which is an amphoteric oxide ?

1) SO_2 2) B_2O_3 3) ZnO 4) Na_2O

14. The acidic character of dioxides of members of oxygen family decreases in the order

1) $SeO_2 > SO_2 > TeO_2 > PoO_2$ 2) $SO_2 > SeO_2 > TeO_2 > PoO_2$

3) $PoO_2 > TeO_2 > SeO_2 > SO_2$ 4) $TeO_2 > PoO_2 > SeO_2 > SO_2$

15. One gas bleaches the colour of the flowers reduction while the other by oxidation in presence of moisture. The gases are

1) CO and CO_2 2) H_2S and Br_2 3) SO_2 and Cl_2 4) NH_3 and SO_3

16. When moist coloured flowers are added in to SO_2 gas the flowers are decolourised because

1) SO_2 absorbs colouring matter 2) SO_2 oxidised vegetable colouring matter

3) SO_2 reduces vegetable colouring matter4) SO_2 gives colourless product

17. Sulphurous anhydride is

1) SO_2 2) SO_3 3) HSO_3^- 4) SO_3^{2-}

18. Which of the following dissolves in water but not give any oxyacid solution ?

1) SO_2 2) OF_2 3) SCl_2 4) SO_2

Oxyarids

19. Which of the following has S – O – S bond in it is

1) pyrosulphurous acid 2) Oleum

3) Caro's acid 4) Marshal's acid

20. The ratio of $p_\pi - d_\pi$ bonds is SO_2 and SO_3 molecules

1) 1 : 1 2) 1 : 2 3) 2 : 1 4) 2 : 3

21. A salt of sulphurous acid is called

1) Sulphate 2) Sulphurate 3) Sulphite 4) Sulphide

22.

LIST - I	LIST - II
A) H_2SO_4	1) + 4
B) $H_2(S)_nO_6$	2) + 3
C) H_2SO_3	3) + 2 , -2
D) $H_2S_2O_4$	4) + 6
	5) + 5, 0

The correct match is

	A	B	C	D		A	B	C	D
1)	2	5	2	4	2)	3	2	1	4
3)	4	5	1	2	4)	2	3	1	5

23. Number of hydroxyl groups present in pyrosulphuric acid is

1) 3 2) 4 3) 2 4) 1

24. The acid containing S - O - O - S bond is

1) H_2SO_5 2) $H_2S_2O_7$ 3) $H_2S_2O_6$ 4) $H_2S_2O_8$

25. S - S bond is not present in

1) Pyro sulphurous acid 2) Dithionic acid

3) Dithionous acid 4) Pyro sulphuric acid

26. Oxidation state of S in H_2SO_5 and $H_2S_2O_8$ respectively are

1) +6, +6 2) +6, +4 3) +8, +7 4) +4, +4

27. Iron sulphide is heated in air to form A. an oxide of sulphur. A is dissolved in water to give an acid. The basicity of this acid is

1) 2 2) 3 3) 1 4) zero

28. Identify the correct sequence of increasing number of π-bonds in the structures of the following molecules.

I. $H_2S_2O_6$ II. H_2SO_3 III. $H_2S_2O_5$

1)1, II, III 2) II, III, I 3) II, I, III 4) I, III, II

29. The number of sigma and pi bonds in peroxodisulphuric acid are respectively

1) 9 and 4 2) 11 and 4 3) 4 and 8 4) 4 and 9

Ozone

30. Select the wrong statement

1) Ozone is a pale blue gas 2) O_3 acts as both oxidant and reductant

3) Ozone is used as an antiseptic inhaler 4) Ozone is used in sterlization of water

31. Pure ozone is

1) Pale blue gas 2) Dark blue liquid 3) Violet black solid 4) All the above

32. The incorrect statement among the following is

1) Ozone is an angular molecule 2) O_3 is a piosonous gas

3) O_3 is highly soluble in water 4) Ozone is present in stratosphere

33. Which of the following conversion is not brought about by ozone

1) HF to F_2 2) Moist KI to I_2 3) Ag_2O to Ag 4) PbS to $PbSO_4$

34. Number of volumes of Oxygen that gives 4 volumes of Ozone is
1) 4 2) 6 3) 8 4) 2

35. Starch paper moistened with KI solution turns blue in ozone because of
1) Iodine liberation 2) Oxygen liberation 3) Alkali formation 4) Ozone is acidic

36. Higher concentrations of ozone is characterised as
1) Dangerously explosive 2) Harmless gas
3) Both 1 and 2 4) None of these

37. Which of the following is not correct ?
$3O_2 \xrightarrow[\text{discharge}]{\text{Silent electric}} 2O_3; \Delta H = -284.5 \text{ KJ}$
2) Ozone undergoes addition reaction with unsaturated carbon compounds.
3) Nitrogen oxides emitted from jet planes might be slowly depleting ozone.
4) Ozone oxides lead sulphide to lead sulphate

38. Ethylene on reaction with ozone gives
1) Glyoxal 2) Formaldehyde 3) Ethylene ozonidc 4) Acetaldehyde

Sulphuric acid

39. Which characteristic property of H_2SO_4 is responsible for its chcmcial properties
1) low boiling point 2) weak acidic nature 3) acting as rcductant 4) affinity for water

40. Pick out the ideal condition for H_2SO_4 manufactured by Contact process
1) Low temperature, high pressure and high concentration of reactants
2) Low temperature, low pressure and low concentration of reactants
3) High temperature, high pressure and high concentration of reactants
4) Low temperature, low pressure and high concentration of reactants

KEY

1) 1	2) 3	3) 3	4) 3	5) 4	6) 4	7) 4	8) 1
9) 1	10) 4	11) 4	12) 4	13) 3	14) 2	15) 3	16) 3
17) 1	18) 2	19) 2	20) 2	21) 3	22) 3	23) 3	24) 4
25) 4	26) 1	27) 1	28) 2	29) 2	30) 3	31) 4	32) 3
33)1	34)2	35)1	36) 1	37) 1	38) 3	39) 4	40) 1

Question Bank - III

1. The total number of lone pairs of electrons present in a S_8 molecule.
1) 8 2) 16 3) 12 4) 4

2. The chalcogen having same number of electrons both in penultimate and antipenultimate shells is
1) O 2) S 3) Se 4) Te

3. The number of paired and unpaired electrons in the valence shell of the members of oxygen family are
1) 4 and 2 2) 2 and 4 3) 3 and 3 4) 2 and 3

4. The oxidation state of sulphur in the anions follow the order

1) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$ 2) $S_2O_4^{2-} < S_2O_3^{2-} < S_2O_6^{2-}$

3) $S_2O_4^{2-} < S_2O_6^{2-} < S_2O_3^{2-}$ 2) $S_2O_6^{2-} < S_2O_4^{2-} < S_2O_3^{2-}$

5. In which allotropic form of sulphur, puckered S_8 rings are not present ?

1) Chair form of sulphur 2) Rhombic sulphur

3) Monoelinie sulphur 4) γ - monoclinic sulphur

6. Which of the following order is wrong ?

1) $H_2O > H_2S > H_2Se > H_2Te$ (Thermal stability)

2) $H_2S < H_2Se < H_2Te < H_2O$ (Boiling points)

3) $H_2O < H_2S < H_2Se < H_2Te$ (pKa value)

4) $O-H > S-H > Se-H > Te-H$ (Bond Energy)

7. The hydride of group 16 elements which shows greater Lewis base character

1) H_2O 2) H_2Te 3) H_2S 4) H_2Se

8. Regarding H_2O the wrong statement is

1) H_2O is an exothermic compound 2) It is an associated liquid

3) Central atom is sp^3 hybridised 4) It is an excellent solvent for covalent compounds

9. Amongst H_2O, H_2S, H_2Se and H_2Te. the one with the highest boiling point is

1) H_2O because of hydrogen bonding 2) H_2Te because of higher molecular weight

3) H_2S because of hydrogen bonding 4) H_2Se because of lower molecular weight

10. Regarding SF_6 the wrong statement is

1) It is inert and does not undergo hydrolysis

2) It is a covalent compound

3) Hybridisation of S is sp^3d^2 and shape is octahedral

4) S forms SF_6 in third excited state

11. Sulphur shows maximum coordination number in SX_n. where ‘X’ is

1) F 2) Br 3) 1 4) Cl

12. The statements about oxides of chalcogens

i) The solubility of dioxides decreases from SO_2 to PoO_2

ii) TeO_2 is highly acidic in nature

iii) Trioxides are more acidic than dioxides The correct combination is

1) Both i & iii arc correct 2) All are correct

3) Only iii is correct 4) Both i & ii are correct

13. The molecule having one $p\pi - p\pi$ and two $p_\pi - d_\pi$ bonds is

1) SO_2 2) SO_3 3) CO_2 4) N_2

14. Which of the following is oxidised by SO_2 ?

l) Mg 2) $K_2Cr_2O_7$ 3) $KMnO_4$ 4) All

15. In aqueous solutions H_2SO_4 ionises as :

$$H_2SO_4 + H_2O \rightleftharpoons HSO_4^- + H_3O^{\bullet} ; Ka_1$$

$HSO_4^- + H_2O \rightleftharpoons SO_4^{2-} + H_3O^{\bullet} ; Ka_2$ is

The relation between Ka_1 and Ka_2 is

1) $Ka_1 < Ka_2$ 2) $Ka_1 > Ka_2$ 3) $Ka_1 = Ka_2$ 4) $2Ka_1 = 3Ka_2$

16. Single bond between sulphur atoms is present in

1) $H_2S_2O_7$ 2) $H_2S_2O_8$ 3) $H_2S_2O_6$ 4) $H_2S_2O_3$

17. Which of the following does not have S-S linkage ?

1) $S_2O_8^{2-}$ 2) $S_2O_6^{2-}$ 3) $S_2O_5^{2-}$ 4) $S_2O_3^{2-}$

18. Which of the following statements regarding the manufacture of H_2SO_4 by Contact process is not true ?

1) Sulphur is burnt in air to form SO_2 2) SO_2 is catalytically oxidised to SO_3

3) SO_3 is dissolved in water to get 100% sulphuric acid

4) H_2SO_4 obtained by Contact process is of higher purity than that obtained by other methods

19. In the preparation of H_2SO_4 by Contact process V_2O_5 is used as a catalyst in the reaction.

1) $S + O_2 \rightarrow SO_2$ 2) $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$

3) $SO_3 + H_2O \rightarrow H_2SO$ 4) $2SO_2 + O_2 \rightarrow 2SO_3$

20. Which statement is correct ?

1) Ozone is a resonance hybrid of oxygen

2) Ozone is an allotropic modification of oxygen

3) Ozone is an isomer of oxygen

4) Ozone has no relationship with oxygen

21. Which gas is used to improve the atmosphere of crowded places ?

1) H_2 2) O_2 3) O_3 4) N_2O

22. Ozonization of water is carried out to remove

1) Bacterial impurities 2) Bad taste

3) Excess of chlorine present 4) Calcium and magnesium salt present in it

23. $C_{12}H_{22}O_{11} \xrightarrow{H_2SO_4} H_2O + A.$

$A \xrightarrow{H_2SO_4} B + C + H_2O$

If the compound C is an oxide of group VIA element then the compound B is

1) SO_2 2) CO 3) CO_2 4) C_3O_2

24. All of the following decompose easily on heating to give O_2 except

1) HgO 2) MnO_2 3) $Pb(NO_3)_2$ 4) $NaN0_3$

25. In the preparaiton of O_2 from $KClO_3$, MnO_2 acts as

1) Activator 2) Catalyst 3) Oxidizing agent 4) Dehydrating agent

26. Oxygen is liberated from water using

1) P 2) Na 3) F_2 4) I_2

27. The gases absorbed by alkaline pyrogallol and turpentine oil respectively are

1) O_3, CH_4 2) O_2, O_3 3) SO_2, CH_4 4) N_2O, O_3

28. Regarding oxygen the correct statements are

A) It is an important constituent of rocket fuels

B) It is used for artificial respiration

C) It is used in oxyacetylene welding.

1) A, B 2) B, C 3) A, C 4) A, B, C

29. Concentrated H_2SO_4 is not used to prepare HBr from KBr because it

1) Oxidizes HBr 2) Reduces HBr

3) Causes disproportionation of HBr 4) Reacts too slowly with KBr

30. Most acidic oxide in group VIA is formed by

1) oxygen 2) sulphur 3) nitrogen 4) chlorine

31. The element which evolves two gases on reacting with conc. H_2SO_4 is

1) Si 2) C 3) S 4) P

32. H_2SO_4 has very corrosive action on skin because

1) It reacts with proteins 2) It acts as an oxidizing agent

3) It acts as dehydrating agent

4) It acts as dehydrating agent and absorption of water is highly exothermic

33. A student accidently splashes few drops of conc. H_2SO_4 on his cotton shirt. After a while, the splashed parts blacken and the holes appear. This has happened because sulphuric acid

1) Dehydrates the cotton with burning 2) Causes the cotton to react with air

3) Heats up the cotton 4) Removes the elements of water from cotton

34. Sulpuric acid is used

A) In petroleum refining B) In galvanising C) In making fertilizers

1) A, B 2) B, C 3) A, C 4) A, B, C

35. Which reaction represents the oxidizing behaviour of H_2SO_4 ?

1) $2PCl_5 + H_2SO_4 \longrightarrow POCl_3 + 2HCl + SO_2Cl_2$

2) $2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

3) $NaCl + H_2SO_4 \longrightarrow NaHSO_4 + HCl$

4) $2HI + H_2SO_4 \longrightarrow I_2 + SO_2 + 2H_2O$

36. Which substance chars when warmed with conc. H_2SO_4 ?

1) Protein 2) Fat 3) Hydrocarbon 4) Carbohydrate

37. HCOOH reacts with conc. H_2SO_4 to produce

1) CO 2) CO_2 3) NO 4) NO_2

38. Ozone oxidises iodide to

1) iodine 2) hypoiodite 3) iodate 4) periodate

KEY

1) 2	2) 4	3) 1	4) 1	5) 1	6) 3	7) 1	8) 4
9) 1	10) 4	11) 1	12) 1	13) 2	14) 1	15) 2	16) 3
17) 1	18) 3	19) 4	20) 2	21) 3	22) 1	23) 3	24) 2
25) 2	26) 3	27) 2	28) 4	29) 1	30) 2	31) 2	32) 4
33) 4	34) 4	35) 4	36) 4	37) 1	38) 1		

(c) GROUP-17 ELEMENTS

Synopsis:

1. Fluorine, chlorine, bromine and iodine are collectively known as halogens (sea salt producers).
2. Halogens are very reactive non metals. Therefore they do not occur in free state. They occur in the combined state as halides. Iodine is also available as $NaIO_3$.
3. Synthetically made element of group VIIA is astatine. It is radioactive short lived element.
4. The general outer electronic configuration of the halogens is $ns^2\ np^5$.
5. Fluorine is the most reactive element. It is regarded as super halogen
6. Halogens are diatomic molecules, van der Waals forces of attraction between molecules increases from fluorine to iodine.
7. Gaseous elements in VIIA group are fluorine and chlorine. Bromine is a liquid, iodine is a subliming solid.
8. The melting points and the boiling points increase from fluorine to iodine due to increase in van der Waals forces. But volatile nature decreases down the group.
9. Atomic volume and density increase from Fluorine to iodine. The size of atoms and the ions also increase gradually.
10. Ionisation energies decrease from fluorine to iodine.
11. Fluorine has abnormally high ionisation energy due to its small size and electrons in it are held strongly by the nucleus
12. The decreasing order of bond energies is : $Cl_2 > Br_2 > F_2 > I_2$. Low bond energy of fluorine is responsible for its high reactivity.
13. According to Mulliken, Cl_2, Br_2 and I_2 form multiple bonds due to overlapping of d- and p- orbitals. Fluorine has no such bonds due to lack of'd' orbitals. Hence bond energy is expected to be less.
14. According to Coulson, small sized flurione results in greater inter electronic repulsions, which is responsible for low bond dissociation energy in fluorine.
15. Fluorine has the highest electronegativity (4.0) on Pauling scale. Electronegativity decreases down the group.
16. Order of electron affinities : $Cl > F > Br > I$. Small size and greater repulsion of electrons are responsible for low electron affinity of fluorine than chlorine.
17. Mostly halogens form ionic compounds with metals. Metallic fluorides are all ionic except BeF_2.
18. Covalent bond is formed between two halogen atoms. The compounds formed between halogens and other non metals are covalent.
19. Fluorine is always univalent. Fluorine exhibits -1 oxidation state, since it is the

most electronegative element.

20. Most common covalency of Cl, Br or I is 1, but highest valency is 7.

21. Common oxidation state of halogens is -1. Except fluorine other halogens can also exhibit +1, +3, +5 and +7.

22. Fluorine cannot exhibit variable valencies due to the absence of 'd' orbitals. Cl, Br and I exhibit higher oxidation states in different excited states and undergo various types of hybridisations.

23. Halogens are strong oxidising agents due to high electron affinity values. The oxidising capacity decreases from fluorine to iodine.

24. The oxidising capacity depends on the net enthalpy change in the following reaction, which can be estimated by the application of Born-Haber cycle.

$$\frac{1}{2}X_{2(s)} + \bar{e} + aq \rightarrow x^{-}_{(aq)}$$

25. The energies involved in this reaction are : enthalpy of fusion, enthalpy of vapourisation, enthalpy of bond dissosciation, electron gain enthalpy and enthalpy of hydration.

26. F_2 is stronger oxidising agent than Cl_2 even though its electron affinity is less than that of Cl_2.
27. It is due to low enthalpy of dissociation of F_9 and high hydration energy of F^-.
28. Greater the standard electrode potential, greater is the oxidising power. Order of oxidation capacities of halogens is : $F_2 > Cl_2 > Br_2 > I_2$
29. Hydration enthaply is the energy involved when one mole of a halide ion is hydrated. As the size of halide increases, the electrostatic attaractions to dipolar water molecules decrease. Hence the enthaply of hydration gradually decreases. F^- has the highest hydration energy.
30. Lighter halogen displaces a heavier halogens from their halides.
31. Halogens absorb one of the seven colours of the visible light. This absorbed radiation promotes an electron to higher state.
32. Small fluorine atom requires more energetic violet radiation and transmits low energetic yellow radiation (complementary colour). So fluorine is pale yellow gas.
33. Large iodine atom absorbs less energetic yellow light and transmits high energetic violet light (complementary colour). So it is violet.
34. Br_2 is orange red liquid. Cl_2 is greenish yellow coloured gas.
35. The reactivity of halogens with H_2 decreases from F_2 to I_2. F_2 reacts violently even in dark with hydrogen. The reaction of Cl_2 with H_2 is slow in dark but fast in

sunlight. Br_9 reacts with H_2 at 593 K. I_2 reacts with H_2 at 713K in the presence of Pt catalyst. The reaction of F_2 with H_2 is reversible.

36. The order of stability or boiling points is : HF > HC*l* > HBr > HI. Order of acidic strength and reducing property : HI > HBr > HC*l* > HF

37. Properties of hydrogen halides

Property	HF	HC*l*	HBr	HI
M.P. (in K)	190	159	185	222
B.P.(in K)	293	189	206	238
Bondlength (H-X)/pm	91.7	121A	141.4	160.9
$\Delta H_{diss} / kJmol^{-}$	574	432	363	295
pK_a value	3.2	-7.0	-9.5	-10.0

38. The solubility of halogens in water and their reactivity decrease from F_2 to I_2.

39. F_2 decomposes water to form O_2 and O_3. Solution of chlorine in water is called ‘chlorine water’ which contains HC*l* and HOC*l*. Due to the presence of HOC*l*, chlorine water is bleaching agent.

40. Br_2 is less soluble in water and gives ‘bromine water’. I_2 is insoluble in water and does not react with water at ordinary temperature. It is due to decrease in free energy.

41. With dilute NaOH, fluorine gives OF_9 and with conc. NaOH, it liberates O_2. Other halogens (Cl_2, Br_2,1_2) form halides and hypohalites with cold dilute alkali

42. With hot concentrated alkali, halogens (Cl_2, Br_2,1_2) form halides and halates. In these reactions Cl_2,Br_2,I_2 undergo disproportionation.

43. Reaction with metals : All halogens react with metals to form metal halides. F_9 reacts even with noble metals like Au, Pt etc.

44. Since fluorine is highly reactive and it occurs in nature only in combined state. Important minerals of fluorine are : Fluorospar CaF_2, Cryolite Na,AlF_6 and Fluorapatite $CaF_2.3Ca_3(PO_4)_2$

45. The anomalous behaviour of fluorine is due to its small size, highest electronegativity, low F-F bond dissociation enthalpy, and non availability of d orbitals in valence shell.

46. Fluorine exhibits -1 oxidation state because it is the most electronegative element known. Therefore, no higher oxidation state for it in its compouds.

47. Sea water contains about 2.5% (w/v) by weight of sodium chloride.

48. Important minerals of chlorine are : Rock salt, Camalite KC*l*. $MgCl_2.6H_2O$, Horn silver AgC*l* and Silvine KC*l*.

49. Chlorine was first prepared by Scheele by the oxidation of HC*l* with MnO_2.

50. Chlorine is commercially produced as a by- product in the electrolysis of aqueous NaC*l*. Nelson cell method and from fused NaOH in Down’s process.

51. Chlorine is greenish yellow gas with pungent smell. Chlorine is 2.5 times heavier than air. Chlorineis poisonous and produces suffocation and headache and cause even death. Chlorine is soluble in water.

52. Aqueous solution of chlorine is called chlorine water and gives smell of chlorine. Chlorine attacks mucous membrane in the nose.

53. Boiling point of chlorine is 239K. It is easily liquified to yellow liquid. At 172K, Cl_2 freezes to yellow solid.

54. Except with nitrogen, oxygen and noble gases chlorine reacts with non- metals directly at ordinary temperature.

55. In the case of metals which can form more than one type of chloride, always the chloride in the higher oxidation state is formed.

56. The bleaching action and disinfectant property of chlorine water is due to oxidation.

57. With cold dilute alkali chlorine gives chloride and hypochlorite. With hot concentrated alkali chlorine gives chloride and chlorates. With dry slaked lime chlorine gives bleaching powder.

58. Chlorine liberates bromine from bromides and iodine from iodides.

59. Chlorine oxidises ferrous salts to ferric salts, hydrogen sulphide to sulphur, sulphites and thiosulphates to sulphates.

60. When excess chlorine reacts with ammonia NCl_3 and HCl are formed. When chlorine reacts with excess ammonia N_2, and NH_4Cl are formed.

61. Chlorine acts as a bleaching agent in the presence of moisture. Chlorine bleaches vegetable colours like litmus and indigo. Bleaching action of chlorine is due to production of nascent oxygen.

62. Bleaching action of chlorine is permanent. Chlorine bleaches the textiles and paper. Chlorine cannot be used to bleach silk and wool because they are destroyed by chlorine.

63. Chlorine is used for the purification of drinking water. It is used in the preparation of poisonous gases like phosgene ($COCl_2$), mustard gas $S(CH_2 - CH_2 - Cl)_2$, teargas CC/$_3$. N0$_2$ and | D.D.T. (dichloro diphenyl trichloro ethane). ^{L}

64. Oxy acids of chlorine :

Oxy acid	No.of $d_\pi - p_\pi$ bonds	No.of lone pairs on Cl	Shape of acid
HC/O	0	3	Linear
HC/O$_2$	1	2	Angular
HC/O$_3$	2	1	Pyramidal
HC/O$_4$	3	0	Tetrahedral

Chlorine undergo sp^3 hybridisation in all acids

65. Acidic nature and thermal stability of oxyacids increases with increasing oxidation state of chlorine : HC/O < HC/O-, < HC/0$_3$ < HC/0$_4$

66. Order of bond length of *Cl* - O in oxyanions C/0$_4$“ < C/0$_3$~ < C/0$_9$“ < C/0~. Order of bond energy of C/-0 in oxyanions of chlorine: *ClO~* < *ClOf* < *ClOf* < *cio$_4$~*.

67. The bond angles in $C/0_9$~, $C/0_3$' and $C/0_4$“ are 111°, 106° and 109°28^1 respectively.

68. Bleaching powder is also called chloride of lime. Chemically it is calcium chloro hypochlorite. It is a mixed salt.

69. The oxidation states of Cl in bleaching powder are +1 and -1, an average of Zero.

70. Bleaching powder is manufactured in Bachmann's plant by the action of dry Chlorine on dry slaked lime.

71. With cold water bleaching powder forms Ca^{+2}, Cl~ and C/CT ions. With hot water bleaching powder forms Ca^{+2}, Ct~ and CIO A ions.

72. With little amount of dilute acid, bleaching powder forms HOC/ which is responsible for bleaching action.

73. Bleaching powder oxidises lead salts to lead dioxide.

74. With excess amount of dilute acid, bleaching powder gives out all the chlorine present in it. It is called "available chlorine". Bleaching powder gives chlorine on reaction with even CO-,.

75. A good quality bleaching powder contains 35-38% of available chlorine. Theoritical percentage of $C/_2$ in $CaOC/_9$ is 56%.

76. Bleaching powder gives 0_9 on heating in presence of cobalt chloride.

77. On long standing bleaching powder undergoes auto oxidation and gives calcium chloride (CC) and calcium chlorate (C/0~$_3$). The quality of bleaching powder decreases.

78. Bleaching powder is used for bleaching the wood pulp in the paper and textile industry and in the manufacture of $CHCl_3$ (anasthetic agent).

79. Bleaching powder is used for sterilisation of drinking water as disinfectant, germicide, oxidising agent and chlorinating agent.

80. Bleaching powder forms chloroform on reaction with alcohol or acetone.

95. Binary compounds formed between two halogens are called interhalogen compounds.

81. In the ground state monohalides like IC*l* are formed.

82. T shaped XX^ trihalide is formed in the first excited state. Hybridisation of central halogen atom is sp3d and oxidation state is +3.

83. Square pyramidal XX]5 pentahalide is formed in the second excited 7state. Hybridisation of central halogen atom is sp3d2 and oxidation state is + 5.

84. Pentagonal bypyramidal XX17 pentahalide is formed in the third excited state. Hybridisation of central halogen atom is sp3d3 and oxidation state is +7

85. Number of lone pairs on the central halogen atom is 2 in trihalide, 1 in pentahalide and nil in heptahalide

86. Inter halogens are polar and more reactive than corresponding halogens.

SYNOPSIS - II

1. Fluorine, chlorine, bromine and iodine are collectively known as halogens (sea salt producers).
2. Halogens are very reactive non metals. Therefore they do not occur in free state. They occur in the combined state as halides. Iodine is also available as $NaIO_3$.
3. Synthetically made element of group VIIA is astatine. It is radioactive short lived element.
4. The general outer electronic configuration of the halogens is $ns^2\ np^5$.
5. Fluorine is the most reactive element. It is regarded as super halogen.
6. Halogens are diatomic molecules vander Waals forces of attraction between molecules increases from fluorine to iodine.
7. Gaseous elements in VII A group are fluorine and chlorine. Bromine is a liquid, iodine is a subliming solid.
8. The melting points and the boiling points increase from fluorine to iodine due to increase in van der Waals forces. But volatile nature decreases down the group.
9. Atomic volume and density increase from Fluorine to iodine. The size of atoms and the ions also increase gradually.
10. Ionisation energies decrease from fluorine to iodine.
11. Fluorine has abnormally high ionisation energy due to its small size and electrons in it are held strongly by the nucleus
12. The decreasing order of bond energies is : $Cl_2 > Br_2 > F_2 > I_2$. Low bond energy of fluorine is responsible for its high reactivity.
13. Fluorine has the highest electronegativity (4.0) on Pauling scale. Electronegativity decreases down the group.
14. Order of electron affinities : $Cl > F > Br > I$. Small size and greater repulsion of electrons are responsible for low electron affinity of fluorine than chlorine.
15. Covalent bond is formed between two halogen atoms. The compounds formed between halogens and other non metals arc covalent.
16. Fluorine is always univalent. Fluorine exhibits -1 oxidation state, since it is the most electronegative element.
17. Most common covalency of Cl, Br or I is 1 but highest valency is 7.
18. Common oxidation state of halogens is -1. Except fluorine other halogens can also exhibit + 1, +3. +5 and +7.
19. Fluorine cannot exhibit variable valencies due to the absence of 'd' orbitals. Cl, Br and I exhibit higher oxidation states in different excited states and undergo various types of hybridisations.
20. Halogens are strong oxidising agents due to high electron affinity values. The oxidising capacity decreases from fluorine to iodine.
21. Lighter halogen displaces a heavier halogens from their halides.
22. Halogens absorb one of the seven colours of the visible light. This absorbed radiation promotes an electron to higher state.

23. Fluorine is yellow gas. Br_2 is red liquid. Cl_2 is greenish yellow coloured gas and iodine is violet.

24. The reactivity of halogens with H_2 decreases from F_2 to I_2. F_2 reacts violently even in dark with hydrogen. The reaction of Cl_2 with H_2 is slow in dark but fast in sunlight.

25. The order of stability or boiling points is : $HF > HCl > HBr > HI$. Order of acidic strength and reducing property : $HI > HBr > HCl > HF$

26. The anomalous behaviour of fluorine is due to its small size, highest electronegativity, low F-F bond dissociation enthalpy, and non availability of d orbitals in valence shell.

27. Fluorine exhibits −1 oxidation state because it is the most electronegative element known. Therefore, no higher oxidation state for it in its compounds.

28. Sea water contains about 2.5% (w/v) by weight of sodium chloride. Important minerals of chlorine are : Rock salt. Camalite $KCl. MgCl_2. 6H_2O$, Horn silver AgCl and Silvine KCl.

29. Chlorine is commercially produced as a byproduct in the electrolysis of aqueous NaCl. Nelson cell method and from fused NaOH in Down's process.

30. Except with nitrogen, oxygen and noble gases chlorine reacts with non- metals directly at ordinary temperature.

31. In the case of metals which can form more than one type of chloride. The chloride in the higher oxidation state is formed.

32. The bleaching action and disinfectant property of chlorine water is due to oxidation.

33. With cold dilute alkali chlorine gives chloride and hypochlorite. With hot concentrated alkali chlorine gives chloride and chlorates. With dry- slaked lime chlorine gives bleaching powder.

34. Chlorine oxidises ferrous salts to ferric salts, hydrogen sulphide to sulphur, sulphites and thiosulphates to sulphates.

35. Chlorine acts as a bleaching agent in the presence of moisture. Chlorine bleaches vegetable colours like litmus and indigo. Bleaching action of chlorine is due to production of nascent oxygen.

36. Chlorine is used for the purification of drinking water. It is used in the preparation of poisonous gases like phosgene ($COCl_2$), mustard gas $S(CH_2 - CH_2 - Cl)_2$, teargas $CCl_3 . NO_2$ and D.D.T. (dichloro diphenyl trichloro ethane).

37. Fluorine has no oxyacids. Four types of oxyacids of other halogens are known.

38. Acidic nature and thermal stability of oxyacids increases with increasing oxidation state of chlorine : $HClO < HClO_2 < HC/O_3 < HClO_4$

39. Order of bond length of Cl - O in oxyanions $ClO_4^- < ClO_3^- < ClO_2^- < ClO^-$.
Order of bond energy of Cl–O in oxyanions of chlorine:
$ClO^- < ClO_2^- < ClO_3^- < ClO_4^-$.

40. There are four types of interhalogcn compounds. Their compositiona are: XX', XX'_3, XX'_5 and XX'_7.

41. XX'_3 is T shaped, XX'_5 is square pyramidal and XX'_7 has pentagonal bipyramidal structure.

Question Bank - I

1. Valence shell electronic configuration of halogens is
   1) ns^2np^4 2) ns^2np^5 3) ns^2np^6 4) ns^2np^3
2. Super halogen is
   1) F_2 2) Cl_2 3) Br_2 4) I_2
3. Liquid and solid halogens are
   1) Br_2 and Cl_2 2) I_2 and Br_2 3) Br_2 and I_2 4) Cl_2 and I_2
4. The pale yellow coloured gas is
   1) F_2 2) Cl_2 3) Br_2 4) I_2
5. The order of reactivity of halogens with Hydrogen is
   1) $F_2<Cl_2<Br_2<I_2$ 2) $F_2>Cl_2>Br_2>I_2$
   3) $F_2<Br_2<Cl_2<I_2$ 4) $F_2>I_2>Br_2>Cl_2$
6. Halogens are
   1) Monoatomic 2) Diatomic 3) Triatomic 4) Tetratomic
7. The halogen that undergoes sublimation is
   1) F_2 2) Cl_2 3) Br_2 4) I_2
8. Bond dissociation energy is minimum in
   1) F_2 2) Cl_2 3) Br_2 4) I_2
9. The important minerals of fluorine are
   1) Fluorspar (CaF_2) 2) Cryolite (Na_3AlF_6)
   3) Fluorapatite $CaF_2.3Ca_3(PO_4)_2$ 4) All the above
10. In the reaction of I_2 with water, change in free energy is
    1) Negative 2) Positive 3) zero 4) cannot be predicted
11. Which of the following oxide of chlorine contain three electron bond
    1) Cl_2O 2) ClO_2 3) Cl_2O_6 4) Cl_2O_7
12. Total number of lone pairs of electrons on all atoms of Cl_2O is
    1) 2 2) 4 3) 6 4) 8
13. $HClO_4$ dimerises due to
    1) Hydrogen bonds 2) Covalent bonds
    3) dative bonds 4) vanderwaal's forces
14. Bond angle in ClO_3^- is
    1) $109^0 28^1$ 2) 111^0 3) 106^0 4) 118^0
15. The weakest acid is
    1) HOCl 2) $HClO_2$ 3) $HClO_3$ 4) $HClO_4$
16. The element which can displace three other halogens from their compounds is
    1) Cl_2 2) Br_2 3) I_2 4) F_2

17. The oxide of chlorine which is a colourless oily liquid is
    1) Cl_2O 2) Cl_2O_6 3) ClO_2 4) Cl_2O_7
18. SiO_2 is soluble in
    1) H_2SO_4 2) HNO_3 3) HF 4) HCl
19. Chlorine acts as a bleaching agent only in presence of
    1) Dry air 2) Moisture 3) Sunlight 4) Pure oxygen
20. Fluorine does not show multiple oxidation states due to absence of
    1) d-orbitals 2) s-orbitals 3) p-orbitals 4) None

21. Mark the strongest acid
1) HF 2) HCl 3) HBr 4) HI

22. The order of EA of halogens is
1) F<Cl<Br<I 2) F>Cl>Br>I 3) Cl>Br>F>I 4) Cl>F>Br>I

23. The number of unpaired electrons and lone pairs of electrons in the first excited state of Chlorine
1) 2 and 2 2) 3 and 3 3) 2 and 3 4) 3 and 2

24. The maximum oxidation state that can be exhibited by a halogen in its second excited state
1) +1 2) +3 3) +5 4) +7

25. Hydrogen energy of fluorine is
1) Less than that of Br^- 2) Less than that of I^-
3) Less than that of Cl^- 4) More than that of Cl^-

26. Interhalogen compound is
1) ClF_3 2) IF_5 3) ICl 4) All of these

27. The formula of Hydrofluorosilic acid is
1) H_2SiF_4 2) H_2SiF_6 3) H_2SiO_3 4) H_2SiO_4

28. The following is not a mineral of Chlorine
1) Carnalite 2) Horn silver 3) Sylvine 4) Cryolite

29. At ordinary temperature Cl_2 reacts with
1) O_2 2) N_2 3) He 4) Cu

30. Bleaching and disinfectant nature of Chlorine is based on its ---- property
1) reducing 2) oxidising
3) both oxidation and reduction 4) disproportination

31. Chlorine oxidises H_2S to
1) S 2) SO_2 3) H_2SO_4 4) H_2SO_3

32. In Whytlaw Gray's method cathode and anode respectively are
1) Graphite rods acts as both anode and cathode
2) Cu acts as both anode and cathode
3) Cu acts as anode and Graphite acts as cathode
4) Cu acts as cathode and Graphite acts as anode

33. The high boiling point of HF is due to
5) the presence of intramolecular hydrogen bonds
6) the presence of intermolecular hydrogen bonds
7) the presence of dative bonds
8) the presence of polar covalent bonds

34. The chemical formula of the oxy-acids of chlorine in which chlorine exhibits maximum oxidation number is
1) HClO 2) $HClO_2$ 3) $HClO_3$ 4) $HClO_4$

35. The chemical formula of bleaching powder is
1) CaO_2Cl_2 2) $CaOCl_2$ 3) $Ca(ClO_3)_2$ 4) CaO_2Cl

36. The deep colour produced when Iodine is dissolved in a solution of KI is caused by the presence of ------ ion
1) I^{3-} 2) I_3^- 3) I_2^{3-} 4) I_2^-

37. Chlorine acts as bleaching agent by means of the following process
1) oxidation 2) reduction 3) Hydrolysis 4) Decomposition

38. Glass reacts with HF giving
1) Na_3AlF_6 2) H_2SiF_6 3) H_2SiO_3 4) SiF_6

39. Oxidation state of chlorine in hypochlorous acid is
1) +1 2) +3 3) +5 4) +7

40. Cl_2O_7 is the anhydride of
1) $HClO_2$ 2) $HClO_3$ 3) $HClO_4$ 4) $HClO$

41. Which one of the following represents the reaction between fluorine and cold dilute NaOH?
1) $2F_2+4NaOH \rightarrow 4NaF+2H_2O$ 2) $3F_2+NaOH \rightarrow 5NaF+NaFO_3$
3) $F_2+2NaOH \rightarrow NaF+NaOF+H_2O$ 4) $2F_2+2NaOH \rightarrow 4NaF+OF_2+H_2O$

42. Chlorine atom, in the third excited state, reacts with fluorine to form a compound ‘x’. The formula and shape of ‘x’ are
1) ClF_5, Pentagonal 2) ClF_4, Tetrahedral
3) ClF_4, Pentagonal bipyramidal 4) ClF_7, Pentagonal bipyramidal

43. Bond dissociation energies of HCl, HF and HBr follow the order
1) HCl>HBr>HF 2) HF>HBr>HCl 3) HF>HCl>HBr 4) HBr>HCl>HF

44. The electron affinity values (in KJ $mole^{-1}$) of three halogens x, y and z are respectively –349, -333 and –325. Then x, y and z respectively are
1) F, Cl and Br 2) Cl, F and Br 3) Cl, Br and F 4) Br, Cl and F

45. Assertion: F_2 is used for etching of glass is the form of HF.
Reason: The formula of hydofluoro silica acid is H_2SiF_6.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

46. Assertion: Chlorine bleaches by oxidation in presence of moisture.
Reason: Chlorine can react with noble gases to form stable compounds.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

47. Assertion: Cl-O bond length decreases from ClO^- to ClO_4^-.
Reason: Cl-O bond order increases from ClO^- to ClO_4^-.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

48. Assertion: F_2 has lesser bond energy than Cl_2.

Reason: Down the group, for halogens bond energy increases with increase in atomic size

1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

49.

List-I	List-II
A) HClO	1) Pyramidal
B) $HClO_2$	2) Salts are chlorites
C) $HClO_3$	3) Strongest acids
D) $HClO_4$	4) Strongest oxidizing agent
	5) Reacts with the inert gases.

The correct match is

	A	B	C	D
1)	4	2	1	5
2)	2	4	1	3
3)	4	2	1	3
4)	3	5	1	2

50.

List-I	List-II
A) Super halogen	1) CCl_3NO_2
B) Tear gas	2) $COCl_2$
C) Phosgene	3) Cl- C_2H_4 –S- C_2H_4-Cl
D) Mustard gas	4) F_2
	5) HF

The correct match is

	A	B	C	D
1)	4	2	1	3
2)	2	4	1	3
3)	2	5	3	4
4)	3	5	1	2

KEY

1. 2	2. 1	3. 3	4. 1	5. 2	6. 2	7. 4	8. 4	9. 4	10. 2
11. 2	12. 4	13. 1	14. 3	15. 1	16. 4	17. 4	18. 3	19. 2	20. 1
21. 4	22. 4	23. 4	24. 3	25. 4	26. 4	27. 2	28. 4	29. 4	30. 2
31. 1	32. 4	33. 2	34. 4	35. 2	36. 2	37. 1	38. 2	39. 1	40. 3
41. 4	42. 4	43.3	44.2	45.2	46.3	47.1	48.3	49.3	50.1

Question Bank - II

General characteristics

1. The number of unpaired electrons present in the first excited state of chlorine atom is

1) 1 2) 3 3) 5 4) 2

2. Which of the following halogens has metallic character ?

1) F_2 2) CI_2 3) Br_2 4) I_2.

3. Super halogen is

1) F_2 2) CI_2 3) Br_2 4) I_2.

4. The element which never acts as reducing agent in a chemical reaction is

1) 0 2) Li 3) F 4) C

5. The high reactivity of fluorine is mainly due to

1) high heat of hydration 2) small size

3) low bond dissociation energy of the F-F bond 4) high ionisation potential

6. The type of forces present among halogen molecules

1) H-bonds 2) Covalent bonds 3) Vander waals forces 4) Ionic bond

7. The correct order of Vander Waals radius of F, Cl and Br is

1) Cl > F > Br 2) Br > Cl > F

3) F > Cl > Br 4) Br > F >Cl

8. Liquid and solid halogens are

1) Br_2 and Cl_2 2) I_2 and Br_2 3) Br_2 and I_2 4) Cl_2 and I_2

9. The halogen that undergoes sublimation is

1) F_2 2) Cl_2 3) Br_2 4) I_2

10. Ionisation potential of fluorine is abnormally high. It is due to

1) Its high EN value 2) Its high EA value

3) Its small size 4) Its big size

11. The elements with the highest electron affinity and electronegativity respectively are

1) Cl and Cl 2) F and F 3) F and Cl 4) Cl and F

12. An element M has an atomic mass 19 and atomic number 9. Its ion is represented by

1) M^+ 2)M^{2+} 3)M^- 4)M^{2-}

13. General oxidation states of halogens are

1) 0-1, + 1 2) -1, +1, +3 3) -1, +1, +3, +5 4) -1, +1, +3, +5, +7

14. Which one of the following elements can show both positive and negative oxidation state?

l) F 2) I 3) Li 4) He.

15. The maximum oxidation state that can be exhibited by a halogen in its second excited state

1) +1 2) +3 3) +5 4) +7

16. Which one of the following elements show different oxidation states ?

1) Sodium 2) Fluorine 3) Chlorine 4) Potassium

17. Enthalpy of dissociation is low for

1)F_2 2) Cl_2 3) Br_2 4) I_2

18. F_2 absorbs ..... portion of light and appear yellow and I_2 absorbs ..... portion of light and appears violet

1) Red and Green 2) Violet and Yellow

3) Blue aud Orange 4) Green and Red

19. In AX_5 type of molecule if 'A' undergoes sp^3d^2 hybridisation then the shape of the molecule is

1) T-shape 2) Octahedral 3) Square pyramidal 4) Tetrahedal

20. The hybridization in interhalogen compound AX_7 is

l) sp^3d^3 2) sp^3 3) sp^3d 4) sp^3d^2

21. The strongest oxidising agent among the following is

1) Cl_2 2) F_2 3) O_3 4) H_2O_2

22. The order of reactivity of halogens with Hydrogen is

1) $F_2 < Cl_2 < Br_2 < I_2$ 2) $F_2 > Cl_2 > Br_2 > I_2$

3) $F_2 < Br_2 < Cl_2 < I_2$ 4) $F_2 > I_2 > Br_2 > Cl_2$

23. Which of the following is incorrect with respect to property indicated ?

1) E.N : F > Cl > Br 2) E.A : Cl > Br < F

3) Oxidising power : $F_2 > Cl_2 > Br_2$ 4) Bond energy ; $F_2 > Cl_2 > Br_2$.

24. Which halogen has highest ionisation potential

1) Fluorine 2) Chlorine 3) Bromine 4) Iodine

25. The electron affinity va1ues (in KJ mole^{-1}) of three halogens x, y and z are respectively -349, -333 aud -325. Then x, y and z respectively are

1) F, Cl and Br 2) Cl, F and Br

3) Cl, Br and F 4) Br, Cl and F

26. Which of the following is most volatile

1) HI 2) HBr 3) HCl 4) HF

27. Correct order of boiling points of hydrogen halides is

1) HF > HCl > HBr > HI 2) HF< HCl < HBr < HI

3) HCl < HBr < HI < HF 4) HF < HBr < HI < HCl

28. One gas bleaches the colour of flowers by reduction and another gas by oxidation. The gases respectively are

1) SO_2 and Cl_2 2) CO and Cl_2

3) NH_3 and SO_2 4) H_2S and Br_2

29. In the reaction $2Br^- + X_2 \rightarrow Br_2 + 2X^-$, X_2 is

l) Cl_2 2) Br_2 3) I_2 4) N_2

30. Which of the following has greatest reducing power?

1) HI 2) HBr 3) HCI 4) HF.

31. Mark the element which shows only one oxidation state in its compounds

1) F 2) Cl 3) Br 4) I

Chlorine

32. Cl_2 reacts with water and forms

1) HCl + HOCl 2) HCl + O_2 + O_3

3) HCl + HOCl + O_3 4) HOCl + O_2

33. Chlorine acts as a bleaching agent only in the presence of

1) Dry air 2) Moisture 3) Sun light 4) None of these

34. Cl_2 (or) Br_2 (or) I_2 reacts with cold and dilute alkali solution to form

1) Halide + Hypohalite 2) Halide + Hypohalite + H_2O

3) Halide + halite 4) Halide + Halate + H_2O

35. Cl_2 (or) Br_2(or) I_2 reacts with hot conc. alkali solution to form

1) Halide + Hypohalite 2) Halide + Hypohalite + H_2O

3) Halide + halite 4) Halide + Halate + H_2O

36. The following is not a mineral of Chlorine

1) Carnalite 2) Horn silver 3) Sylvine 4) Cryolite

37. When Brine solution is subjected to electrolysis the gases liberated at anode and at cathode are

1) H_2 and Cl_2 2) H_2 and O_2 3) Cl_2 and O_2 4) Cl_2 and H_2

38. At ordinary temperature Cl_2 reacts with

1) O_2 2) N_2 3) He 4) Cu

39. Chlorine oxidises H_2S to

1) S 2) SO_2 3) H_2SO_4 4) H_2SO_3

40. The products formed when Cl_2 reacts with excess of NH_3 are

l) NCl_3+ HCl 2) N_2 + HCl 3) NCl_3 + N_2 4) N_2 + NH_4Cl

41. What are the products obtained when ammonia is reacted with excess chlorine

1) N_2 and NCl_3 2) N_2 and HCl

3) N_2 and NH_4Cl 4) NCl_3 and HOCl

42. In the use of Cl_2 as bleaching agent, the substance that is mainly responsible for the bleaching is

1) $HClO_2$ 2) $HClO_3$ 3) $HClO_4$ 4) HOC/

43. Which of the following is. used in the extraction of gold

1)F_2 2) Cl_2 3) Br_2 4) I_2

44. Which one of the following is formed apart from sodium chloride when chlorine reacts with hot concetrated sodium hydroxide

1) NaClO 2) $NaClO_2$ 3) $NaClO_3$ 4) $NaClO_4$

Oxyacids

45. Cl in ClO^- undergoes ... hybridisation

1) sp^2 2) sp^3 3) sp^3d 4) sp^3d^2

46. What is the oxidation state of chlorine in hypochlorous acid ?

1) + 7 2) + 5 3) + 3 4) + 1

47. Which of the following is not peroxy Acid

1) Perphosphoric Acid 2) Pernitric Acid

3) Perdisulphuric Acid 4) Perchloric Acid

48. The geometry' of ClO_3^- according to valence shell electron pair repulsion theory will be

1) Planar triangle 2) Pyramidal

3) Tetrahedral 4) Square planar.

49. The bond angle in ClO_2^- is

1) 109^O28^1 2) 111° 3) 118° 4) 115°

50. Sigma bond between Cl and O in C/O_4^- is formed by overlapping

l) sp^2-p 2) sp^2-s 3) sp^3 - s 4) sp^3 - p

51. Shape and bond angle in ClO_4^- ion is

1) planar trigonal. 109^O28^1 2) tetrahedral. $109°28^1$

3) pyramidal. 105° 4) V-shape, 118°

52. The number of π bonds in ClO_4^- ion is

1) 2 2) 3 3)4 4) 1

53. The number of lone pairs on Chlorine atom in $ClO^-, ClO_2^-, ClO_3^-, ClO_4^-$ ions are

1) 0, 1, 2, 3 2) 1, 2, 3, 4 3) 4, 3, 2, 1 4) 3, 2, 1, 0

54. The order of Cl-O bond energy in $ClO^-, ClO_2^-, ClO_3^-, ClO_4^-$ is

1) $ClO^- > ClO_2^- > ClO_3^- > ClO_4^-$ 2) $ClO_4^- > ClO_3^- > ClO_2^- > ClO^-$

3) $ClO_4^- > ClO_2^- > ClO_3^- > ClO^-$ 4) $ClO_3^- > ClO^- > ClO_2^- > ClO_4^-$

KEY

1) 2	2) 4	3) 1	4) 3	5) 3	6) 3	7) 2	8) 3
9) 4	10) 3	11) 4	12) 3	13) 4	14) 2	15) 3	16) 3
17) 4	18) 2	19) 3	20) 1	21) 2	22) 2	23) 4	24) 1
25) 2	26) 3	27) 3	28) 1	29) 1	30) 1	31) 1	32) 1
33) 2	34) 2	35) 4	36) 4	37) 4	38) 4	39) 1	40) 4
41) 4	42) 4	43) 2	44) 3	45) 2	46) 4	47) 4	48) 2
49)2	50)4	51) 2	52) 2	53) 4	54) 2		

(d) GROUP-18 ELEMENTS

Synopsis:

1. Helium, neon, argon, krypton, xenon and radon are noble gas elements.
2. Noble gases constitute the elements of zero group or 18th goup in the long form of the periodic table.
3. The general outermost electronic configuration of noble gases is ns^2np^6.
4. Noble gases are called iner gases and are monoatomic. Noble gasesa re chemically inser because of 'octet' configuration.
5. Argon is the principal noble gas constitute in the air.
6. First compound Xenon was prepared by H bertlett. And thd compound is Xenon Hexa Fluroplatinate (II). – $Xe[PtF_6]$
7. Due to stable electronic configuration these gases exhibit very high ionisation enthalpy. However, it decreases down the group with increase in atomic size.
8. Atomic radii increase down the group with increase in atomic number
9. Separation of noble gases can be carried out by Dewar's adsorption method on activated charcoal.
10. The first and reasonable stable compound of any noble gas, xenonplatinum hexafluoride was prepared by Bartlett.
11. The compounds of xenon are usually three types: fluorides, oxides and oxyfluorides.
12. Helium is totally inert because of its small size, high ionisation potential and zero electron affinity.
13. The structure of xenon difluoride is linear, xenon tetrafluoride is square planar and xenon hexafluoride is distorted octahedral.
14. Xenon trioxide has pyramidal shape and xenontetroxide is tetrahedral.
15. Helium is preferred to nitrogen by deep sea divers and asthma patients. The respiration mixture is 20% O, and 80% He by volume.
16. He is also used to provide inert atmosphere, in gas thermometers and as a cryoscopic liquid.
17. Neon is used in advertisement discharge lamps and in green houses
18. Argon is used to provide inert atomosphere in metallurgy and for filling electric bulbs.
19. Krypton is used in miners cap lamps.
20. Xenon is used in photographic flash bulbs
21. Radon is used to locate defects in steel castings.

(a) Xenon-fluorine compounds

Xenon forms three binary fluorides, XeF_2, XeF_4 and XeF_6 by the direct reaction of elements under appropriate experimental conditions.

$$Xe\ (g) + F_2\ (g)\ \ XeF_2(s)$$
(xenon in excess)

$$Xe\ (g) + 2F_2\ (g)\ \ XeF_4(s)$$
(1:5 ratio)

$$Xe\ (g) + 3F_2\ (g)\ \ XeF_6(s)$$
(1:20 ratio)

XeF_6 can also be prepared by the interaction of XeF_4 and O_2F_2 at 143K.

XeF_2, XeF_4 and XeF_6 are colourless crystalline solids and sublime readily at 298 K. They are powerful fluorinating agents. They are readily hydrolysed even by traces of water. For example, XeF_2 is hydrolysed to give Xe, HF and O_2.

$$2XeF_2\ (s) + 2H_2O(l) \rightarrow 2Xe\ (g) + 4\ HF(aq) + O_2(g)$$

The structures of the three xenon fluorides can be deduced from VSEPR and these are shown in Fig. XeF_2 and XeF_4 have linear and square planar structures respectively. XeF_6 has seven electron pairs (6 bonding pairs and one lone pair) and would, thus, have a distorted octahedral structure as found experimentally in the gas phase.

Xenon fluorides react with fluoride ion acceptors to form cationic species and with fluoride ion donors to form fluoroanions.

$$XeF_2 + PF_5 \rightarrow [XeF]^+\ [PF_6]^-; \qquad XeF_4 + SbF_5 \rightarrow [XeF_3]^+\ [SbF_6]^-$$

$$XeF_6 + MF \rightarrow M^+\ [XeF_7]^-\ (M = Na, K, Rb\ or\ Cs)$$

(b) Xenon-oxygen compounds

Hydrolysis of XeF_4 and XeF_6 with water gives $Xe0_3$.

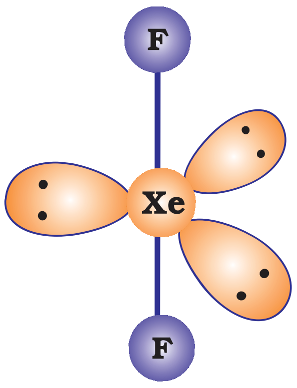
$6XeF_4 + 12\ H_2O \rightarrow 4Xe + 2Xe0_3 + 24\ HF + 3\ O_2$

$XeF_6 + 3\ H_2O \rightarrow XeO_3 + 6\ HF$

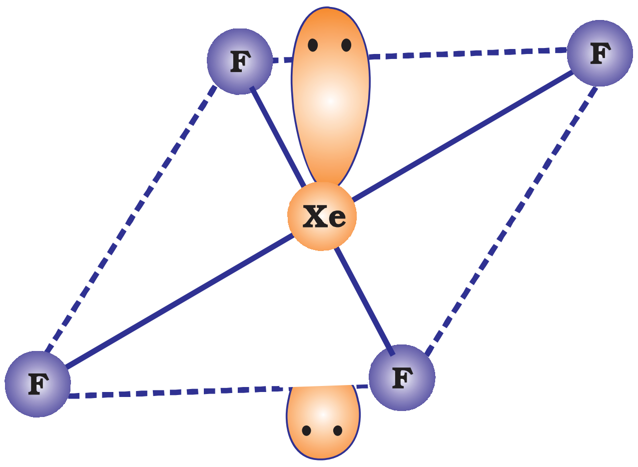
Partial hydrolysis of XeF_6 gives oxyfluorides, $XeOF_4$ and XeO_2F_2.

$XeF_6 + H_2O \rightarrow XeOF_4 + 2\ HF$

$XeF_6 + 2\ H_2O \rightarrow XeO_2F_2 + 4HF$

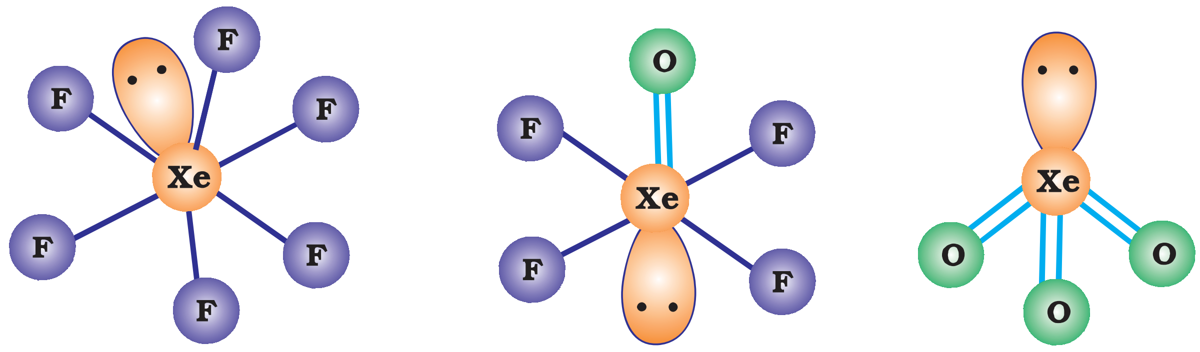


(a) Linear



(b) Square planar

XeO_3 is a colourless explosive solid and has a pyramidal molecular structure (Fig.). $XeOF_4$ is a colourless volatile liquid and has a square pyramidal molecular structure (Fig.).



(c) Distorted octahedral (d) Square pyramidal (e) Pyramidal

Fig. *The structures of (a) XeF_2 (b) XeF_4 (c) XeF_6 (d) $XeOF_4$ and (e) XeO_3*

Question Bank

1. In which of the processes O_2 is removed by hot Cu?
   1) Ramsay method I 2) Fischer-Ringe's method
   3) Ramsay methodII 4) All the three
2. The separation of Ar from the mixture Ar, Kr, Xe activated charcoal is maintained at
   1) -180^0C 2) 77K 3) 83^0C 4) At any tem above 200K
3. From Ar, Kr and Xe at liquid N_2 temperature the component separated out is
   1) O_2 2) Kr 3) Xe 4) Ar
4. He and Ne mixture is separated by passing it through
   1) Liquid O_2 pipes 2) Liquid H_2 pipes
   3) Cannot be separated 4) Both 1&2
5. The charcoal maintained at -100^0C adsorbs
   1) Ne, Kr, Ar 2) Ar, Kr, Xe 3) He, Ar 4) He, Ne
6. During fractional evaporation of liquid air nitrogen will be mixed with
   1) Ar, Kr, Xe 2) Ar only 3) He &Ne 4) Kr, Xe
7. Claude's apparatus is used for the isolation of ----from liquid air
   1) noble gases 2) liquid nitrogen 3) liquid oxygen 4) all of these
8. Noble gases do not occur in
   1) ores 2) sea water 3) atmosphere 4) natural gas
9. Which among the following has the highest density
   1) Ar 2) Ne 3) Kr 4) Xe
10. The following has zero valency
    1) Na 2) Kr 3) Al 4) Be
11. Which one of the following gas exists in mono atomic state?
    1) Chlorine 2) Oxygen 3) Helium 4) Nitrogen
12. Element with highest, I.P in the periodic table
    1) H_2 2) O_2 3) He 4) F_2
13. The inert gas amongst the following with least boiling point in Kelvin scale
    1) Ne 2) He 3) Kr 4) Xe

14. Which of the following cannot be easily liquified?

1) He 2) Ne 3) Xe 4) Ar

15. In the Dewar's method of separation of noble gases, the mixture of noble gases is kept in contact with coconut charcoal at 173K which one of the following gaseous mixture is not adsorbed on to the charcoal?

1) Ar, Kr 2) Xe, Ar 3) He, Ne 4) Xe, Kr

16. In Fischer-Ringe's method of separation of noble gas mixture from air, ----- is used

1) 90% CaC_2+10%$CaCl_2$ 2) coconut charcoal

3) soda lime+ potash solution 4) 90% $CaCO_3$+urea

17. Least chemical activity is shown by

1) NH_3 2) CH_4 3) Ar 4) H_2SO_4

18. The general electronic configuration of noble gases is

1) ns^2np^3 2) ns^2np^6 3) ns^2np^4 4) ns^2np^5

19. Which of the following is not a noble gas?

1) He 2) Ne 3) Ar 4) Ra

20. Which of the following noble gas is not present in atmosphere?

1) He 2) Ne 3) Rn 4) Ar

21. The noble gases were first reported by?

1) Frankland 2) Rayleigh 3) William Ramsay 4) Cavendish

22. Helium was discovered by

1) Dorn 2) Rutherford 3) Chadwick 4) Janssen & Lockyer

23. Monazite is a source of

1) He 2) Kr 3) Ne 4) Ar

24. Most important source of He

1) Sun 2) Radon 3) Natural gas 4) Minerals

25. Which electron configuration corresponds to minimum energy and maximum stability

1) $(n-1)d^{10}ns^1$ 2) $(n-1)d^5ns^1$ 3) ns^2np^6 4) ns^2np^3

26. Which of the following gaseous molecules is mono atomic

1) Chlorine 2) helium 3) oxygen 4) nitrogen

27. The S-block element present in zero group is

1) H 2) He 3) Ne 4) Rn

28. Noble gases belong to

1) S-block 2) P-block 3) d-block 4) f-block

29. Assertion: Helium does not get absorbed on activated charcoal in Deewar's method.
Reason: Helium has lower atomic weight.

1. Both A and R are true and R is the correct explanation of A
2. Both A and R are true and R is not the correct explanation of A
3. A is true but R is false
4. A is false but R is true

30. Assertion: In the separation of noble gas mixture from air, CO_2 is removed with potash.

Reason: KOH being a base reacts with CO_2 which is acidic in nature to form potassium carbonate.

1. Both A and R are true and R is the correct explanation of A
2. Both A and R are true and R is not the correct explanation of A
3. A is true but R is false
4. A is false but R is true

31. Assertion: Helium and Neon do not participate in chemical reactions.

Reason: The I.P value of He and Ne are very high.

1. Both A and R are true and R is the correct explanation of A
2. Both A and R are true and R is not the correct explanation of A
3. A is true but R is false
4. A is false but R is true

32. Assertion: The shape of XeF_2 is linear.

Reason: In XeF_2, Xe undergoes sp^3d hybridisation.

1. Both A and R are true and R is the correct explanation of A
2. Both A and R are true and R is not the correct explanation of A
3. A is true but R is false
4. A is false but R is true

33.

List-I	List-II
a) XeF_2	1) Pyramidal
b) XeO_3	2) Square planar
c) XeF_6	3) Linear
d) XeF_4	4) Distorted octahedral

The correct match is

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

34.

List-I	List-II
a) XeF_2	1) One lone pairs on Xe
b) XeF_4	2) Two lone pairs on Xe
c) XeO_4	3) Three lone pairs on Xe
d) XeF_6	4) Zero lone pairs on Xe

The correct match is

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

35. Separation of noble gases from liquid air is done commercially by dividing liquid air into

1) 6 fractions 2) 2 fractions 3) 3 fractions 4) 4 fractions

36. Which is a wrong statement?

1) All inert gases posses ns^2 np^2 configuration
2) Zero group elements are gases
3) Noble gases are chemically inert generally
4) Inert gases are mono atomic

37. Regarding Ramsay – Reyleigh II method, the wrong statements are

(a) O_2 is removed in the form of CuO
(b) N_2 is removed in the form of Mg_3N_2
(c) The ratio of air and oxygen taken is 9 : 11

1) (a) and (b) 2) (b) and (c) 3) (a) and (c) 4) all are correct

38. Lone pairs are not present on the central atoms of the molecule

1) XeO_4 2) XeF_4 3) XeO_3 4) XeF_6

39. About the uses of noble gases

(a) Ar is used in Geiger counter tubes
(b) Kr-85 is used for voltage regulation
(c) Ar is used in thermoionic tubes

The wrong statements are

1) (a) and (b) 2) (a) and (c) 3) (b) and (c) 4) all are correct

40. To separate argon from a mixture containing Ar + Kr + Xe, the activated charcoal should be maintained at

1) 77K 2) 183K 3) 93°C 4) 85°C

41. **A:** The density of nitrogen isolated from air is more than that obtained by chemical methods

R: Inert gases are associated with N_2 of the atmospheric air.

1) Both **A** and **R** are true and **R** is the correct explanation of **A**
2) Both **A** and **R** are true and **R** is not the correct explanation of **A**
3) **A** is true but **R** is false
4) **A** is false but **R** is true

42. **A:** The extent of adsorption of inert gases on activated charcoal is different.

R: Adsorption of noble gases on charcoal depends on the Vanderwaals attraction.

1) Both **A** and **R** are true and **R** is the correct explanation of **A**
2) Both **A** and **R** are true and **R** is not the correct explanation of **A**
3) **A** is true but **R** is false
4) **A** is false but **R** is true

43. **A:** A mixture of 80% He + 20% O_2 is used for respiration by deep sea divers instead of air.

R: The N_2 is air at high pressure dissolves in blood but helium is not soluble.

1) Both **A** and **R** are true and **R** is the correct explanation of **A**
2) Both **A** and **R** are true and **R** is not the correct explanation of **A**
3) **A** is true but **R** is false
4) **A** is false but **R** is true

44. Match the following.

List – I	**List – II**
Molecule	***Position of lone pairs***
A) XeF_2	1) axial positions
B) XeF_4	2) corners of triangle
C) XeO_3	3) equatorial positions
	4) corners of a tetrahedron

The correct match is

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

45. Which of the following is not correct?

1) XeO_3 has four σ and four π bonds
2) the hybridization of Xe in XeF_4 is sp^3d^2
3) Among noble gases, the occurrence of argon is highest in air
4) Liquid He is used as cryogenic liquid

KEY

1.1	2.2	3.4	4.2	5.2	6.3	7.4	8.2	9.4	10.2
11.3	12.3	13.2	14.1	15.3	16.1	17.3	18.1	19.4	20.3
21.3	22.4	23.1	24.3	25.3	26.2	27.2	28.2	29.2	30.1
31.1	32.2	33.3	34.3	35.3	36.1	37.1	38.1	39.4	40.1
41.1	42.1	43.1	44.2	45.1					

Question Bank - II

General characteristics

1. When a radioactive substance is kept in a vessel, the atmosphere around it is rich with
   1) He 2) Ne 3) Ar 4) Xe
2. Which element disintegrates to give two noble gases
   1) Ra 2) Th 3) Rn 4) He
13. The actual density of nitrogen is l.25glir^{-1}. The density of nitrogen obtained from the atmosphere is l.258 g lir^{-1}. This is because of the fact that atmospheric nitrogen contains
   1) Argon and other noble gases 2) Carbon dioxide
   3) Neon 4) Carbon monoxide
4. Noble gases exists only in monoatomic state. This is due to
   1) Non availability of unpaired electrons 2) high ionization energy
   3) large size 4) zero electron affinity
5. If one litre of air is passed repeatedly over heated copper and magnesium till no further reduction in volume takes place, the volume finally obtained is
   1) 800ml 2) 990 ml 3) 10 ml 4) 100 ml
6. The maximum valency (8) is shown by
   1) Xe and Os only 2) Xe and Ru only
   3) Xe, Os and Ru 4) Xe, Os. Ru and Mn
7. Regarding XeF_2 the correct combination is
   1) sp^3d - 4 LP 2) sp^3d - 3 LP
   3) sp^3d - 2 LP 4) sp^3d - 1 LP
8. Which of the following is diamagnetic in nature?
   1) O_2 2) NO_2 3) He 4) Fe^{2+}
9. The incorrect statement regarding noble gases is
   1) Their electronegativity values are zero
   2) They are held together by Vanderwaals forces
   3) They occupy the peaks in the graphs of ionisation potential and atomic number
   4) Their boiling points decrease from He to Xe
10. The fact helped the preparation of first compound of Xenon
   1) High bond energy of Xe - F 2) Low bond energy of F - F in F_2
   3) Ionisation energies of O_2 and xenon were almost similar
   4) None of these
11. Noble gases are only sparingly soluble in water due to :
   1) dipole - dipole interactions 2) induced dipole- induced dipole interactions
   3) dipole-induced dopole interactions 4) hydrogen bonding
12. The noble gas compound iso-structural with bromate ion is :
   I) XeO_2 2) XeF_4 3) XeP_2 4) $XeOF_2$

13. Which of the following is planar ?

1) XeO_4 2) XeO_3F 3) XeO_2F_2 4) XeF_4

14. Which of the following is not correct ?

1) Xe is the most reactive among the rare gases 2) He is an inert gas

3) Radon Is obtained by decay of radium

4) The most abundant rare gas found in atmosphere is He

15. Which of the following is more volatile ?

1) He 2) Xe 3) Kr 4) Ne

16. Among the following molecules,

a) XeO_3 b) $XeOF_4$ and c) XeF_6 ;

Those having same number of lone pairs on Xe are

1) a and b 2) b and c 3) a, b and c 4) a and c

17. In the compound formation xenon atom is in the third excited state, the expected hybridisation of xenon is

l) sp^2 2) sp^3 3) sp^3d 4) sp^3 or sp^3d^3

18. Bond length order in various xenon fluorides is

1) $Xel_6 > XeF_4 > XeF_2$ 2) $XeF_2 = XeF_4 = XeF_6$

3) $XeF_2 > XeF_4 > XeF_6$ 4) cannot be predicted

19. XeF_6 on partial hydrolysis gives

1) $XeOF_4$ only 2) XeO_2F_2 only

3) both XeF_4 and XeO_2F_2 4) $XeOF_4$ or XeO_2F_2

20. Number of σ and π bonds present in $XeOF_4$ molecule are

1) 5σ and 1π 2) 4σ and 2π

3) 2σ and 4π 4) 3σ and 3π

21. Number of lone pair and bond pairs present on Xe in $XeOF_4$ molecule is

I) 1,2 2) 1,4 3) 1,6 4) 2,4

22. Xenon difluoride reacts with PF_5 and give which pair of ions

3) $[XeF]^+ [PF_6]^-$ 4) $[XeF_3]^+ [PF_6]^-$

l) $[XeF_5]^- [PF_6]^+$ 2) $[XeF_7]^+ [PF_6]^-$

23. $XeF_6 + MF \rightarrow M^+ [XeF_7]^-$ Here “M” is

1) Alkali metals 2) Alkaline earth metals

3) Transition metals 4) Inner transition metals

24. The oxidation state of the noble gas element in xenon oxydifluoride $[XeOF_2]$ is

1) 0 2) +1 3) +4 4) +8

KEY

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

7. d AND f BLOCK ELEMENTS & COORDINATION COMPOUNDS

Synopsis:

1. Elements in which differentiating electron enters into (n - 1) d orbitals are called d-block elements.
2. The d-block elements are present in group 3 to 12 of the long form periodic table and lie in between s-block and p-block. They represent a transition from electropositive to electronegative character.
3. Transition elements are defined as the elements having partially filled d-orbitals in elemental " form or in their stable oxidation state.
4. All d-block elements except Zn, Cd and Hg (group 12) are transition elements.
5. There are four transition series, namely 3d, 4d, 5d which are completely filled and 6d series.It is incomplete
6. 3d series : Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu and Zn
   4d series : Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag and Cd
   5d series : La, Hf, Ta, W, Re, Os, Ir, Pt, Au and Hg
7. The general electronic configuration of d-block elements is $(n-l)d^{1"10}$ $ns^{0,2}$. Only Pd has pseudo inert gas configuration.
8. Exceptional outer electronic configurations:
   Cr [Z = 24] = $3d^5 4s^{1-}$, Cu [Z = 29] = $3d^{10}$ $4s^1$, Mo[Z = 42] = $4d^5 5s^1$,
   Pd [Z = 46] = $4d^{10}$ 5s° , Ag [Z = 47] = $4d^{10}$ $5s^1$, Au [Z = 79] = $Sd\text{^}s^1$,
   Pt [Z = 78] = $5d^9 6s$*
9. Changed names of few elements

Z	Old name	New name
104	Khurchatovium	Dubium
105	Neilsbohrium	Joliotium
106	Unnilhexium	Rutherfordium
107	Neilsbohrium	Bohrium
108	Hassium	Hatirium
109	Meitnerium	Meitnerium

10. IUPAC names : 104 Unnilquadium (Unq) ; 105 Unnilpentium (Unp) ; 106 Unnilhexium (Unh) ; 107 Unnilseptium (Uns); 108 Unniloctium (Uno); 109 Unnilennium (Une)
11. The atomic and ionic radii of 3d elements are smaller than 4d and 5d elements.
12. The radii of 4d and 5d elements do not differ significantly due to lanthanide contraction.
13. In first transition series as the electrons are added to 3d orbitals, the atom shows slow contraction in size. These slight irregularities in size have been ascribed to crystal field effects.
14. The atomic and ionic radii of terminal elements of each d series increases (Zn, Cd, Hg) due to repulsions between paired electrons which reduces attractive forces. This effect increases so much that the s-electrons of the outer orbi: are shielded

from nuclear attractions.

15. All transition elements are metals. They are less metallic compared to s- block metals. The} possess metallic lustre. They are hard and brittle They easily form alloys.
16. Transition metals are less reactive due to high ionisation energy and high heat of sublimation Pt and Au are almost unreactive. They are callec noble metals.
17. The transition metal ions with the configuratio: d^5 or d^{10} will be more stable. Ferric ion with d^5 configuration is more stable than ferrous ion
18. Transition elements possess high melting anc boiling points. This is due to involvement o: electrons from both ns and (n-l)d subshell i: metallic bonding.
19. In any series highest melting point is for VI B group elements, due to the presence maximum number of unpaired electrons that gives strong metallic bonding.
20. Zn, Cd and Hg have very low melting pom's due to non involvement of d^{10} configuration ir metallic bonding.
21. As number of valence electrons increases strength of metallic bond, enthalpy of atomisation increases.
22. In a period decrease in atomic size is less compared to decrease in atomic size of representative elements. This is due to added (n-l)d electrons provide screening effect.
23. Conductivities of transition elements are very high. ‘Ag’is the best conductor.
24. Densities of transition metals are very high due to their low atomic volumes. In 3d series highest E 38. density is observed in 'Cu' and least in 'Sc'.
25. VIII group elements possess maximum densities, very high densities are exhibited byIr and Os.
26. Ionisation potential of ‘3d’ transition metals increases from Sc to Fe, then decreases to Ni and increases in Cu and Zn.
27. IP values of transition elements are high and they have low heat of hydration. Hence transition elements are less reactive than s-block elements. The least reactive metals are Pt, Ir, Au.
28. The increase in I.P. while passing from 4d to 5d is larger than 3d to 4d. The increase in I.P. from 'Zr^1 to 'Hf is 86 kj/mole, whereas from ’Ti' to 'Zr' is 18 kj/mole.
29. 5d' transition elements possess higher ionisation energies than 3d and 4d elements. This is due to the greater effective nuclear charge ineffective shielding of the nucleus by 4f - electrons.
30. Decreasing order of IP, values : SC > Y > La, Hg > Zn > Cd, Hf > Zr > Ti
31. IP_2 values are much higher for Cr and Cu as they have stable configurations in unipositive state, with considerable loss of exchange energy.
32. IP_3 values relatively high for Zn as it is getting stable configuration after IP_2
33. IP_3 values of Mn^{+2} is much higher than Fe^{+2}. Hence half filled (or) completely

filled d orbitals have relatively high ionisation values.

34. d-Block elements form ionic bonds in lower oxidation states and covalent bonds in higher oxidation states.
35. Transition metals possess good catalytic properties due to the free valencies and ability to show variable oxidation states.
36. The characteristic properties of transition elements are : variable oxidation states, formation of coloured ions, paramagnetism, formation of alloys, complex compounds, etc.
37. Transition metals exhibit variable oxidation states as they use outer ns electrons as well as inner (n-1) d-electrons in bonding.
38. The oxidation state will be in between 0 and +8. The common oxidation state +2, due to loss of electrons either from ns or (n-1) d levels.
39. In 3d series lowest oxidation state is +1, shown by Cr and Cu. Highest oxidation state is +7, shown by Mn.
40. In 4d series highest oxidation state is +8 (unstable) shown by Ru in RuO_4. In 5d series highest is +8 (stable) shown by Os in OsO_4.
41. Substances are classified as paramagnetic, diamagnetic and ferromagnetic on the basis of their magnetic behaviour in an external magnetic field.
42. If the magnetic lines of forces are drawn into the substance the field (B) in the substance is greater than the applied field (H) such a substance is called paramagnetic substance. They move from low field to high field.
43. Paramagnetic substances are weakly attracted in to magnetic field. Examples are : O_2, NO, NO_2, ClO_2, Fe^{+2}, Cu^{+2}, $K_3[Fe(CN)_6]$, Cr^{3+}.
44. Paramagnetic nature is due to the presence of unpaired electrons.
45. If the magnetic lines of forces are repelled by the substance then the field (B) is less than the applied field (H). Such a substance is called diamagnetic substance
46. Diamagnetic substances are weakly repelled in a magnetic field. They do not contain unpa::r : electrons. Examples are : O_3, H_2O_2. Zn^{2+}
47. In ferromagnetic substances all magnet:.: moments are alligned in the same dir Ferromagnetism is a special ca paramagnetism.
48. In ferromagnetic substances the field strength, (B) >>> (H). Ferromagnetism disappear in the solution form of the substance. Eg : Fe, Co and Ni.
49. Transition metal ions are generally paramagnetic since they contain unpaired electrons.
50. Magnetic property is measured in Bohr magnetons (BM). BM = eh/4 π me, where e is the charge of electron, h is Planck's constant 'm^1 is the mass of electron. One BM is 9.273 x Lo^{-24} JT^{-1} (S.I.Unit). (or) 9.273 x 10^{-24} erg/gauss.
51. Magnetic moment p is calculated using equation.

$$\mu_{(S+L)} = \sqrt{4S(S+1)+L(L+1)}\ \text{B.M.}$$

where S is sum of the electron spin of all unpaired electrons. L is sum of the azimuthal quantum numbers of all unpaired electrons.

52. In many compounds of 3d seiies elements, the angular momentum due to orbital motion of unpaired electons is small and can be ignored.

53. If 'n' is the number of unpaired electrons, the magnetic moment is

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

54. Au^+ is diamagnetic due to $5d^{10}$ Configuration and is colourless. Au^{+3} is para magnetic due to $5d^8$ configuration and is green in colour.

55. The solution of solids of transition metal ions absorb light in visible region and exhibit colours. The d-d transition causes colour, if the ion contains unpaired d-electrons. $[Ti(H_2O)_6]Cl_3$ absorbs light of wave length 500 to 575nm and transmit red and violet. Hence it appears purple.

56. Fe^{2+} is green, Fe^{3+} is yellow, Cr^{2+} is blue, Cr^3+ is green, Mn^{2+} is pink, Mn^{6+} is green.

57. Hydrated Cu^+,Zn^{+2}, Sc^{3+}, Ti^{4+}, Mn^{+7} are colourless as d-d transition is not possible.

58. But in oxo ions $Cr_2O_7^{2-}$, CrO_4^{2-}, MnO_4^- the colour is due to charge transfer phenomenon.

59. An intimate mixture having physical properties similar to that of the metal, formed by a metal with other metals or metalloid or sometimes a nonmetal, is called an alloy.

60. Alloys are generally prepared to modify malleability, ductility, toughness, resistance to corrossion etc, so as to suit industry.

61. Alloys are classified into ferrous type and non ferrous type depending upon the presence or absence of iron in the alloy.

62. Invar : Fe-64%, Ni-35%, Mn and C in traces. As it has a low temperature coefficient it is used in pendulum rods

63. Nichrome : Ni-60%, Fe-25%, Cr-15%. It is used in heating elements of fire stoves and furnaces.

64. German silver: Cu-50 to 60%, Ni-10 to 30%, Zn- 20 to 30%. It is used in spoons, forks, and utensils.

65. Bronze : Cu-75 to 90%, Sn-10 to 25%. It is used in utensils, coins and statues.

66. Brass : Cu 60 to 80%, Zn 20 to 40%. It is used in machinery parts.

67. Some alloys are also used in nuclear engineering, dental fillings and strong magnetic material.

68. Alloys are prepared by melting a mixture of metals or the components taken in proper proportion followed by cooling or simultaneous electrolytic deposition of the metals used under suitable conditions.

69. Transition metals form interstetial or nonstoichiometric compounds with non

metals such as carbon, hydrogen, boron and nitrogen The non metal (guest) atoms are accommodate in the voids of crystals.

70. The non metal atoms occupy holes with ou altering metal lattice. But the lattice expands little. Due to this the density of intersteti compounds is less than that of metal.

71. Metals like Ti, V, Zr, Nb, Hf, Ta form intersteti compounds.

72. Hydrogen always occupy tetrahedral voids a C and N occupy larger octahedral voids.

73. Interstitial compounds will not possess a chemical bond. Since no bond is prese between guest & host elements they are call no bond compounds.

74. Catalytic activity of transition metals depends on their ability to exist in different states of oxidation or to form coordination compounds.

75. Catalytic acitivity is due to variable oxidation states and presence of vacant'd' orbitals.

76. Potassium dichormate is prepared from chromite ore fusing with sodium carbonate in air.

77. Potassium permanganate is prepared from pyrolusite ore.

78. Chromate, manganate and permanganate are all tetrahedral.

79. The elements from ${}_{5?}$La to ${}_{71}$Lu are known as lanthanoids. They are characterized by the filling of 4f orbitals in their atoms.

80. The lanthanides occur as orthophosphates in Monazite sand. It is a mixture containing mostly 'La' phosphate and trivalent phosphates of Ce, Pr and Nd.

81. The general electronic configuration of the lanthanides is [Xe]$4f^{\circ-]4}$ $5d^{0-1}$ $6s^{2}$ (or) [Pd] $4f^{\circ}\text{-}^{14}$ $5d^{\circ-1}$ $6s^{2}$

82. Among lanthanides the same theoritical and experimental configurations are observed in Ce, Gd and Lu.

83. Lanthanides are silvery white in colour. They are malleable, ductile, have low tensile strength and are good conductors of heat. They have relatively high density and posses high melting points.

84. Many of the lanthanoid ions are coloured due to the electronic transition between different 4f levels.

85. The majority of the lanthanoid ions exhibit paramagnetism due to the presence of unpaired electrons.

86. The oxides and hydroxides of the lanthanoids are basic in character.

87. Lanthanides are called rare earths because of their rare abundance in the earth's crust. Promethium (z = 61) does not occur in nature.

88. Lanthanides have high electropositive character due to low ionisation energies.

89. Lanthanides mostly exhibit +3 in their compounds. They exhibit +2 and +4 states where they are able to get half filled or completely filled orbitals. But in +2 & +4 they are unstable, they reverse back to +3.

90. Ce^{+4} has noble gas configuration. Still it comes back to +3 by accepting electron hence acts as oxidant. Eu^{+2} has F^7 configuration. It returns back to Eu^{+3} by loosing electrons. Elence Eu^{+2} is reductant.

91. Lanthanides react slowly with cold water and quickly with hot water liberating H_9 gas.

92. Lanthanides form basic oxides M_20_3 and hydroxides $M(OH)_3$. The basic nature decreases from $Ce(OH)_3$ to $Lu(OH)_3$.

93. In air lanthanides get oxidized to form M_20_3 ($M0_2$ if stable). Their oxides are ionic in nature. These oxides are basic in nature and the basic nature decreases with increase in atomic weights.

94. Lanthanides do not form coordination compounds as readily as d-block elements due to their larger sizes. Thier ions are similar to inert gas atoms. However complexes with chelating ligands are well known for lanthanides.

95. The magnetic moment and colours show periodicity in lanthanides. The colour of lanthanide (III) ion with 4P configuration is similar to the lanthanide (III) ion with $4f^{m}\sim^{n)}$ configuration.
Nd^{3+} ($4f^3$) —Pink, Er^{3+} ($4f^{14,3}$)...Pink , Sm^{3+} (4P) ...yellow Dy ($4f^{14-5}$) ....yellow

96. Consequences of lanthanide contraction are : 4d series elements are larger than 3d series (but the same trend is not followed while going from 4d to 5d). The size of 4d and 5d are almost same. Hf & Zr, Nb & Ta, Mo & W these pairs shows same size and same chemical properties.

97. Chemical properties of lanthanides vary little from one another. Due to this their separation from mixture becomes difficult.

98. The elements from $_{90}A1$ to $_{103}Lw$ are known as actinides.

99. Actinides are mostly synthetic and are called transuranic elements.

100. Addition compounds are formed when two or more independent stable compounds combine either physically or chemically.

101. A double salt gives test for all the constituent ions present in it. Eg. Carnallite, Alum, etc.

102. A complex species is either a molecule or ion whose physical properties such as colour and , conductivity are distinctly different from those * of the substances from which it is formed. ”

103. A complex compound retains its odentily and does not exhibit the properties of constituent elements.

104. Werner proposed that transition metals possess two types of valencies: primary (1°) valency and secondary (2°) valency.

105. Primary valency indicates oxidation number. It is ionisable valency and is satisfied by only negative ions.

106. Secondary valency is non-ionisable valency and determines the shape of complex. It is satisfied by positive ions, negative ions and neutral molecules.

107. Ligand is an ion or molecule that surrounds the metal ion in a condition complex. Ligand is an electron pair donor.

108. Based on the charge, ligands are 3 types : neutral ligands like NH_3, H_2O, CO; anionic ligands like CN^-, Cl^-, NO_2^- and cationic ligands like NO^+.

109. Based on the number electron pairs donated, " ligands are three types: monodeutate ligands, like NH_3 H_2O, Cl^-, CN^-, bidentate ligands like $-OOC-COO^-$, $H_2OCH_2COO^-$ and polydentate ligands like ethylenediamine tetracetate $(EDTA)^{4-}$.

110. Number of coordinate covalent bonds that a metal ion forms with the ligands in a complex compound is called coordination number.

111. It denotes 2° valency. Shape of complex can be assumed based on the coordination number.

112. Shapes of complexes

Coordination number	Shape of the corresponding complex
2	Linear
3	Trigonal planar
4	Tetrahedral (sp^3)or square planar (dsp^2)
5	Square pyramidal
6	Octahedral
7	Pentagonal bipyramidal

113. Werner prepared cobalt amine complexes $CoCl_3$. $6NH_3$ or $[Co(NH_3)_6]Cl_3$, $CoCl_35NH_3$ or $[Co(NH_3)_5Cl]Cl_2$, $CoCl_3.4NH_3$ or $[Co(NH_3)_4Cl]Cl$ and $CoCl_3.3NH_3$ or $[Co(NH_3)_3Cl_3]$.

114. One mole $CoC/_3.6NH_3$ produces four moles of ions in solution with excess $AgNO_3$ solution three moles of AgCl precipitate. $CoCl_3.3NH_3$ does not ionise in solution and gives no precipitate.

115. Werner's theory does not correlate electronic configuration of the central metal with the formation of the complex compounds.

116. Werner's theory fails to explain colour, magnetic and optical properties of complexes.

117. In the formation of a complex ion, the central metal ion acts as a Lewis acid where as the ligand acts as Lewis base.

118. The formation of coordination complex is a Lewis neutralisation.

119. Some ligands contain two or more atoms with unshared pairs of electrons. If they coordinate to the same central metal or ion to form a ring, the phenomenon is known as chelation.

120. Transition metal ions form complex compounds due to small size, high effective nuclear charge of the metal ion and presence of vacant d-orbitals.

121. The central metal ion together with the ligands is known as complex ion or coordination sphere. Coordination entities are mainly two types : Mononuclear compounds like $[Co(NH_3)JCl_3$, $K_4[Fe(CN)_6]$ and polynuclear compounds like $[Fe_2(CO)_9]$ $[Co_2(NH_3)_6(OH)_3]Cl_3$.

122. The coordination sphere of a complex compound carrying negative charge is anionic complex.
eg. $K_4[Fe(CN)_6]$, $K_3[Fe(CN)_6]$, $K_2[Ni(CN)_4]$,

123. The coordination sphere of a complex e compound carrying positive charge is cationic t complex.
eg. $[Ag(NH_3)_2]Cl$, $[Cu(NH_3)_4]S0_4$

124. The coordination sphere of a complex compound which does not carry any charge is neutral complex, eg. $[Ni(CO)_4]$, $[Co(NH_3)_3Cl_3]$

125. IUPAC rules to write the formula : All mononuclear complex entities contain a single central metal atom, which is symbolised first. If more than one ligand of each type is present, alphabetical order according to the first letter is to be followed in listing them. Formulae of polyatomic ligands are enclosed in parantheses. Complete coordination entity is enclosed in square brackets. Different species present in the formula are written continuously without leaving space. Charge of anionic or cationic complex is indicated outside the square brackets as a right superscript.

126. IUPAC rules for naming the complexes : Neutral coordination entity is written as one word. Cationic part is named first, and then anionic part. Number of cations or anions is not indicated. Within a coordination entity, ligands are named in alphabetical order and then name of the central metal atom (or ion) follows. The oxidation state of the metal is represented in Roman numerical after the name in parenthesis.

127. The names of cationic ligands and neutral ligands do not change, except aqua for H_2O, ammine for NH_3, carbonyl for CO and nitrosyl for NO. The names of anionic ligands ends with - 'O'.

128. Prefixes like di-, tri—, tetra- etc are used to name simple ligands bis-, tris-, tetrakis- etc for ligands whose names have di-, tri- etc already included. In anionic entities, the name of central metal ion terminates with -ate. The atom of the ligand which is bonded to the metal is indicated by its chemical symbol.

129. If complex compound possesses water or solvent of crystallisation, these follow the name of the compound and their numbers are represented by Arabic numericals before their names.

130. Names of some complexes

Formula	Name
$[Co(NH_3)_6]Cl_3$	Hexaammine cobalt (III) chloride
$[CoCl(NH_3)_5JCl_2$	Pentaamminechlorocobalt (III) chloride
$K_4[Fe(CN)_6]$	Potassium hexacyanoferrate (II)
$K_3[Fe(CN)_6]$	Potassium hexacyanoferrate (III)
$[Pt(NH_3)_6ClJ$	Hexaamineplatinum (IV) chloride
$[Pta_2(NH_3)_2]$	Diamminedichloroplati n um(II)
$K_3[Fe(C_70_4)_3]$	Potassium trioxalatoferrate (III)

131. Pauling's valence bond theory provided useful understanding of the valence and structure of compounds.

132. Complexes with unpaired electrons are paramagnetic and with no unpaired electons are diamagnetic

133. The hybridisation of central metal atom depends upon the co-ordination number.

134. Hybridisation in complexes

Co-ordination Number	Complex	Hybridisation
2	$[Ag(NH_3)_2]Cl$	sp
4	$Ni(CO)_4$	sp^3
4	$[Ni(CN)_4]^{2-}$	dsp^2
6	$K_4[Fe(CN)_6]$	d^2sp^3
6	$K_3[Fe(CN)_6]$	d^2sp^3
6	$[Co(NH_3)_6]Cl_3$	d^2sp^3

135. With dsp^2 and d^2sp^3 hybridisation, inner complexes are formed. Inner complex is also called spin paired, low spin or strong field or covalent complex.

136. With sp^3 and sp^3d^2 hybridisation, outer complexes are formed. Outer complex is also called sping free or high spin or weak field or low field or ionic complexes.

137. The orbitals in the valance shell of central atom, such as (n-l)d, ns, np, nd orbitals undergoes hybridisation to form identical hybrid orbitals. These empty hybrid orbitals of metal overlaps with completely filled orbitals of ligands to form dative bonds with ligands.

138. With sp^3 hybridisation, tetrahedral complex is formed. Bond angle is 109.5°.

139. With dsp^2 hybridisation square planar complex is formed. Bond angle is 90°.

140. With d^2sp^3 or sp^3d^2 hybridisation, octahedral complex is formed. Bond angle is 90°.

141. $[Co(NH_3)_6]^{3+}$ has d^2sp^3 hybridization. Oxidation state of Co is +3. It is diamagnetic, inner orbital complex and has ochahedral shape

142. $[NiCl_4J^{2-}$ has sp^3 hybridization. Oxidation state of Ni = +2. It is tetrahedral,

paramagnetic and high spin complex.

143. $[Ni(CN)_4]^{2-}$ has dsp^2 hybridization. Oxidation state of Ni = +2. It is square planar, diamagnetic and low spin complex

144. Valency bond theory can explain the structure and magnetic behaviour of co-ordination compounds.

145. Effective atomic number (EAN) concept was introduced by Sidgwick to explain the stability of complexes.

146. EAN is the sum of number of electrons of the metal ion and number of electrons gained from ligands.

147. When EAN of central metal cation is equal to the atomic number of the nearest inert gas, the complex is expected to possess greater stability.

148. Two or more complexes with identical composition but with different properties are called isomers.

149. Structural isomerism arises due to different kinds of bonds. Ionisation, hydrate, ligand and coordination isomerism are examples of structural siomerism.

150. Ionisation isomerism : Isomers differs in type of ions obtained on dissociation in aqueous solutions.

$[Pt\ Cl_2(NH_3)JBr_2$ gives Br ions ; $[Pt\ Br_2(NH_3)_4]Cl_2$ gives Cl^- ions

151. Hydrate Isomerism: (Solvate Isomerism).It is a special type of ionisation isomerism, arises due to the presence of different number of water molecules in and outside the coordination sphere.

$[Cr(H_20)_6]Cl_3$	- Violet
$[CrCl\ (H_2O)_5]Cl_2.H_2O$	- Light Green
$[CrCl_2(H_20)_4]Cl.2H_20$	- Dark Green

152. Ligand Isomerism: Due to different isomers of the ligand

$[Co(H_2N\ CH_2CH_2CH_2NH_2)_3]^{3+}$; $[Co(CH_3CH(NH_2)\ CH_2NH_2)_3]^{3+}$

153. Stereoisomerism is due to difference in spacial orientation.

154. Geometrical isomerism is also known as cis- trans isomerism. It is shown by complexes in which the coordination entities have the general formula, $[Ma_2b_2]$ and $[Ma_2b_4]$ or $[Ma_2(bb)_2]$ where M is the central metal atom/ion; a and b are (ligands).

155. In cis-isomer the same ligands are on the same side whereas in trans-isomers they are on the opposite side.

156. When there are three ligands of each type $[Ma_3b_3]$, a different type of geometrical isomerism occurs in octahedral coordination entities. It is known as facial (fac) meridional (mer) isomerism.

157. Cis - trans isomerism is observed only in some square planar and octahedral complexes.

158. Tetrahedral complexes do not show geometrical isomerism. Square planar complex Ma_4, Ma_3b do not show geometrical isomerism. Octahedral complexes

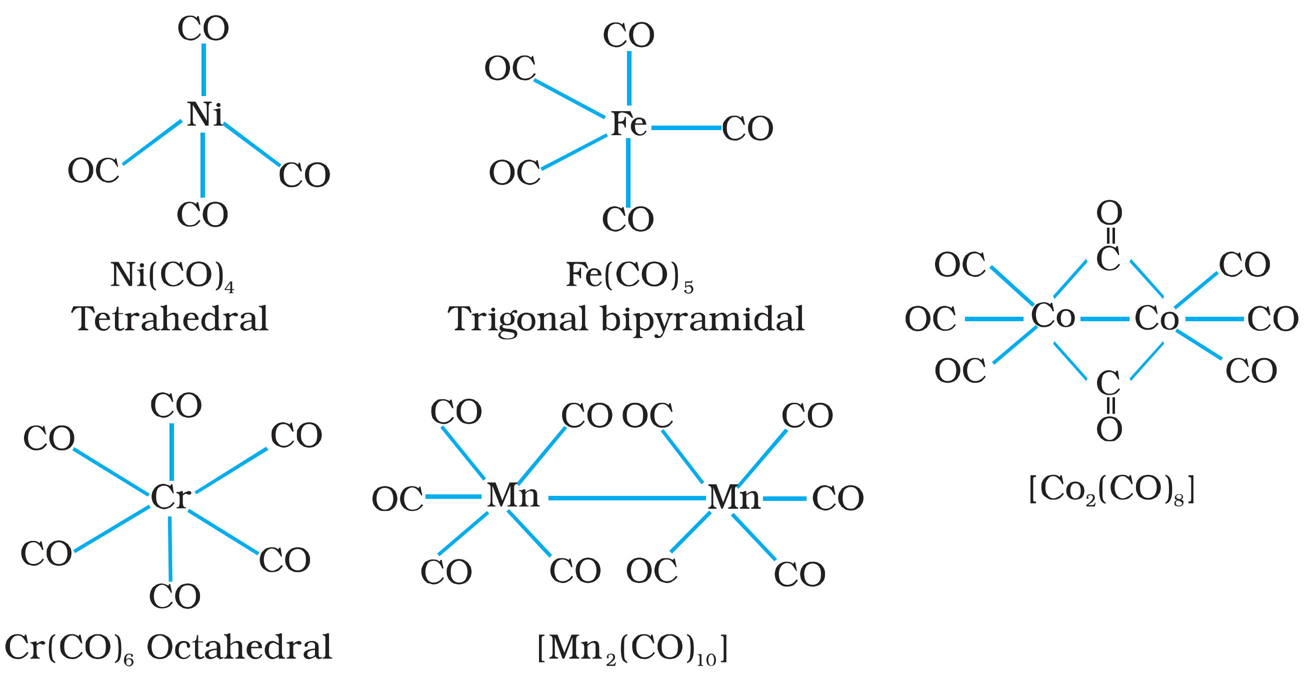
Ma_6, Mab_5, do not show geometrical isomerism.

159. Optical isomerism is due to the difference in the rotation of plane of polarised light in a polarimeter.
160. Dextro (d- or +) isomer rotates the light to right of the original plane and laevo (1- or -) isomer rotates to left.
161. Optical isomerism is generally shown by octahedral complexes, containing polydentate ligands. They must have the property of chirality.
162. equilibrium mixture of d- and 1- isomers e gives a recemic mixture, with a net optical L rotation of zero.
163. Optical isomers are called enantiomorphs or enantiomers. They are non-superimposable mirror images and almost identical in physical and chemical properties.
164. Complex formation is an important feature in qualitative analysis cu^{2+} is identified by deep blue complex. $[Cu(NH_3)_4(H_2O)_2]^{2+}$
165. Nesseler's reagent is used for detection of NH_3 or NH_4^+ salts. Nesseler's reagent is a solution of $K_2[HgI_4]$ complex in excess of KOH. K_2 [HglJ (colourless).
166. In group 3 cations, the formation of blood red coloured complex $[Fe(NCS)_6]$ indicates the presence of ferric iron.
167. Depending upon the characterstic colour of hydrate complexes, respective metal ions can be detected, eg. $[Fe(H_2O)_6]^{2+}$ - pale green. $[Cu(H_2O)_4]^{2+}$ - blue $[Ti(H_2O)_6]^{3+}$ - purple.
168. In photography the unreacted AgX on the film is dissolved in dilute hypo solution due to the formation of complex, $Na_3[Ag(S_2O_3)_2]$
169. Metal complexes .releases metal slowly and thus give a uniform coating in electroplating of the metal. In electroplating of silver, $K[Ag(CN)_2]$ is used because it provides Ag^+ slowly and thus give uniform coating
170. Ag and Au are extracted by use of complex formation. The metal Ag or Au is displaced from the complex in the solution by using Zn.

Bonding in Metal Carbonyls

Metal carbonyls (compounds containing carbonyl ligands only) are formed by most of the transition metals. These carbonyls have simple, well defined structures. Tetracarbonylnickel(0) is tetrahedral, pentacarbonyliron(0) is trigonalbipyramidal while hexacarbonyl chromium(0) is octahedral.

Decacarbonyldimanganese(0) is made up of two square pyramidal $Mn(CO)5$ units joined by a Mn – Mn bond. Octacarbonyldicobalt(0) has a Co – Co bond bridged by two CO groups (Fig.).



$Ni(CO)_4$ Tetrahedral

$Fe(CO)_5$ Trigonal bipyramidal

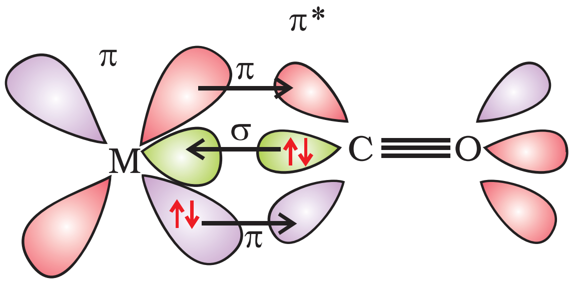
$[Co_2(CO)_8]$

$Cr(CO)_6$ Octahedral

$[Mn_2(CO)_{10}]$

Fig. *Structures of some representative homoleptic metal carbonyls.*

The metal-carbon bond in metal carbonyls possess both σ and π character. The M–C σ bond is formed by the donation of lone pair of electrons on the carbonyl carbon into a vacant orbital of the metal. The M–C π bond is formed by the donation of a pair of electrons from a filled *d* orbital of metal into the vacant antibonding π* orbital of carbon monoxide. The metal to ligand bonding creates a synergic effect which strengthens the bond between CO and the metal (Fig.).



Synergic bonding

Fig. : *Example of synergic bonding interactions in a carbonyl complex.*

Stability of Coordination Compounds

The stability of a complex in solution refers to the degree of association between the two species involved in the state of equilibrium. The magnitude of the (stability or formation) equilibrium constant for the association, quantitatively expresses the stability. Thus, if we have a reaction of the type:

$$M + 4L \rightleftharpoons ML_4$$

then the larger the stability constant, the higher the proportion of ML_4 that exists in solution. Free metal ions rarely exist in the solution so that M will usually be surrounded by solvent molecules which will compete with the ligand molecules, L, and be successively replaced by them. For simplicity, we generally ignore these solvent molecules and write four stability constants as follows:

$$M + L \rightleftharpoons ML \qquad K_1 = [ML]/[M][L]$$

$$ML + L \rightleftharpoons ML_2 \qquad K_2 = [ML_2]/[ML][L]$$

$$ML_2 + L \rightleftharpoons ML_3 \qquad K_3 = [ML_3]/[ML_2][L]$$

$$ML_3 + L \rightleftharpoons ML_4 \qquad K_4 = [ML_4]/[ML_3][L]$$

where K_1, K_2, etc., are referred to as **stepwise stability constants.** Alternatively, we can write the **overall stability constant** thus:

$$M + 4L \rightleftharpoons ML_4 \quad \beta_4 = [ML_4]/[M][L]^4$$

The stepwise and overall stability constant are therefore related as follows:

$\beta_4 = K_1 \times K_2 \times K_3 \times K_4$ or more generally,

$\beta_n = K_1 \times K_2 \times K_3 \times K_4 \ldots\ldots. K_n$

If we take as an example, the steps involved in the formation of the cuprammonium ion, we have the following:

$Cu^{2+} + NH_3 \rightleftharpoons Cu(NH_3)^{2+}$ $\quad K_1 = [Cu(NH_3)^{2+}]/[Cu^{2+}][NH_3]$

$Cu(NH_3)^{2+} + NH_3 \rightleftharpoons Cu(NH_3)_2^{2+}$ $\quad K_2 = [Cu(NH_3)_2^{2+}]/[Cu(NH_3)^{2+}][NH_3]$ etc.

where K_1, K_2 are the stepwise stability constants and overall stability constant.

Also $\beta_4 = [Cu(NH_3)_4^{2+}]/[Cu^{2+}][NH_3]^4$

The addition of the four amine groups to copper shows a pattern found for most formation constants, in that the successive stability constants decrease. In this case, the four constants are:

$\log K_1 = 4.0$, $\log K_2 = 3.2$, $\log K_3 = 2.7$, $\log K_4 = 2.0$ or $\log \beta_4 = 11.9$

The **instability constant or the dissociation constant** of coordination compounds is defined as the reciprocal of the formation constant .

Importance and Applications of Coordination Compounds

- Coordination compounds are of great importance. These compounds are widely present in the mineral, plant and animal worlds and are known to play many important functions in the area of analytical chemistry, metallurgy, biological systems, industry and medicine. These are described below:
- Coordination compounds find use in many qualitative and quantitative chemical analysis. The familiar colour reactions given by metal ions with a number of ligands (especially chelating ligands), as a result of formation of coordination entities, form the basis for their detection and estimation by classical and instrumental methods of analysis. Examples of such reagents include EDTA, DMG (dimethylglyoxime), α–nitroso–β–naphthol, cupron, etc.
- Hardness of water is estimated by simple titration with Na_2EDTA. The Ca^{2+} and Mg^{2+} ions form stable complexes with EDTA. The selective estimation of these ions can be done due to difference in the stability constants of calcium and magnesium complexes.
- Some important extraction processes of metals, like those of silver and gold, make use of complex formation. Gold, for example, combines with cyanide in the presence of oxygen and water to form the coordination entity $[Au(CN)_2]^-$ in aqueous solution. Gold can be

separated in metallic form from this solution by the addition of zinc (Unit 6).

- Similarly, purification of metals can be achieved through formation and subsequent decomposition of their coordination compounds. For example, impure nickel is converted to $[Ni(CO)_4]$, which is decomposed to yield pure nickel.
- Coordination compounds are of great importance in biological systems. The pigment responsible for photosynthesis, chlorophyll, is a coordination compound of magnesium. Haemoglobin, the red pigment of blood which acts as oxygen carrier is a coordination compound of iron. Vitamin B_{12}, cyanocobalamine, the anti–pernicious anaemia factor, is a coordination compound of cobalt. Among the other compounds of biological importance with coordinated metal ions are the enzymes like, carboxypeptidase A and carbonic anhydrase (catalysts of biological systems).
- Coordination compounds are used as catalysts for many industrial processes. Examples include rhodium complex, $[(Ph_3P)_3RhCl]$, a Wilkinson catalyst, is used for the hydrogenation of alkenes.
- Articles can be electroplated with silver and gold much more smoothly and evenly from solutions of the complexes, $[Ag(CN)_2]^-$ and $[Au(CN)_2]^-$ than from a solution of simple metal ions.
- In black and white photography, the developed film is fixed by washing with hypo solution which dissolves the undecomposed AgBr to form a complex ion, $[Ag(S_2O_3)_2]^{3-}$.
- There is growing interest in the use of chelate therapy in medicinal chemistry. An example is the treatment of problems caused by the presence of metals in toxic proportions in plant/animal systems. Thus, excess of copper and iron are removed by the chelating ligands D–penicillamine and desferrioxime B via the formation of coordination compounds. EDTA is used in the treatment of lead poisoning. Some coordination compounds of platinum effectively inhibit the growth of tumours. Examples are: *cis*–platin and related compounds.

Question Bank – I

1. The following represents the electronic configuration of a transition element
   1) ns^2np^3
   2) $ns^2np^6nd^3(n+1)s^2$
   3) $ns^2np^6nd^{10}(n-1)s^2(n+1)p^4$
   4) ns^2np^5
2. Transition elements are so called because
   1) they form coloured compounds
   2) they occur in between the s-block and p-block in the periodic table
   3) they show variable oxidation states
   4) they exhibit paramagnetic nature

3. Substances which are repelled by the external magnetic field are called
1) diamagnetic 2) paramagnetic
3) ferromagnetic 4) antiferromagnetic

4. The following is paramagnetic
1) $CaCl_2$ 2) $CuCl_2$ 3) $ZnCl_2$ 4) NaCl

5. Diamagnetism is not exhibited by
1) Zn^{2+} 2) Sc^{3+} 3) Cu^{2+} 4) Cu^{1+}

6. Coloured ion among the following is
1) Zn^{2+} 2) Mn^{2+} 3) Cu^{1+} 4) Ti^{4+}

7. Coloured complexes absorb radiation in the
1) visible region 2) infrared region 3) U.V region 4) far IR region

8. The element which has half-filled d-orbitals in its '+1' oxidation state is
1) Mn 2) Cr 3) Zn 4) Fe

9. Resistance wires for electrical furnaces are prepared using the alloy
1) German silver 2) Gun metal 3) Nichrome 4) Aluminium Bronze

10. IUPAC name of $[Cu(NH_3)_4]SO_4$
1) tetra ammine copper sulphate 2) tetra ammine copper (II) sulphate
3) copper tetra amine sulphate 4) copper sulphate tetraamine

11. A bidentate ligand is
1) pyridine 2) thiocyanate 3) ethylene diammine 4) water

12. The number of 'd' electrons in Fe^{2+} is equal to that of
1) s-electrons in Mg 2) p-electrons in Ne
3) p-electrons in Cl 4) d-electrons in Fe

13. The pair of ions which do not have diamagnetic nature
1) Cu^{1+} and Zn^{2+} 2) Sc^{3+} and Ti^{4+}
3) Ca^{2+} and Zn^{2+} 4) V^{2+} and Fe^{2+}

14. IUPAC name o $K_3[Fe(CN)]_6$
1) Potassium ferrocyanide (II) 2) Potassium hexacyanate (II)
3) Potassium hexa Ferro cyanate(II) 4) Potassium hexa cyano Ferrate (III)

15. The magnetic behaviour of complexes $K_4[Fe(CN)_6]$ and $K_3[Fe(CN)_6]$ is
1) Para, Dia 2) Dia, Para 3) Dia, Ferro 4) Both dia

16. $K_2SO_4.Al_2(SO_4)_3.2H_2O$ is
1) a complex salt 2) a double salt
3) a complex salt & double salt 4) a basic salt

17. Which of the following orbitals are filled progressively in the transition elements
1) s 2) p 3) d 4) f

18. The transition element that has stable configuration in +1 oxidation state is
1) Cu 2) Zn 3) Sc 4) Mn

19. The element of the following group are called Typical trnasitional elements
1) IB 2) IIB 3) VIII 4) IVB

20. Divalent Manganese is more stable due to
1) $3d^4$ configuration 2) $3d^2$ configuration
3) $3d^5$ configuration 4) $3d^3$ configuration

21. The units of Magnetic moment are
1) Newton-ohm 2) Torrs 3) Bohr Magneton 4) Pascals

22. Which of the following atom would be repelled by magnetic field
1) Ti 2) Cr 3) Ni 4) Zn

23. Magnetic moment of diamagnetic substance in Bohr magnetons is
1) 1.73 2) 2.83 3) 5.0 4) 0

24. Element furnishing coloured ions in the aqueous medium is
1) Zinc 2) Mercury 3) Copper 4) Aluminium

25. The value of paramagnetic moment Ti^{+3} ion in Joule/Tesla is
1) 273×10^{-24} 2) 16.042×10^{-24} 3) 26.34×10^{-24} 4) 16.042×10^{-27}

26. Number of dative bonds in the complex $CoCl_3.5NH_3$ is
1) 5 2) 6 3) 3 4) 4

27. The alloy used to reduce nitrites to ammonia
1) Type metal 2) Devarda’s metal 3) Wood’s metal 4) Solder metal

28. Variable valency of transition metals is due to
1) incomplete s-orbitals 2) incomplete d-orbitals
3) completely filled d-orbitals 4) incomplete p-orbitals

29. Which of the following is colourless
1) Sc^{3+} 2) Ti^{3+} 3) V^{3+} 4) Cr^{3+}

30. Which of the following metal ion is colourless in aqueous solution
1) V^{2+} 2) Cr^{3+} 3) Zn^{2+} 4) Ti^{3+}

31. The magnetic moment of Sc^{3+} is
1) 1.73BM 2) 0 3) 2.56BM 4) 3.43BM

32. A set of elements does not belong to transitional elements is
1) Fe, Co and Ni 2) Cu, Ag and Au
3) Ti, Zn and Hf 4) Ga, In and Tl

33. The number of moles of AgCl precipitated when excess of $AgNO_3$ is added to one mole of $[Cr(NH_3)_4Cl_2]Cl$ is
1) 0 2) 1 3) 2 4) 3

34. Which of the following ions has same number of unpaired electrons as that of V^{3+} ion
1) Cr^{3+} 2) Mn^{2+} 3) Ni^{2+} 4) Fe^{3+}

35. Which of the following pair of ions contain the same number of unpaired electrons?
1) Ni^{2+} and Co^{2+} 2) Mn^{2+} and Fe^{2+}
3) Mn^{2+} and Ni^{2+} 4) Ti^{2+} and Ni^{2+}

36. The following ion exhibits highest magnetic moment?
1) Cu^{2+} 2) Ti^{3+} 3) Ni^{2+} 4) Mn^{2+}

37. Which does not obey EAN rule ?
1) $K_4[Fe(CN)_6]$ 2) $K_3[Fe(CN)_6]$ 3) $[Co(NH_3)_6]CI_3$ 4) $[Ni(CO)_4]$

38. Example of neutral complexs
A) Potassium pentacyanonitrosyl ferrate (II)
B) Triaquotrichloro chromium (III) trihydrate
C) Triamminetrichloro cobalt (III)
D) Diamminedibromo dichloroplatinum (IV)
1) A & B 2) B, C & D 3) A, C & D 4) B only

39. Fac and mer isomerism is associated with the general formula
1) MA_3X_3 2) $M(AA)_3$ 3) MABCD 4) $M(AA')_3$

40. Correct order of ligands for writing the formula of complex compounds
1) neutral, anionic, cationic 2) anionic, neutral, cationic
3) anionic, cationic, neutral 4) cationic, neutral, anionic

41. $[Co(NH_3)_5 Br] SO_4$ and $[Co(NH_3)_5 SO_4] Br$ are example of which typing of isomerism
1) Linkage 2) Geometrical 3) Ionisation 4) Optical

42. Which of the following is a polynuclear compounds
1) $[Co (NH_3)_4 CI_2] CI$ 2) $Na Fe [Fe(CN)_6]$
3) $[Cr (H_2O)_5 CI] CI_2$ 4) $[(CO)_3Fe(CO)_3 Fe(CO)_3]$

43. Assertion (A): Racemic mixture has a net rotation of zero.
Reason (R): Racemic mixture contains optically inactive isomers.
1) Both A and R are true, R property explains A.
2) Both A and R are true, R does not explain A.
3) A is true, but R is false.
4) A is false, but R is true.

44. Assertion (A): According to EAN rule, ferricyanide is not a stable complex compound.
Reason (R): EAN of Fe in ferricyanide is 35.
1) Both (A) and R are true, R properly explains A.
2) Both A and R are true, R does not explain A.
3) A is true, but R is false.
4) A is false, but R is true.

45. Assertion: The primary valency of iron in $[Fe (CO)_5]$ is zero.
Reason: The oxidation state of metals in metal carbonyl is zero.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

46. Assertion: $CoCl_3 4NH_3$ as three ionizable chlorides.
Reason: The coordination number of Cobalt is 6.
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true and R is not the correct explanation of A
3) A is true but R is false
4) A is false but R is true

7.

List –I	**List –II**
A) 3d	1) Ru
B) 4d	2) Ac
C) 5d	3) Mn
D) 6d	4) Pt

The correct match is
1) 1-C, 2-D, 3-B, 4-A 2) 1-C, 2-A, 3-D, 4-B
3) 1-C, 2-A, 3-B, 4-D 4) 1-A, 2-C, 3-D, 4-B

48.

List –I	List –II
A) Sc^{+3}	1) 5.92BM
B) Cr^{+3}	2) 7.73BM
C) Fe^{+2}	3) 3.87BM
D) Mn^{+2}	4) zero
	5) 4.9BM

The correct match is

	A	B	C	D		A	B	C	D
1)	4	2	5	1	2)	2	1	4	5
3)	4	3	5	1	4)	5	4	3	1

49.

List –I	**List –II**
A) Simple salt	1) $CuSO_4.4NH_3$
B) Double salt	2) $CaOCl_2$
C) Complex salt	3) $KCl\ MgCl_2.6H_2O$
D) Mixed salt	4) $MgCl_2$

The correct match is

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

50.

List –I	**List –II**
A) Octahedral	1) 4
B) Tetrahedral	2) 5
C) Linear	3) 6
D) Square pyramidal	4) 2
	5) 8

The correct match is

	A	B	C	D		A	B	C	D
1)	2	5	3	1	2)	3	1	4	2
3)	3	4	1	5	4)	5	1	4	2

KEY

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

Question Bank – II

1. The element having general configuration $\mathbf{4f^{14}5s^{2}5p^{6}fd^{0-1}6s^{2}}$ are referred as
   (1) Alkali metals (2) Transition elements (3) Lanthanides (4) Actinides

2. Which of the following lanthanides is radio active.
   (1) Cerium (2) Promethium (3) Thulium (4) Lutetium
3. Which of the following ion is paramagnetic.
   (1) La^{3+} (2) Lu^{+3} (3) Vb^{+3} (4) Sm^{+3}
4. Which of the following has tendency to act as on oxidizing agent
   (1) Ca^{+4} (2) Sm^{+2} (3) Lu^{+3} (4) Gd^{+3}
5. In which of the following lanthanides oxidation state +2 is most stable.
   (1) Ca (2) Eu (3) Gd (4) Dy
6. Which element has smallest ionic radius.
   (1) Nd^{+3} (2) Dy^{3+} (3) Lu^{+3} (4) Pm^{3+}
7. Lanthanide contraction is responsible for
   (1) Zr and Y have same radius (2) Zr and Nb have similar oxidation state
   (3) Zr and Hf have same radius (4) Zr and Zn have same oxidation state
8. Which is most basic
   (1) $\mathbf{Sc(OH)_3}$ (2) $\mathbf{La(OH)_3}$ (3) $\mathbf{Lu(OH)_3}$ (4) $\mathbf{Yb(OH)_3}$
9. In aqeous solution Eu^{+2} acts as
   (1) An oxidizing agent (2) Reducing agent
   (3) Can act as either of these (4) Act as redox agent
10. Which of the following has a maximum tendency to from complexes.
   (1) La^{+3} (2) Lu^{3+} (3) Gd^{+3} (4) Ce^{3+}

KEY

34) **3** 35) **2** 36) **4** 37) **2** 38) **2** 39) **3** 40) **3** 41) **2** 42) **2** 43) **2**

Question Bank - III

1. Which metal has the least melting point
1) Cr 2) Ti 3) Cu 4) Zn

2. Among the transition elements the element with lowest melting point belongs to
1) group IIIB 2) group IB 3) group VIB 4) group IIB

3. Arrange the following in order of their decreasing thermal conductivity
1) Al, Ag, Cu 2) Cu, Ag, A1 3) Ag, Cu, Al 4) Al, Cu, Ag

4. A) In a group the correct order of melting points is 3d < 4d < 5d
B) VI B group have highest melting points in any series
C) In 3d and 4d series, VIIB group elements have exceptionally low melting points
D) The correct order of melting points is Cu > Ag > Au
1) Only A,. B, C are correct 2) Only A, B, D are correct
3) Only A, C, D are correct 4) Only A, D, C are correct

5. The reason for the stability of Gd^{3+} ion is
1) 4f subshell - half filled 2) 4f subshell - completely filled
3) Possesses the general electronic configuration of noble gases
4) 4f subshell empty

6. Electronic configuration of a transition element is [Ar] $4s^2 3d^6$. A sudden hike is observed between
1) IP, & $1P_2$ 2) $1P_2$ & IP_3 3)IP_3 & IP_4 4) IP_4 & IP_5

7. Transition elements have higher enthalpy of atomisation than alkali metals due to
1) High electropositive nature of transition elements
2) Larger size of transition elements
3) Stronger metallic bond in transition elements
4) Participation of ns and (n - 1) id electrons in bond formation in alkali metals

8. Enthalpy of atomisation is lowest in
1) Sc 2) Mn 3) Ni 4) Zn

9. Which of the following has highest tendency for M^{+2} M
1)V 2) Cr 3) Co 4) Cu

10. Cu^{+2} can oxidise the halide
1) 1 2) Br 3) Cl 4) F

11. In aqueous solution the following undergoes disproportionation reaction
l) Cr^{5+} 2) Mn^{6+} 3) Cu^{+} 4) All

12. d- block elements can act as catalysts due to their ability to
1) Exhibit variable oxidation states 2) Coloured ion formation
3) Paramagnetic nature 4) Alloy formation

13. Incorrect statement regarding interstial hydrides is
1) They show metallic conduction 2) They are harder than pure metal
3) They have high mp than pure metal 4) They are denser than pure metal

14. The properties of Zr and Hf are similar because :
1) both belong to d-block 2) both belong to same group of the periodic table
3) both have similar radii 4) both have same number of electrons

15. The stability of particular oxidation state of a metal in aqueous solution is determined by
1) Enthalpy of sublimation of the metal 2) Ionisation energy
3) Enthalpy of hydration of the metal ion 4) All of these

16. Which among FeO and Fe_2O_3 is more basic?
1) FeO 2) Fe_2O_3
3) Both have same basic strength 4) None of them is basic

17. Which of the following properties would you not expect copper (Cu) to exhibit?
1) High thermal conductivity 2) High electrical conductivity
3) Ductility 4) Malleability

18. Identify the incorrect statement among the following
1) La and Lu have partially tilled 'd' orbitals and no other partially filled orbitals
2) The chemistry of various lanthanoids is very similar
3) 4f and 5f orbitals are equally shielded
4) d-block elements show irregular and drastic chemical properties among themselves

19. The complex $K_3[Fe(CN)_6]$ should have a spin only magnetic moment of
1) $\sqrt{3}$ BM 2) $2\sqrt{5}$ BM 3) $\sqrt{35}$ BM 4) 6 BM

20. The pair of the compounds in which both the metals are in the highest possible oxidation state is.
1) $[Fe(CN)_6]^3$,$[Co(CN)_6]^3$ 2) CrO_2Cl_2, MnO_4
3) $Mn_2(CO)_{10}$ 4) $[Co(CN)_6]^3$, MnO_2

21. In which of the following complexes the metal ion is in zero oxidation state ?
1) $[Cu(NH_3)_4]Cl_2$ 2) $Zn_2[Fe(CN)_6]$
3) $Mn_2(CO)_{10}$ 4) $[Ag(NH_3)_2]Cl$

22. Which of the following is diamagnetic?
1) $[Zn(NH_3)_4]^{2+}$ 2) $[Cu(CN)_4]^2$
3) $[NiCl_4]^{2-}$ 4) $[Ni(NH_3)_4]^{2+}$

23. Which one of the following sets correctly represents the increase in the paramagnetic property of the ions ?
1) $Cu^{2+} < V^{2+} < Cr^{2+} < Mn^{2+}$ 2) $Cu^{2+} < Cr^{2+} < V^{2+} < Mn^{2+}$
3) $Cu^{2+} < V^{2+} > Cr^{2+} < Mn^{2+}$ 2) $V^{2+} < Cu^{2+} < Cr^{2+} < Mn^{2+}$

24. In the complex $[Ni(H_2O)_2 (NH_3)_4]^{2+}$ the number of unpaired elctrons is
1) 0 2) 1 3) 3 4) 2

25. Heat of atomization of zinc is lowest among 3d block elements due to
1) Stronger metallic bond in zinc 2) (n-l) d electrons do not involve in bonding
3) (n -l) d electrons involve in bonding 4) Larger size of zinc

26. The positive standard reduction potential of Cu^{2+}/Cu electrode is due to
1) high heat of atomisation and hydration energies
2) low heat of atomisation and hydration energies
3) high heat of atomisation and low heat of hydration
4) low heat of atomisation and high heat of hydration

27. The observed and calculated E^o values of M^{+2}/M are same for
1) Fe 2) Co 3) Ni 4) Cu

28. When a large amount of $KMnO_4$ is added to concentrated H_2SO_4 an explosive compound is formed. The formula of the compound is
1) Mn_2O_7 2) Mn_3O_4 3) MnO_3 4) MnO_3^+

29. Reaction of $KMnO_4$ in neutral or very weakly acidic solution can be represented as
1) MnO_4 $+2H_2O+3e$ MnO_2+4OH
2) $2MnO_4$ $+2OH$ MnO_4^2 $+ 1/2O_2+H_2O$
3) $2MnO_4$ $+ 8H$ $5e$ Mn^2 $+ 4H_2O$
4) MnO_4 $+ e$ MnO_4^2

30. When $KMnO_4$ is added to oxalic acid, the decolorisation is slow in the begining but becomes instantaneous after sometime- because
1) Mn^{2+} acts as autocatalyst 2) CO_2 is formed as the product
3) reaction is exothermic 4) MnO_4 catalyses the reaction

31. A solution of potassium chromate is treated with an excess of dilute nitric acid. Then the observations is
1) Cr^{3+} and $Cr_2O_7^2$ are formed 2) $Cr_2O_7^2$ and H_2O are fonned
3) $Cr_2O_7^2$ is reduced to +3 state of Cr
4) $Cr_2O_7^2$ is oxidised to +7 state of Cr

32. $K_2Cr_2O_7$ cannot be used for
1) preparing azo compounds 2) tanning leather
3) as a laboratory oxidant 4) as a reductant

33. When acidified solution of potassium dichromate is shaken with aqueous solution of ferrous sulphate then
1) $Cr_2O_7^2$ ion is reduced to Cr^{3+} ions 2) $Cr_2O_7^2$ ion is reduced to $Cr_2O_4^2$ ions
3) $Cr_2O_7^2$ ion is oxidised to Cr 4) $Cr_2O_7^2$ ion is oxidised to CrO_3

34. The blue colour produced on adding hydrogen peroxide to acidified $K_2Cr_2O_7$ is due to the formation of
l) CrO_5 2) Cr_2O_3 3) CrO_4^2 4) CrO_3

35. Which of the following metals is known to form acidic oxide
1) iron 2) manganese 3) cobalt 4) mercury

36. In the dichromate anion
1) 4 Cr O bonds are equivalent 2) 6 Cr O bonds are equivalent
3) All Cr O bonds are equivalent 4) All Cr O bonds are non-equivalent

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

1) +4 2) +6 3) +2 4) +3

38. Which of the following element has f^7 electronic configuration in its + 4 state

1)Ac 2) Bk 3) Er 4) Lv

39. The natures of the oxides CrO and CrO_3 respectively

1) acidic and basic 2) basic and amphoteric

3) amphoteric and basic 4) basic and acidic

40. Acedified $K_2Cr_2O_7$ cannot oxidise

1) Ferrous to ferric 2) Sulphide to sulphur

3) Stanous to stannic 4) Flouride to fluorine

41. The equilibrium $Cr_2O_7^{2} \rightleftharpoons 2CrO_4^{2}$

1) exists in acidic medium 2) exists in basic medium

3) exists in neutral medium 4) never exists

42. The correct statement among the following is

1) The colour of $Cr_2O_7^{2}$ ion is due to d-d transition of unpaired electrons

2) Transition elements form a large number of alloys because of similar boiling points

3) Bronze is an alloy of Copper and Zinc

4) Salt of Fe^{2+} ion has greenish colour

43. Identify the correct statements among the following

I) Both Cr and Cu show +1 oxidation state

II) The complementary colour of absorbed green colour of visible radiation is purple.

III) Ni^{+2} ion in its hydrated state exhibits green colour

IV) Brass is an alloy of copper

1) All 2) I, II, Ill only 3) I, IV only 4) I, III only

44. Which of the following has very high IP, value

l) Zn 2) Mn 3) Cu 4) Ti

45. Zn. Cd and Mg are only d-block elements but not transition elements because

1) They have partly filled d-sub shells both in their atomic and ionic states

2) They have completely filled d-sub shells both in their atomic and ionic states

3) They have fully filled d-sub shells only in their atomic states

4) Ihev have partly filled d-sub shells only in their atomic states

46. Acidified $KMnO_4$ oxidizes nitrites to

1) N_2 2) NO_2 3) NO_3 4) NO

47. Permanganate ion oxidize $S_2O_3^{2}$ in fairly alkaline solutions to give

1) SO_4^{2} 2) SO_3^{2} 3) S^{2} 4) S

48. Which of the following ions is most para- ^ magnetic

1) Nd^{+2} 2) Yb^{+2} 3) Lu^{3+} 4) Ce^{2+}

49. Yb^{+2} and Lu^{3+} are diamagnetic due to

1) Vacant ‘f’ sub shells 2) Fully ‘f’ sub shells

3) Parity filled ‘f’ sub shells 4) Partly filled ‘d’ sub shells

50. Alloy of Mitsch metal consists of

1) 95% of actionoid metal +5% iron

2) 95% of alkali metal 5% iron

3) 95% of lanthanoid metal +5% iron

4) 95% of alkaline earth metal + 5% iron

KEY

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

Question Bank - IV

Complex compounds

1. The primary valency of the central transition metal ion in a complex compound $[Cr(NH_3)_4Cl_2]Cl$

1) 3 2)2 3) 1 4)0

2. The number of ions given by $[Co(NH_3)_3Cl_3]$ in aqueous solution is

1) 1 2) 2 3) 3 4) zero

3. The oxidation state ef Chromium in the complex. $[Cr(NH_3)_4Cl_2]Cl$ is

1) +3 2) +2 3) +l 4) 0

4. When 1 mole of $[Co(NH_3)_3Cl_3]$ is added to excess of $AgNO_3$ solution the weight of AgCl precipitated is

1) 143.5g 2) 108 g 3) zero 4) 54 g

5. The secondary valency of Chromium in $[Cr(en)_3]Cl_3$ is

1) 6 2) 3 3) 2 4) 4

6. The deep blue complex produced by adding excess of Ammonia to $CuSO_4$ solution is

1) $[Cu(NH_3)_2]^{2+}$ 2) $[Cu(NH_3)_4]^{2+}$

3) $[Cu(NH_3)_6]^{2+}$ 4) $[Cu(NH_3)_4]^{+}$

7. $K_2SO_4.A1_2(SO_4)_3$, $2H_2O$ is

1) a complex salt 2) a double salt

3) a complex salt & double salt 4) a basic salt

8. Number of dative bonds in the complex $CoCl_3.5NH_3$ is

1) 5 2) 6 3) 3 4) 4

9.

LIST - I (complex)	LIST - II (Charge on co-ord. shere)
A) $CoCl_3.6NH_3$	1) +1
B) $CoCl_3.5NH_3$	1) +2
C) $CoCl_3.4NH_3$	3) +3
D) $CoCl_3.3NH_3$	4) +4
	5) 0

The correct match in terms of the charge on the complex

	A	B	C	D		A	B	C	D
1)	3	2	5	1	2)	3	1	2	5
3)	3	1	1	5	4)	4	3	2	1

10. A complex of Co^{+3} having molecular formula $CoCl_3.XNH_3$ when dissolved in water three ions are produced. The number of *Cl'* ions satisfying both primary and secondary valencies is

1)3 2) 1 3)4 4) zero

11. Pick up true statement about the complex compound with formula $[Co(NH_3)Cl_3]$

1) IUPAC name is triamminecobalt(III)chloride
2) The complex can exhibit fac and mer isomerism
3) The complex can show optical isomerism
4) The hybrid state of cobalt is dsp^3

12. Neutral complex among the following

1) $CuSO_4.4NH_3$ 2) $[Co(NH_3)_6]Cl_3$
3) $Ni(CO)_4$ 4) $[Pt(NH_3)_2]Cl_2$

13. Cationic complex is

1) Potassium ferrocyanide 2) Cryolite
3) Cuprammonium (II) sulphate 4) Sodium argentothiosulphate

14. Number of unpaired electrons in $[Fe(CN)_6]^{4}$ ion

1) 6 2) 5 3) 4 4) zero

15. Which of the following is diamagnetic

1) $[Fe(CO)_5]$ 1) $[Fe(CN)_6]^{3}$ 3) $[Cr(NH_3)_6]^{3+}$ 4) $[Cr(H_2O)_6]^{3+}$

16. The number of ions formed when cupra ammonium sulphate is dissolved in water

1) 1 2) 2 3) 4 4) zero

17.

Property of transition element	Reason for the property
1) Colour of ion	A) unpaired e in (n-1)d orbital
2) Variable oxdation states	B) Same crystal structure
3) fomation of alloys	C) d-d- transition
4) paramagnetic	D) high magnitude of positive charge
	E) slight energy between ns and (n-1)d shells

1) 1-C, 2-E, 3-A, 4-B 2) 1-C, 2-E, 3-B, 4-A
3) 1-C, 2-B, 3-E, 4-A 4) 1-B, 2-A, 3-E, 4-B

18. Ammonia form the complex ion $[Cu(NH_3)_4]^{2+}$ with copper ions in alkaline solutions but not in acidic solutions. The reason is

1) In acidic solutions hydration protects copper ions

2) In acidic solutions protons coordinate with ammonia molecules forming NH_4^+ ions and NH_3 molecules are not available

3) In alkaline solutions insoluble $Cu(OH)_2$ is precipitated which is soluble in excess of any alkali

4) Copper hydroxide is an amphoteric substance.

19. Nickel combines with a uninegative mono- dentate ligand X to form a paramagnetic complex $[NiX_4]^{2}$. The number of unpaired electron/s in the nickel and geometry of this complex ion are respectively

1) two, square planar 2) one, tetrahedral

3) two, tetrahedral 4) one, square planar

20. $[PdBr_4]^{2}$ is a sqaure planar complex. The hybridisation of Pd^{2} is

1) sp^3 2) dsp^2 3) sp^3d 4) sp^3d^2

Theories

21. Stabilisation energy of octahedral complex with d^7 configuration

A) 1.8 $_0$ with one unpaired electron

B) 1.8 $_0$With three unpaired electrons

C) 0.8 $_0$with one unpaired electron

D) 0.8 $_0$ with three unpaired electrons

1) A and D 2) A and R 3) C and D 4) B and C

22. If $_0 < P$, the correct electronic configuration for d^4 system will be

1) $t_{2g}^4 e_g^0$ 2) $t_{2g}^3 e_g^1$ 3) $t_{2g}^0 e_g^4$ 4) $t_{2g}^2 e_g^2$

23. Which of the following complexes is an outer orbital complex?

1) $[Fe(CN)_6]^4$ 2) $[Ni(NH_3)_6]^{2+}$

3) $[Co(NH_3)_6]^{3+}$ 4) $[Mn(CN)_6]^4$

24. Which of the following statement is incorrect for metals involving in formation of alloys

1) must have almost same atomic radii

2) must have similar chemical properties, especially number of valency electrons

3) must have same crystal structures

4) must belong to same 'd' series

25. Match the lists I and II and pick the correct matching from the codes given below

List -I (complex)	List -II (Structure and magnetic moment)
a) $[Ag(CN)_2]$	1) square planar and 1.73 BM
b) $[Cu(CN)_4]^3$	2) Linear and zero
c) $[Cu(CN)_6]^4$	3) Octahedral and zero

d) $[Cu(NH)_3)_4]^2$ 4) tetrahedral and zero

e) $[Fe(CN)_6]^4$ 5) octahedral and 1.73BM

1) a-2, b-4, c-5, d-l, e-3 2) a-5, b-4, c-l, d-3, e-2

3) a-l, b-3, c-4, d-2, e-5 4) a-4, b-5, c-2, d-l, e-3

26. Compound that is both paramagnetic and coloured is

1) $K_2Cr_2O_7$ 2) $[TiCl_6].(NH_4)_2$

3) $VOSO_4$ 4) $K_3[Cu(CN)_4]$

27. Strongest oxidant among the following is

1) VO_2^+ 2) $Cr_2O_7^{\ 2}$ 3) MnO_4 4) $MnO_4^{\ 2}$

Properties

28. The number of unpaired electrons in the square planar complex $[Pt(CN)_4]^2$ is

1) 2 2) 3 3) 0 4) 1

29. The correct statement regarding $[Co(C_2O_4)_3]^{3+}$ complex is

1) It .is inner orbital complex and diamagnetic

2) It is outer oibital complex and diamagnetic

3) It is inner orbital complex and paramagnetic.

4) It is outer oibital complex and para magnetic

30. Match the following

complex	colour
I) $[Ni(H_2O)_4en]_{aq}^{2+}$	A) Grey-green
II) $[Ni(H_2O)_2(en)_2]_{aq}^{2+}$	B) Violet
III) $[Ni(en)_3]_{aq}^{2+}$	C) blue/Purple
IV) $Cr[H_2O)_5Cl]Cl_2.H_2O$	D) Pale blue

The correct match is

	I	II	III	IV
1)	D	C	B	A
2)	B	A	C	D
3)	A	D	B	C
4)	C	A	D	B

31. The spin only magnetic moment $[Mn(Br)_4]^{2+}$ is 5.9BM. Then possible hybridisation of Mn in the complex is

1) sp^3d 2) dsp^3 3) d^2sp^3 4) sp^3

Nomenclature

32. IUPAC name of $Ni(CO)_4$ is

1) tetracarbonyl Nickel (II) 2) tetracarbonyl Nickel (O)

3) tetracarbonyl Nickelate (II) 4) tetracarbonyl Nickelate (O)

33. Potassium hexa chloro platinate (IV) is

1) $Pt_2[K(Cl)_6$ 2) $K[Pt(Cl)_6]$ 3) $K_2[Pt(Cl)_6]$ 4) $K_4[Pt(Cl)_6]$

34. IUPAC name of $Li[AlH_4]$ is

1) Lithium aluminium hydride 2) Lithium tetrahydrido aluminate [III]

3) Tetrahydride aluminium lithionate 4) Aluminium lithium hydride

35. When $AgNO_3$ solution is added in excess to 1lit. of $CoCl_2$ x NH_3 solution, one mole of AgCl is formed. What is the value of 'x'

1) 1 2) 2 3) 3 4) 4

36. The IUPAC name of the coordination compound $K_3[Fe(CN)_6]$

1) Potassium hcxacyanoferrate (II) 2) potassium hexacyanoferrate (III)

3) potassium hexacyanoiron (II) 4) tripotassium hexacyano iron (II)

37. Example showing ionisation isomerism

1) $[Co(NO)_3(NH_3)]\ SO_4$ & $[Co(SO_4)\ (NH_3)_5]\ NO_3$

2) $[Co(NH_3)_4Cl_2]Cl$ & $[Co(NH_3)_5Cl]Cl_2$

3) $[Cr(H_2O)_5Cl_2]Cl_2.H_2O$ & $[Cr(H_2O)_4Cl_2]Cl.2H_2O$

4) $[Pt(NH_3)_4]\ [Pt\ Cl_4]$ & $[Pt(NH_3)_3Cl]_2[Pt\ Cl_4]$

38. Geometrical isomerism in square planar complexes is given by

1) Ma_4 type complex 2) Ma_3b type complex

3) Ma_2b_2 type complex 4) Mb_4 type complex

39. Ligands with which linkage isomerism is possible

A) NO_2 B) CN C) SCN

1) A only 2) A & B 3) B & C 4) A,B & C

40. Which of the following complex compound shows optical isomerism?

1) $[Cu(NH_3)_4]^{2+}$ 2) $[Zn(Cl)_4]^2$

3) $[Cr(C_2O_4)_3]^2$ 4) $[Co(CN)_6]^3$

41. Identify the correct statements among the following

I) Cr in first series of d-block has highest oxidation state.

II) Colour of MnO_4 is due to charge transfer phenomenon.

III) Zn can show variable oxidation state.

IV) Ferromognetism disappears in the solution of Fe

1) All 2) I & II only 3) II & IV only 4) II & III only

42. The types of isomerism exhibited by $[Co(NH_3)_5(NO_2)](NO_3)_2$ is

1) Geometrical and linkage 2) Linkage and ionization

3) Optical and ionization 4) Co-ordination and hydrate

43. Which of the following compound is expected to be coloured

1) Ag_2SO_4 2) CuF_2 3) MgF_2 4) CuCl

44. The orbitals having lower energy in tetrahedral complexes according to CFT are

1) d_{xy}, d_{yz}, d_{z^2} 2) $d_{xy}, d_{yz}, d_{x^2\ \ y^2}$ 3) d_{xy}, d_{yz}, d_{zx} 4) $d_{x^2\ \ y^2}, d_{z^2}$

45. $K_3[Fe(CN)_6]$ is a

1) double salt 2) complex compound

3) neutral molecule 4) Simple salt

46. According to CFT the energy of t_2g orbitals in an octahedral complex

1) decrease $\frac{2}{5}\ {}_0$ 2) increase by $\frac{2}{5}\ {}_0$

2) increase by $\frac{3}{5}\Delta_0$ 4) decrease by $\frac{3}{5}\Delta_0$

47. Transition elements form complexes due to

1) small size 2) High nuclear charge

3) Presence of vacant d orbitals 4) All the above

48. The IUPAC name of $[Co(NH_3)_5(CO_3)]Cl$ is

1) Penta ammine chloro cobalt (III) chloride

2) Penta amino chloro cobalt (III) carbonate

3) Penta ammine carbonate cobalt(III) chloride

4) Penta amino carbonate chloro cobalt (III)

49. $(Co(NH_3)_6SO_4]Br$ and $[CoC(NH_3]_6Br]SO_4$ are a pair of .... isomers

1) Ionization 2) Ligand 3) Co ordination 4) Hydrate

Applications

50. Hardness of water is estimated by simple titration using

1) formate 2) acetate 3) edta 4) glyoxile

51. In photography silver bromide dissolves in hypo to give

1) $Na_2[Ag(S_2O_3)_2]$ 2) $Na[Ag(S_2O_3)_2]$

3) $Na_3[Ag(S_2O_3)_2]$ 4) $Na_4(Ag(S_2O_3)_2]$

52. Nickel is purified using the concept of complex compounds. The complex related is

1) $Ni(CO)_6$ 2) $[Ni(NH_3)_4]^{2+}$ 3) $Ni(CO)_4$ 4) $[Ni(NH_3)_6]^{2+}$

53. $[(Ph_3P)_3RhCl]$ is a familiar catalyst used in

1) hydrogenation of oils 2) hydrogenation of alkenes

3) dehydration of alcohols 4) dehydration of aldehydes

54. Ammonium cations can be detected using the complex

1) $[Cu(NH_3)_4]^{2+}$ 2) $[HgI_4]^2$

3) $[Ag(CN)_2]$ 4) $[HgI_2]$

55. $(Ph_3P)_3RhCl$ is

1) Zieglar natta catalyst 2) Wilkinsons catalyst

3) Developer in photography 4) Bio catalyst

KEY

1) 1	2) 4	3) 1	4) 3	5) 1	6) 2	7) 2	8) 2
9) 3	10) 2	11) 2	12) 3	13) 3	14) 4	15) 1	16) 2
17) 2	18) 2	19) 3	20) 2	21) 1	22) 2	23) 2	24) 4
25) 1	26) 3	27) 3	28) 3	29) 1	30) 1	31) 4	32) 2
33) 3	34) 2	35) 4	36) 2	37) 1	38) 3	39) 4	40) 3
41) 3	42) 2	43) 2	44) 4	45) 2	46) 1	47) 4	48) 3
49) 1	50) 3	51) 3	52) 3	53) 2	54) 2	55) 2	

8. POLYMERS

Synopsis:

1. Polymers are the large molcules built up by repeating structural units joined by the covalent bonds.
2. The smallest unit that repeatedly combines to form the polymer is known as monomer.
3. Polymers have different physical, structural, mechanical and thermal characteristics from those of the simple molecules constituting them.
4. Polymer made from single monomeric chemical species are known as homopolymer.
   eg. Polythene, Teflon, PVC etc.,
5. Polymers synthesised from two or more different monomers, are called co-polymers, eg : PET, Nylon-6,6, BuNa- N, BuNa - S etc.,
6. Addition polymers are formed by reaction between molecules possessing multiple bonds. These are also known as chain reaction polymers or vinyl polymers or chain growth polymers, eg. Polyethylene, Styrene-butadiene rubber.
7. Addition polymerisation is of 3 types : Cationic polymerisation, Anionic polymerisation and Free radical polymerisation.
8. In general, the addition polymerisation involves three steps : Chain initiation, Chain propagation and Chain termination.
9. In cationic polymerisation process the initiator is a positive ion. Lewis acids such as BF_3, $AlCl_3$, $SnCl_4$ also act as initiators for this process.
10. In anionic polymerization process the initiator is an anion. Potassium amide (KNH_2) or n-butyl lithium can be used as initiators.
11. In anionic polymerisation the termination step is generally absent.
12. A condensation polymer contains fewer atoms than the number of atoms in all the monomeric units from which it is formed.
13. The condensation occurs between molecules having polyfunctional groups. The process involves elimination of small molecules such as water, ammonia and alcohol.
14. The condensation polymers are also called step growth polymers.
15. Co-polymers are classified into 4 categories : Random co-polymers, Alternating co-polymers, Block co-polymers, Graft Co-polymers.
16. A milky suspension of crude rubber obtained from certain varieties of trees is called latex. It is an emulsion of poly hydrocarbon droplets in an aqueous solution. It consists of negatively charged particles of rubber.
17. The latex contains about 35% rubber and it is coagulated by the addition of CH_3COOH or HCOOH.
18. Crude rubber is refined by masticating the raw rubber or Compounding, by addition of necessary agents to the rubber.

19. The empirical formula of natural rubber is C_5H_g.

20. On heating in air rubber gives $C0_2$ and H_20. Hence natural rubber is a hydrocarbon.

21. Heating rubber to high temperatures in the absence of air or 0_2 yields isoprene. Hence, rubber is a polymer of isoprene.

22. Ozonolysis experiments on natural rubber explains the mode of linkage between the isoprene units. Ozonolysis gives of natural: rubber 4-oxo-pentanal.

23. Natural rubber may be considered as a linear 1,4 polymer of isoprene. In this polymer the residual double bonds are located between C_2 and C_3 of isoprene units in the polymer.

24. From X - ray studies it is known that all the double bonds have cis configurations. Thus natural rubber is cis-1,4-poly isoprene. The transform of rubber is called ‘gutta percha’.

25. The weight average molecular weight of ($\overline{M}_w$) of rubber varies between 1,30,000 to 3,40,000.

26. The intermolecular forces in the polymer are largely limited to van der Waal’s interactions due to absence of polar groups. The interactions are further weakened due to cis configuration.

27. cis-1,4-Polyisoprene molecule is not a straight chain but has a coiled structure, consequently it can be stretched like a spring, and it imparts elastic nature to the polymer.

28. Rubber has high sensitivity to heat treatment, a low tensile strength, readily abrasive, low elasticity and high water absorbing ability.

29. Properties of rubber can be improved by the addition of sulphur to hot rubber at 373-415K. This process is called vulcanization.

30. Vulcanization process is slow. It can be accelerated by the addition of zinc oxide, zinc stearate and some organic compounds.

31. The rubber can be hardened by increasing the percentage of sulphur. If sulphur amount is raised to 40-45%, the rubber sets to a non-elastic, hard material known as ebonite.

32. The rubber becomes cross linked with sulphur during the process of vulcanization. The vulcanized rubber has excellent elasticity, low water absorption tendency, resistance to oxidation and organic solvents.

33. In natural rubber the double bonds and allylic $-CH_2$ groups are active centers for vulcanization.

34. Synthetic rubbers are synthesised from butadiene and its dlriyativWW^

35. The synthetic rubbers are homopolymers of 1,3- butadiene derivatives or co-polymers in which one of the monomer unit is 1,3-butadiene or its derivatives.

36. There are several types of average molecular weights in polymers. They are

    1) Number - average molecular weight ($\overline{M}_n$)
    2) Weight - average molecular weight ($\overline{M}_w$).

3) Z - average molecular weight ($\overline{M}_x$)

4) Viscosity-average molecular weight ($\overline{M}_v$) .

37. The polymers which are degradable by enzymatic hydrolysis or oxidation are called biodegradable polymers. Aliphatic polyesters are one important class of biodegradable polymers.
38. Poly lactic acid, Nylon - 2- nylon - 6 etc are examples of bio-degradable polymers.
39. Poly β- hydroxybutyrate - Co- β -hydroxy- valerate (PHBV) is a copolymer of 3-hydroxy butanoic acid and 3-hydroxy pentanoic acid. It is a polyester condensation co-polymer.
40. Nylon - 2 - nylon -6 is formed from glycine (H_2N-CH_2-COOH) and amino caproic acid [$H_2N-(CH_2)_5-COOH$], It is an alternating polyamide co -polymer.
41. Low density poly ethylene is obtained by the polymerisation of ethene under high pressure of 1000 to 2000 atm at 350 K to 570 K in the presence of traces of dioxygen or a peroxide catalyst. It has highly branched structure.
42. High density poly ethylene is obtained by the polymerisation of ethene under a pressure of 6-7 atm at 333 K to 343 K in presence of catalyst triethylaluminium and titanium tetra chloride (R_3Al and$TiCl_4$) called Ziegler - Natta catalyst. It consists of linear molecules and has a high density due to close packing.
43. Semi synthetic polymers are the derivates of cellulose, eg : Cellulose acetate (rayon), cellulose nitrate etc.

Question bank

1) On the basis of mode of formation, polymers can be classified
   1) as additional polymers only
   2) as condensation polymers only
   3) as copolymers
   4) Both addition and condensation polymers

2) Which of the following is a polyamide?
   1) Nylon 2) Bakelite 3) Terylene 4) PVC

3) The monomer of polyacrylonitrite is
   1) Vinyl chloride 2) Vinyl alcohol 3) Vinyl cyanide 4) Adipic acid

4) Glyptal is a polymer of
   1) Ethylene glycol and phthalic acid 2) Ethylene glycol and adipic acid
   3) Ethylene glycol and terephthalic acid 4) Caprolactum and formaldehyde

5) The constituents of Nylon –66 are
   1) Benzoic acid and ethylamine 2) Pthalic acid and hexamethylene diamine
   3) Adipic acid and hexamethylene diamine 4) Phenol and adipic acid

6) The repeating units of PCCTFE is
   1) Cl_2CH-CH_3 2) $F_2C=CF_2$ 3) F_3C-CF_3 4) $FClC=CF_2$

7) Which of the following fibres is made of polyamides?
   1) Polythene 2) PVC 3) Neoprene 4) Bakelite

8) Bakellite is obtained from phenol by reacting with
   1) Acetal 2) Acetaldehyde 3) Formaldehyde 4) Chlorobenzene

9) Which of the following polymers is generally used in making carry bags?
1) Polyester 2) Bakellite 3) Polythene 4) Alkyl resins

10) Which of the following fibres is made of polyamides?
1) Dacron 2) Orton 3) Nylon 4) Rayon

11) Which of the following is an example of co-polymer?
1) Buna –S 2) PAN 3) Polythene 4) PTFE

12) Perlon is another name of
1) Nylon –6 2) Nylon –66 3) Nylon 6, 10 4) Terylene

13) Which of the following represents number average molecular mass?

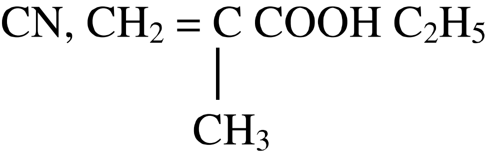
$$1)\ M = \frac{\sum N_i M_i^2}{\sum N_i} \qquad 2)\ M = \frac{\sum N_i M_i}{\sum N_i}$$

$$3)\ M = \frac{\sum N_i M_i^2}{\sum N_i M_i} \qquad 4)\ M = \frac{\sum N_i M_i}{\sum N_i}$$

14) Nitrite rubber is a copolymer of
1) Isobutylene and isoprene 2) Isobutylene and acrylonitrite
3) Butadiene and acrylonitrite 4) Styrene and butadiene

15) Isoprene is a monomer of
1) Starch 2) Natural rubber 3) PVC 4) Synthetic rubber

16) Which of the following is true about the polymer $-\{CH_2-CH(C_6H_5)_{11}-\}$?
1) It is a homopolymer and condensation polymer
2) It is a copolymer and condensation polymer
3) It is a homopolymer and addition polymer
4) It is a copolymer and condensation polymer

17) The monomer for Buna –N are
1) $CH(CN) = CH_2$, $CH_2 = CHHC = CH_2$
2) $CH_3\text{-}CH=CHCN$, $CH_2=CH\text{-}CH=CH_2$
3) $CH_2=CHCN$, 
$CH_2 = \underset{\underset{CH_3}{|}}{C}\ COOH\ C_2H_5$
4) $CH_2 = CH\ COOC_2H_5$, $CH_2 = CHCN$

18) Vinyl polymers are also known as
A) additional polymers
B) Chain reaction polymers
C) Condensation polymers
The correct answer is
1) A only 2) B only 3) A and B 4) A, B, and C

19) Which of the following is not a polyester
1) Polyglycolic acid 2) PABR 3) Polylactic acid 4) Nylon

20) Which one of the following is not a biopolymer
1) Cellulose 2) Proteins 3) DNA 4) Nylon-66

KEY

1. 4	2.1	3.3	4.1	5.3	6.4	7.4	8.3	9.3	10.3
11.1	12.1	13.2	14.3	15.2	16.3	17.1	18.3	19.2	20.4

Question Bank - I I

1. Which of the following is an example of co - polymer ?

   1) PTFE   2 i Perlon-L   3) Neoprene   4) PET

2. Which of the following statements about terylene are correct ?

   A) It is a poly ester

   B) It is obtained by the reaction between ethylene glycol and terephthalic acid H

   C) It is a condensation polymer   D) It is a natural polymer

   1) A and B   2) C and D   3) A,B, and C   4) A,B, and D

3. Common monomer n melamine formaldehyde and Bakelite

   1) Formaldehyde   2) Phenol

   3) Melomine   4) Ethylene glycol

4. Vinyl polymers are also known as

   A) Additional polymers   B) Chain reaction polymers

   C) Condensation Polymers

   The correct answer is

   1) A only   2) B only   3) A and B   4) A,B, and C

5. Which one of the following polymer can be softened and burdened repeatedly on heating and cooling without change in its property?

   1) Bakellite   2) Polysiloxane

   3) Urea formaldehyde resin   4) PVC

6. IUPAC names of monomers in Nylon-6,6 are

   1) Ethylene glycol, terephthalic acid

   2) Adipic acid, hexamethylenediamine

   3) Butane dionic acid, Hexane - 1, 6-diamine

   4) Hexanedioic acid, Hexane-1, 6-diamine

7. Some statements about condensation polymers are given below

   a) Condensation polymer molecule contains same number of atoms as the number of atoms present in all monomers

   b) Monomers of condensation polymers have polyfunctional groups .

   c) Majority of condensation polymers are co-polymers

   d) Molecular weight of condensation polymer molecule is integral multiples of molecular weight of its monomers

   The correct statements is /are

   1) All are correct   2) Only b is correct

   3) Only b and c are correct   4) only b, c and d are correct

8. Chain initiation and chain propagation steps are involved in

   a) Cationic polymerization   b) Anionic polymerization

   c) Free radical polymerization   d) Condensation polymerization

   The correct answer is

   1) all   2) only a, b and c   3) only a   4) only a and c

9. Some statements about addition polymerisation are given below

a) Monomers containing C = C bond can undergo this polymerisation.

b) Polymer molecules may or may not contain C = C bond

c) Addition polymers are formed by chain reactions

d) Molecular weight of addtion polymer molecule is integral multiples of molecular weight of its monomers

Correct statement (s) is (are)

1) All are correct 2) only a, c & d are correct

3) only c and d are correct 4) only c is correct

10. Vinyl derivatives undergo which type of polymerization

1) cationic polymerization only 2) anionic polymerization only

3) condensation polymerization only

4) cationic (or) anionic (or) free radical polymerization

11. Chloroprene is used in making

1) Synthetic rubber 2) Plastic 3) Pelrol 4) All

12. The monomers present in glyptal are

1) ethylene glycol, caproic acid 2) vinyl chloride, terepthalic acid

3) ethylene glycol, pthalic acid 4) urea, formaldehyde

13. Natural rubber on ozonolysis gives

1) 4-oxopentanal 2) 3-oxopentanal

3) Hexane-2, 5-diene 4) Pentanedial

14. The formula for calculating M_n of a polymer is

1) $\frac{\sum NiMi}{\sum Ni}$ 2) $\frac{\sum NiMi}{\sum Mi}$ 3) $\frac{\sum NiMi^2}{\sum Mi}$ 4) $\frac{\sum NiMi^2}{\sum NiMi}$

15 During the vulcanization of rubber, sulphur cross linking occurs at

a) Double bonds b) Allylic - CH_2 - groups

c) Methyl groups

The correct answer is

1) only a 2) only b 3) only a and b 4) all

16. Which of the following is a biodegradable polymer

A) PHBV B) Buna-s C) PMMA D) Nylon -2-Nylon-6

The correct answer is

1) A, B, C 2) B, C, D 3) A, D 4) All are correct

17. For natural polymers PD1 is generally

1) 1 2) 10 3) 100 4) 1000

18. Amide linkage is absent in

1) Nylon - 6 2) Nylon - 66 3) Nylon - 2- Nylon - 6 4) PHBV

19. $\overline{M}_n$ and $\overline{M}_w$ of a synthetic polymer are related as

1) $\overline{M}_n < \overline{M}_w$ 2) $\overline{M}_n > \overline{M}_w$ 3) $\overline{M}_n = \overline{M}_w$ 4) $\overline{M}_n = \sqrt{\overline{M}_w}$

20. Which of the following is currently used as a tyre cord

1) Terylene 2) polyethylene 3) Bakelite 4) Nylon-6

21. Match the following

List-1	List-II
A) Phelnol +CH_2O	1) Synthetic rubber
B) Terephthalic acid and ethylene glycol	2) Bakelite
C) Caprolactum	3) Nylon-6
D) Butadiene and styrene	4) Terylene

The correct match is

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

22. Match tjie following

List-II	List-II
A) PHBV	1) Synthetic fibers
B) Teflon	2) Orthopaedic devices
C) Nylon-66	3) For making laminates
D) Bakelite	4) non-sticking utensils
	5) Automobile tyres

	A	B	C	D		A	B	C	D
1)	2	4	1	3	2)	1	3	2	4
3)	3	2	1	5	4)	4	1	3	2

23. Match the following

List-I (polymer)	Lis-II (type of monomers)
1) Terylene	a) aldehyde, aromatic alcohol
2) Nylon - 6,6	b) Diamine, aliphatic dioic acid
3) Bakellite	c) Diol. aromatic dioic acid
4) Buna-N	d) Unsaturated ester
	e) Diene and unsaturated cyanide

	1	2	3	4		1	2	3	4
1)	c	b	a	e	2)	b	c	a	d
3)	b	c	d	e	4)	c	b	e	d

24. Wrong statement about the polymer BuNa * S is

1) ‘Bu’ stands for 1,3 - butadiene 2) ’Na’ stands for sodium (catalyst)

3) ’S’ stands for styrene 4) it is used in manufacture of hoses

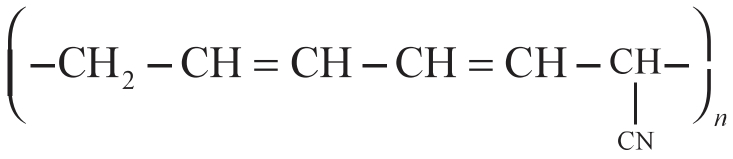
25. Match the following

List-I (polymer)	List-Il (use)
1) Urea formaldehyde resin	a) unbreakable cups
2) Nylon - 6	b) TV cabinets
3) Polystyrene	c) Oil seals
4) GRN	d) Tyre cords

	1	2	3	4		1	2	3	4
1)	a	d	b	c	2)	a	b	d	c
3)	a	b	c	d	4)	d	c	b	a

26. Wrong statement about BuNa - N is

1) it is copolymer
2) 'N' stands for propenenitrile
3) its structure is



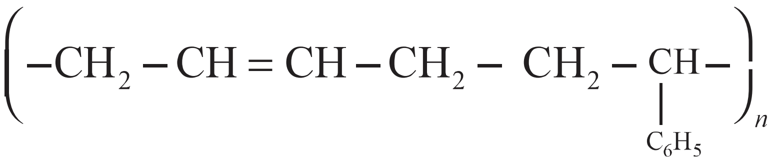
$$\left(-CH_2 - CH = CH - CH = CH - \underset{\underset{CN}{|}}{CH} - \right)_n$$

4) it is an addition polymer

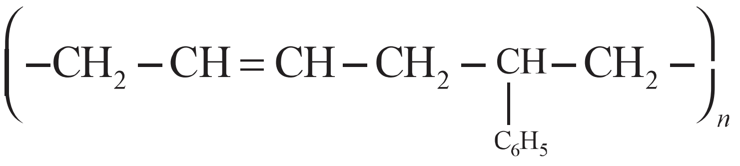
27. The monomer for polystyrene is

1) Ethane 2) Ethene 3) Ethyne 4) Vinyl benzene

28. Structure of styrene butadine rubber is

1) 

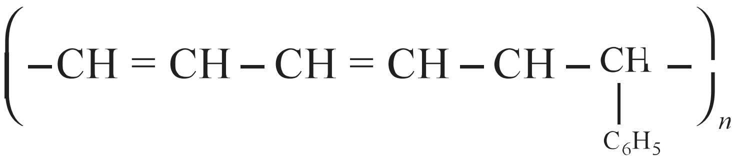
$$\left(-CH_2 - CH = CH - CH_2 - CH_2 - \underset{\underset{C_6H_5}{|}}{CH} - \right)_n$$

2) 

$$\left(-CH_2 - CH = CH - CH_2 - \underset{\underset{C_6H_5}{|}}{CH} - CH_2 - \right)_n$$

3) 

$$\left(-CH_2 - CH = CH - CH = CH - \underset{\underset{C_6H_5}{|}}{CH} - \right)_n$$

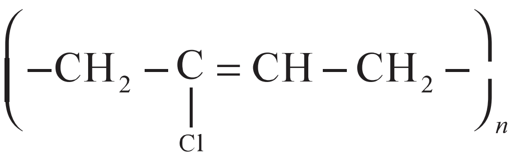
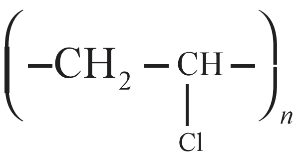
4) 

$$\left(-CH = CH - CH = CH - CH - \underset{\underset{C_6H_5}{|}}{CH} - \right)_n$$

29. Which one of the following polymer molecule contain more double bonds in the polymer chain in the repeating unit.

1) polystyrene 2) BuNa - S 3) PVC 4) Polyethylene

30. Match the following

List-1 (polymer)	List - II (Structure)
1) Urea formalde hyde resin	a) $(-NH-(CH_2)_5-CO-)_n$
2) Neoprene	b) $(-NH-(CH_2)_6-CO-)_n$
3) PVC	c)  $\left(-CH_2 - \underset{\underset{Cl}{|}}{C} = CH - CH_2 - \right)_n$
4) Nylon - 6	d)  $\left(-CH_2 - \underset{\underset{Cl}{|}}{CH} - \right)_n$
	e) $(-NH-CO = NH-CH_2-)_n$

The correct match is

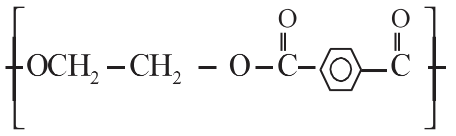
   1 2 3 4   1 2 3 4
1) e d c b   2) e c d b
3) a c d b   4) e c d a

31. Which of the following alkene a most reactive towards cationic polymersation

1) $CH_2 = CHCH_3$ 2) $H_2C = CHC1$
3) $H_2C = CHC_6H_5$ 4) $H_2C = CHC0_2CH_3$

32. Match the following :

Polymer

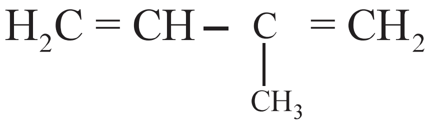
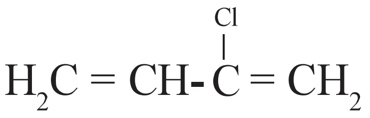
1) $[CO(CH_2)_5–(NH]_n$ 2) $(–CF_2 –CF_2–)_n$
3) $–(CO– (CH_2)_4 –CO–NH–(CH_2)_6 –NH–)_n$
4) 

Monomer

A) Ethylene glycol and terpthalic acid
B) Tetra fluoro ethylene
C) Caprol actum
D) Hexamethylene diamine and adipic acid

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

33. Buna N synthetic rubber is a copolymer of :

1) $H_2C = CH - CH = CH_2$ and $H_5C_6 – CH = CH_2$
2) $H_2C = CH – CN$ and $H_2C = CH – CH= CH_2$
3) $H_2C = CH – CN$ and 
$H_2C = CH– \underset{\displaystyle CH_3}{\underset{|}{C}} = CH_2$
4) 
$H_2C = CH-\overset{\displaystyle Cl}{\overset{|}{C}} = CH_2$ and $H_2C = CH – CH = CH_2$

34. Catalyst commonly used in free radical polymerisation is

1) $MnCl_2$ 2) Fe-Mo   3) R–CO–O–R   4) R–O–O–R

35. Number of steps in free radical polymerisation process

l) four   2) three   3) two   4) one

36. Acrylonitrile is the other name of

1) $H_2C = CHC1$ 2) $H_2C = CHOH$
3) $H_2C = CHC_6H_5$ 4) $H_2C = CHCN$

37. Which of the following is relative stiff and hard addition homopolymer ?

1) Bekalite   2) Melamine-formaldehyde
3) Poly propelene   4) Urea-formaldehyde

38. Number of nitrogen atoms present in melamine is x. The number of -imine and -amine groups is y and z. x, y and z are respectively

1) 3, 1,2 2) 6, 1,3 3) 6, 3, 3 4) 6, 3, 1

39. Hydrolysis of the monomer of polyacrylonitrile gives

1) Propanamine 2) Ethanoic acid
3) Butanamine 4) Propanoic acid

40. Free radical polymerisation may be important for the polymerisation of :

A) $HC \equiv CH$, B) $H_2C = CH_2$ and C) $H_2C = CH - CH = CH_2$

1) A and B 2) B and C 3) A and C 4) A, B and C

41. The polymer containing strong interniolecular forces e.g. hydrogen bonding is

1) natural rubber 2) teflon
3) nylon6, 6 4) polystyrene

42. Bakelite is prepared by the reaction between

1) Urea and formaldehyde
2) Tetramethylene glycol and hexamethylene diisocyanate
3) Phenol and formaldehyde
4) Ethylene glycol and dimethyl terephthalate.

43. The hard plastic covers of telephones are made of polymers of

1) Acrylonitrile 2) Styrene
3) Fluoromethane 4) Phenol formaldehyde

44. Vulchanized rubber resists

1) Jerking movement 2) Cold temperature
3) Drops of acid rains 4) Wear and tear due to friction

KEY

1) 4	2) 3	3) 2	4) 3	5) 4	6) 4	7) 3	8) 2
9) 1	10) 4	11) 1	12) 3	13) 1	14) 1	15) 3	16) 3
17) 1	18) 4	19) 1	20) 4	21) 3	22) 1	23) 1	24) 4
25) 1	26) 3	27) 4	28) 1	29) 2	30) 4	31) 3	32) 3
33) 2	34) 4	35) 2	36) 4	37) 3	38) 3	39) 4	40) 2
41) 3	42) 3	43) 4	44) 4				

9. BIO-MOLECULES

Synopsis:

1. Carbohydrates ttr saccharides arc the optically active polyhydroxy aldehydes or poly-hydroxy ketones. They include simple sugars, starch, glycogen, etc.
2. General formula of carbohydrates is $C_x(H_2O)_y$.
3. Glucose and galactose are aldohexoses but fructose is aketohexose.
4. Mono and oligo saccharides are called sugars due to their sweet taste. Sugars are crystalline solids and soluble in water.
5. All polysaccharides are non-sugars as they are tasteless. All non sugars are amorphous solids and insoluble in water.
6. Reducing sugars reduce Fehling's solution and Tollens' reagent. eg.Glucose, Fmctose, Maltose. Non-reducing sugars do not reduce Fehling solution and Tollens' reagent, eg. Sucrose.
7. All monosaccharides are reducing sugars. Some of the disaccharides are reducing sugars.
8. The simplest monosaccharides are glyceral- dehyde and dihydroxy acetone. Glyceraldehyde is an aldotriose and dihydroxy acetone is a ketotriose. These are functional isomers to each other.
9. Fructose is called fmit sugar. It is a ketohexose and possesses D-configuration and is also called leavulose. It is found in ripe fruits and honey. It is the sweetest sugar. It is obtained by the hydrolysis of sucrose. Naturally occurring fructose is laevo rotatory.
10. Glucose is present in sweet fruits like banana and honey. Ripened grapes contain 20% of glucose hence called grape sugar. It is obtained by the hydrolysis of cane sugar in the presence of alcohol using dilute acid. Glucose is also obtained by the hydrolysis of starch by boiling it with dilute sulphuric acid at 393K under a pressure of 2-3 bar.
11. Glucose on reduction with HI, it forms n-hexane. It confirms presence of all six carbons in straight chain.
12. Glucose reacts with acetic anhydride to form **a** penta acetyl derivative, which suggests the presence of five hydroxyl groups in the molecule of glucose.
13. Glucose reacts with hydroxylamine to give oxime, with HCN gives cyanohydrin, with phenyl hydrazine gives phenyl hydrazone which suggests the presence of carbonyl group.
14. Glucose reduces Tollen's reagent to give silver mirror, and Fehling's solution to give red cuprous oxide. It can be oxidised to gluconic acid with bromine water or alkaline solution of iodine. These reactions suggest the presence of aldehyde group.
15. On oxidation with HNO_3, glucose gives saccharic acid a dicarboxylic acid. This

suggests the presence of one primary alcoholic group.

16. With cone NaOH solution, glucose turns to yellow then brown and finally resinifies.
17. With dil NaOH, glucose undergoes the following reversible isomerisation called Lobry de Bruyn-van Ekenstein rearrangment to give a mixture of D-glucose, D-nannose and D- fructose. Same mixture is also obtained even mannose or fructose when treated with alkali.
18. Based on chemical properties of glucose, Beyer proposed the open chain structure.
19. Spontaneous change in specific rotation of an optically active compound is mutarotation.
20. Aqueous solution of glucose has $[\alpha]_D = +52.5^\circ$ as it is equilibrium mixture of anomers.
21. Isomers which differ only in the spacial orientation of groups or atoms at first chiral carbon are called anomers. All anomers are diastereomers. Anomers differ in physical properties like melting point and specific rotation.
22. Existance of anomers can be confirmed by treating glucose with CH_3OH and dry HC*l* which gives a mixture of methyl α - D- glucoside and methyl - (β - D glucoside.
23. α - D- glucose is obtained by crystallization of glucose from its aqueous solution at 30°C. Whose $[\alpha]_D = +111^0$ withm.p = 146°C.
24. (3 -D-glucose is obtained by crystallisation of glucose from its aqueous solution at above 98°C whose $[\alpha]_D = +19.2^\circ$ and m.p = 150° C.
25. As per IUPAC system of nomenclature, open chain form of D-(+)-glucose is named as (2R, 3S, 4R, 5R) - 2,3,4,5,6 pentahydroxyhexanal.
26. Disaccharides on hydrolysis give two mono saccharides.

    $$\text{Surcrose} \xrightarrow{\text{hydrolysis}} \text{D}-\text{glucose} + \text{D}-\text{fructose}$$

    $$\text{Lactose} \xrightarrow{\text{hydrolysis}} \text{D}-\text{glucose} + \text{D}-\text{galactose}$$

    $$\text{Maltose} \xrightarrow{\text{hydrolysis}} \text{D}-\text{glucose} + \text{D}-\text{glucose}$$

27. Sucrose is a non reducing sugar. Hemiacetal hydroxyl groups of both the mono saccharides are involved in glycosidic linkage.
28. In sucrose glycosidic linkage is formed between C_1 of α - D-glucose and C_2 of β - D-fructose.
29. In the hydrolysis of sucrose, there is a change in optical rotation from'd' to T. This change is known as ‘inversion’ and the mixture is called ‘invert sugar’. The aqueous solution is laevo rotatory.
30. Maltose is obtained from starch by the hydrolysis process caried out by diastase enzyme present in malt.

On hydrolysis maltose gives two molecules of D- glucose. The two glucose units are linked through a-glycosidic linkage between C_1 of one unit and the C_4 of the other.

31. Lactose occurs in milk and is known as milk sugar. Lactose on hydrolysis gives D-galactose and D-glucose. Hydrolysis of lactose occurs by 'emulsin' which specifically hydrolyses β- glycosidic linkages. Glycosidic linkage is formed between C_1 of β - D- galactose and C_4 of β - D- glucose.
32. Starch or amylum is white amorphous powder almost insoluble in cold water but relatively more soluble in boiling water. Its solution gives blue colour with iodine solution in cold but the colour disappears on heating.
33. Starch consists of two components namely amylose (10 to 20%) (water soluble component) and amylopqctin (90 to 80%) (water insoluble component).
34. Amylose is a linear polymer of α -D(+) glucose units, linked at 1,4 positions. It gives blue colour with iodine solution.
35. Amylopectin has a branched chain structure composed of α -D(+) glucose units linked at 1,4 - positions and branches at 1,6 - positions. It does not give blue colour with iodine.
36. Starch easily hydrolyses in saliva by an enzyme amylase. The final product is α - D(+) glucose.
37. Starch does not form osazone. It indicates that hemiacetal hydroxy groups of all glucose units at C-l are in glycosidic form.
38. Wood Contains 50% of cellulose, cotton contains 90-95% cellulose. It is the chief constitent of cell wall of plants.
39. Cellulose does not reduce Tollen's reagent or Fehiling's solution and also does not form osazone.
40. Cellulose is composed of large number of D-glucose units joined by β (1,4) glycosidic linkages. The rigidity of structure is due to multiple hydrogen bonds between the individual strands of cellulose.
41. Cellulolytic bacteria present in stomach (rumen) of ruminant mammals like cattle and sheep break down cellulose with the help of an enzyme cellulase.
42. The carbohydrates are stored in animal bodies as glycogen. It is also called animal starch because its structure is similar to amylopectin and is higly branched. When the body needs glucose, enzymes breakdown glycogens to glucose.
43. Carbohydrates are essential for the life of both plants and animals. Honey is an instant source of energy.
44. Antibiotics like Steptomycins, Kenomycins, Neomycins and Gentamycins that disrupt bacterial protein synthesis are carbohydrates. These are patricularly used against bacteria that are resistant to penicillins.
45. Amino acids contain both carboxylic acid group and amine group.
46. Amide linkages between amino acids are known as peptide bonds (– CO – NH –).

47. The product obtained from two amino acid molecules through a peptide bond is called a dipeptide.

48. The product from three, four and many amino acid molecules through peptide bond are called tri, tetra and polypeptides respectively. A polypeptide chain formed from ‘n’ amino acids contain ‘n-1 ’ peptide bonds.

49. The numerical prefix (di, tri, tetra) of peptide is derived from number of amino acid molecules involved in bonding but not from number of peptide bonds. A tripeptide has two peptide bonds between three amino acid molecules.

50. Generally a- aminoacids form proteins. All α - aminoacids contain a primary amino group except proline.

51. The aminoacids which can be synthesised in the body are called non essential amino acids and amino acids which cannot be synthesized in the body but must be supplied through diet are called essential amino acids.

52. Amino acids containing equal number of $-NH_2$ and –COOH groups are called neutral aminoacids.

53. Aminoacids containing more number of $-NH_2$ groups than –COOH groups are known as basic aminoacid and more number of –COOH groups than $-NH_2$ groups are known as acidic aminoacids.

54. Amino acids containing - OH groups are tyrosine, serine and threonine. Amino acids containing benzene ring are phenylalanine, tyrosine and tryptophan.

55. Amino acids are generally colourless crystalline solids and are highly polar. In aqueous solution, the carboxyl group transfers a proton to $-NH_2$ group to give zwitter ion or inner salt.

56. In acidic solution, amino acid exists as positive and in basic solution as negative ion.

57. The pH at which dipolar ion acts as neutral ion and does not migrate either towards cathode or anode is known as. isoelectric point of the aminoacid.

58. The isoelectric point depends on different groups in the molecule of the amino acid. For neutral aminoacids, the pH range is 5.5 – 6.3

59. At isoelectric point, aminoacids have least solubility which helps in the separation of mixture of aminoacids obtained from the hydrolysis of proteins.

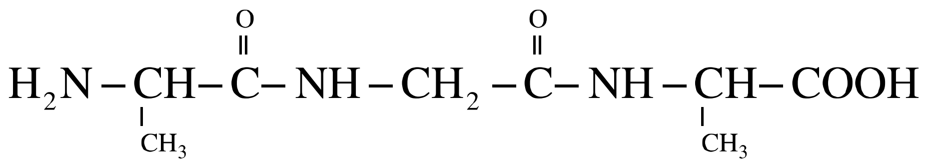
60. Except glycine all other naturally occurring aminoacids are optically active.

61. In Fisher projection formulae, all carbon atoms must be placed vertically with –COOH group at the top and amino grour is kept horizontally.

62. If$-NH_2$ group is on left hand side, it is L–form.

    If it is on right hand side it is D–form. Most of the naturally occurring amino acids have L– configuration.

63. In a polypeptide. free amino group N-terminal residue is written on the left hand side and the free carboxyl group cm the right hand side of the chain.



$$H_2N-\underset{CH_3}{\underset{|}{CH}}-\overset{O}{\overset{||}{C}}-NH-CH_2-\overset{O}{\overset{||}{C}}-NH-\underset{CH_3}{\underset{|}{CH}}-COOH$$

N-terminal residue *C-terminal residue*

Alanine *Glycine* *Aanine*

This is read as alanvl glycylalanine.

64. Shorter peptides are called oligopeptides and peptides are called polypeptides. Polypeptides are amphoteric.
65. Most of the toxins (poisonous substances) in animal and plant venoms are proteins. Oligopeptides are effective hormones.
66. A dipeptide called aspartame being 160 times sweeter to sucrose is used as a substitute for sugar.
67. Proteins are naturally occurring polypeptides containing more than 100 amino acid units eg: Wool. Nail, silk, hair, skin, connective tissues, many hormones and enzymes.
68. Proteins are usually two types fibrous proteins nd globular proteins.
69. Primary structure of proteins refers to the sequence in which amino acids are arranged in protein and also location of disulphide bridges. Any two proteins will never have same primary structure.
70. If a protein is made up of ' m' amino acids of ' n' types, the possible different types of protiens are 'n^m'.
71. Secondary structure of proteins refers to shape of polypeptide chains.
72. Maximum hydrogen bonding between CO group of one amino acid residue and the amide hydrogen of another, Minimum steric henderance between near by 'R' groups, Repulsions between like charges. These factors lower the energy and increases stability.
73. The shape of protien can be either α-helix, β-pleated sheet (or) coil conformation.
74. Tertiary structure of protein gives three dimensional folding of protein. It includes both primary and secondary structures. The three dimensional folding of protein leads to fibrous or globular shapes.
75. Quaternary structure of protein explains arrangement of differnt protein chains (sub units). It is possible only in oligomers.
76. In between protien chains, hydrogen bonding, electrostatic attractions and hydrophobic inter actions are present.
77. The process such as heating, treatment with acids that brings about changes in the physical as well as biological properties of the proteins is called denaturation.
78. Denaturation changes the secondary and tertiary structure of proteins but has no effect on the primary structure.
79. Denaturation may be reversible or irreversible. Coagulation of egg white on boiling is an example for irreversible clenatpration.

80. Reverse process of denaturation is called renaturation which is possible in deoxyribonucleic acid.
81. Most of enzymes are naturally occurring simple (or) conjugate proteins. They act as specific catalysts in biological reactions.
82. Enzymatic reaction may proceed through the following four stages.
    E+S → ES complex → El complex → EP → E+P
83. Nucleic acids are polymers present in living cells and viruses. They are of two types Deoxy ribonucleic acid (DNA) and Ribonucleic acid (RNA)
84. The DNA stores and transmits genetic information and the RNA is responsible for the synthesis of proteins in living cells.
85. Nucleic acids are polymers whose repeating units are nucleotides.
86. The nitrogen base in nucleic acids is of two kinds: pyrimidines and purines.
87. Purine bases, adenine and geianine are found in both RNA and DNA. Cytosine is found in both RNA and DNA but uracil is present only in RNA and thymine only in DNA.
88. Naturally occurring nucleic acids have (β -D- ribose in RNA and (β -D- deoxyribose in DNa
89. A nitrogen base attached to a sugar molecule M forms a nucleoside. A nucleoside joined to a phosphate group is called nucleotide.
90. Nucleic acids contain a chain of five membered ring sugars linked through phosphate groups and each sugar molecule is bonded to nitrogen atom of heterocyclic amine by a (β - N glycosidic bond.
91. Watson and Crick based on X-ray diffraction studies of DNA proposed a double helical structure for DNA.
92. The number of hydrogen bonds between thymine and adenine is 2, but in between the complimentary bases cytosine and guanine is 3.
93. Adenine pairs with thymine but not with cytosine because adenine forms two H-bonds with thymine but no bonds with cytoines.
94. Primary structure of DNA gives sequence of bases in the strands. Secondary structure of DNA is double helix.
95. The synthesis of identical copies of DNA is called replication. A nucleic acid can be synthesized only in the 5 ’ – 3’ direction.
96. The amino acid specified by each three base sequence is called the genetic code. It is universal, it is commaless, it is degenerate and third base in the codon is not always specific.
97. Vitamins are certain organic compounds, required in small quantities in diet, but their defiency causes specific disease.
98. Vitamins are desisuated by alfabates A, B, C, D etc and some of them further named as subgroups like B_1, B_2, $_6$, B_{12} etc.
99. Vitamins are classified into two groyps depending upon their solubility in water

or in fat.

100. Vitamins if B group and vitamins C are water soluble.

101. Vitamins A, D, E and K are fat and oil soluble. These are stored in liver and adiapose tissue.

102. Deficiency of vitamin A causes right blindness vitamin C causes scurvy and vitamin D causes rickets.

103. Deficiency of vitamin B, causes beri beri, B_2 causes cheilosis, B_6 causes convulsions and B_{12} causes pernicious anaemia.

104. Vitamin E is rich in oils and helps in fargility of RBCs and muscular strengthing.

105. Vitamin K is called green leafly vitamin and its deficiency leads to increased blood clothing time.

106. Hormones transfer biological information from one group of cells to distant tissues or organs. Hormones control metabolic activities and are effective in minute amounts.

107. Secretin produced by intestinal mucosa was first named as hormone. Hormones are all generally proteins but not all of them are proteins.

108. Hormones are classified into two types : Steroid hormones and non steroid hormones.

109. Steroid hormones are produced by the adrenal cortex, testis and ovary. These are male sex hormones are androgens and testosterone.

110. Testosterone produed by testis. This, is responsible for the development of male secondary sexual characteristics such as deep voice, facial hair, sturdy physical nature.

111. Estradiol is responsible for the development of secondary female sex characteristics like breast development, shril voice and long hair. They also take part in the control of menstrual cycle.

112. Progesterone is useful for preparing the uterus for the implantation of the fertilized egg. These are also useful as birth control agents.

113. Cortico steroids or adrenal cortical hormones are produced by adrenal cortex.

114. Insulin, peptide harmone is responsible for the entry of glucose and other sugars into the living cells. This helps in the decrease of glucose in the blood hence called hypoglycemic factor.

115. Amino acid derivative hormones are thyroidal hormones, eg : Thyroxin and triiodo thyronine. Thyroid gland is known as pace setter of the endocrine systems

116. Plant hormones are also called growth Hormones/ phyto hormones. They regulate growth and physiological functions.

Question Bank - I

Carbohydrates

Monosaccharides

1. Which one of the following is a pentose sugar?
   1) Ribose 2) Arabinose 3) Lyxose 4) All the three
2. Monosaccharides contain
   1) Six carbon atoms only 2) Five carbon atoms only
   3) Four carbon atoms only 4) May contain 3 to 7 carbon atoms.
3. Raffinose on hydrolysis gives
   1) glucose, fructose and lactose 2) glucose, fructose and galactose
   3) fructose, glucose and erythrose 4) glucose, fructose and mannose
4. Which of the following is not an oligosac-charide ?
   1) Xylose 2) Maltose 3) Raffinose 4) Sucrose
5. A Laevorotatory sugar present in fruits is
   1) Glucose 2) Fructose 3) Sucrose 4) Lactose
6. Glucose is not
   1) a hexose 2) a carbohydrate 3) an oligosaccharide 4) an aldose
7. On heating glucose with Fehling solution, we get a precipitate whose colour is
   1) Orange 2) Red 3) Black 4) White
8. Glucose gives silver mirror test with Tollen's reagent. It shows the presence of
   1) Carboxylic group 2) Alcoholic group
   3) Ketonic group 4) Aldehydic group
9. The reagent which forms crystalline osazone derivatives with glucose is
   1) Fehling solution 2) Phenyl hydrazine
   3) Benedict's solution 4) Hydroxylamine
10. When glucose is heated with nitric acid the product is
    1) Lactic acid 2) Saccharic acid 3) Glycollic acid 4) Oxalic acid
11. Glucose when heated with CH_3OH in presence of dry HCl gas gives α and β methyl glycosides because it contains
    1) –CHO group 2) a $-CH_2OH$ group
    3) a ring structure 4) Five -OH groups
12. When hemiacetai reacts with alcohol the product is
    1) dihemi acetal 2) alcohol
    3) acetal 4) Peptide
13. Frfeshly prepared α –D–glucose solution has specific rotation +lll° and after sometime it becomes
    1) +52° 2) +99° 3) –92° 4) None
14. Which does not show mutarotation?
    1) Glucose 2) Fructose 3) Maltose 4) Sucrose

15. Ring structure of glucose is due to formation of hemiacetal and ring formation is in between

1) C_1 and C_5 2) C_1 and C_4 3) C_1 and C_3 4) C_2 and C_4

16. The wrong statement about glucose is

1) It has one 1°- alcoholic group 2) It has four 2° - alcoholic group

3) It has one aldehydic group 4) It has one 3° - alcoholic groups

17. Fructose contains

1) 3 Secondary alcoholic groups 2) One ketonic group

3) 2 Primary alcoholic groups 4) All the above

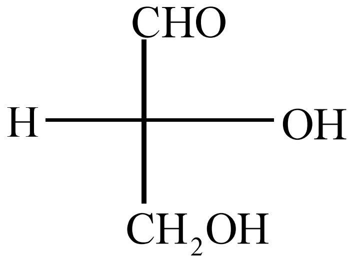
18. The fischer projection of glyceraldehyde represents correct configuration in terms of D & L, R & S and d & *l* designations respectively

1) D, R, d

2) D, R, *l*

3) D, S, d

4) D, S, *l*



19. Which of the following is called as Laevulose ?

1) Glucose 2) Fructose 3) Lactose 4) Maltose

20. The sweetest sugar among the following is

1) Fructose 2) Glucose 3) Sucrose 4) Galactose

21. For naturally occurring fructose, the configuration and sign of specific rotation respectively

1) D, – 2) D , + 3) L , – 4) L , +

22. Glyceraldehyde and Dihydroxy acetone are a pair of

1) Anomers 2) Enantiomeres 3) Functional isomers 4) Epimers

23. According to C1P rules, the configuration of (+) – glyceraldehyde can be designed as

1) R 2) S 3) D 4) L

24. Accroding to CIP rules, the configuration of chiral carbon atoms in D – (+) – glucose are

1) 2S, 3S, 4R, 5R 2) 2S, 3R, 4S, 5R

3) 2R, 3R, 4S, 5S 4) 2R, 3S, 4R, 5R

Disaccharides

25. Glucose and cane sugar can't be distinguished by

1) Fehling's solution 2) Baeyer's reagent

3) Tollens' reagent 4) Benedict's solution

26. In which of the following all are disaccharides ?

1) Maltose, Sucrose, Lactose 2) Maltose, Lactose, Glucose

3) Glycogen, Lactose, Sucrose 4) Starch, Maltose, Lactose

27. A disaccharide on hydrolysis gives

1) Two molecules of the same mono-saccharide

2) Two diffemt monosaccharides

3) Three molecules of the same mono-saccharide

4) Two molecules of the same or different monosaccharides

28. Change in optical rotation of sucrose solution due to hydrolysis is called

1) Specific rotation 2) Inversion

3) Rotatory motion 4) Mutarotation

29. Inverted sugar is

1) Optically inactive form of sugar 2) Equimolecular mixture of glucose and fructose

3) Mixture of glucose and fructose 3) A variety of cane sugar

30. Wlpch of the following is not a reducing sugar ?

1) Glucose 2) Sucrose 3) Lactose 4) Maltose

31. The glycosidic linkage in carbohydrates is

1) Link between two carbon atoms in a carbohydrate by a covalent bond

2) Link between a carbon atom and an oxygen atom

3) Link between carbon atoms in a carbo-hydrate through an oxygen atom formed by elimination of water

4) None of these

32. Identify the one which does not belong to the class to which the other three belong based on hydrolysis

1) Sucrose 2) Fructose 3) Lactose 4) Maltose

33. Which among the following does not give a silver mirror test with Tollens' reagent ?

1) Fructose 2) Glucose 3) Galactose 4) Sucrose

34. Sucrose molecule contains

1) a glucopyranose and a fructopyranose units

2) a glucopyranose and a fructofuranose units

3) a glucofuranose and a fructopyranose units

4) a glucofuranose and a fructofuranose units

35. Maltose consists of

1) Only α-D glucose units 2) α - and β-D Glucose units

3) Glucose and fructose 4) Fructose only

Polysaccharides

36. Which of the following is animal poly-saccharide ?

1) Amylopectin 2) Glycogen

3) Amylose 4) Cellulose

37. Amylose consists of

1) Branched chain of α-D-glucose units

2) Unbranched chain of β -D-glucose units

3) Units of sucrose

4) Unbranched chain of α -D-glucose units

38. Amylopectin is a polymer of

1) β-D glucose 2) α-D glucose

3) β -D fructose 4) α - D fructose

39. In amylopectin the linkage absent is

1) C_1 & C_4 2) C_1 & C_6 3) C_1 &C_2 4) Both C_1 & C_6 and C_2 & C_4

40. Direct conversion of starch into glucose may be carried out by

1) fermentation with diastase 2) fermentation with zymase

3) heating it with dil HCl 4) fermentation with maltase

41. The intermediate compound in the conversion of starch to glucose is

1) Lactose 2) Maltose 3) Fructose 4) Sucrose

42. Starch is turned to disaccharide in presence of

1) Maltase 2) Zymase 3) Diastase 4) Lactase

43. Which one of the following statements about starch is correct ?

1) It occurs in the cell wall of plants 2) It is a disaccharide

3) It gives a dark blue colour with iodine solution

4) It gives an orange red precipitate on boiling with Fehling's solution

44. Which of the following carbohydrates is the essential constituent of cell wall ?

1) Starch 2) Maltose 3) Cellulose 4) Sucrose

45. The monomer of cellulose is

1) L- fructose 2) D-fructose 3) D-glucose 4) Amylose

46. Cellulose is rigid due to

1) hydrogen Bonding 2) β (1,4) glycosidic linkage

3) cell wall material 4) Vegetable matter

47. Which of the following can act as food storage and structural materials ?

1) Monosaccharides 2) Disaccharides

3) Oligosaccharides 4) Polysaccharides

48. The carbohydrates are stored in animal bodies as

1) Starch 2) Amylum 3) Glycogen 4) Cellulose

49. Which of the following is a branched chair polysaccharide ?

1) Cellulose 2) Raffinose 3) Amylose 4) Glycogen

50. Which of the following antiseptic is a carbohydrate ?

A) Streptomycin B) Gentamycin C) Neomycin

1) A, B 2) A, C 3) B, C 4) A, B, C

KEY

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

Question Bank - II

Amino Acids, Proteins and Nuclic Acids

Amino Acids and Proteins

1. The peptide linkage is

   1) $-\overset{|}{C}H - COO - NH$ 2) $-\overset{|}{C}H - CO - NH-$

   3) $-\overset{|}{C}H-CH_2-CO-NH_2$ 4) $-\overset{|}{C}H-NH-NH-CO-$

2. Which of the following contains nitrogen ?

   1) Fats 2) Proteins 3) Carbohydrates 4) Hydrocarbons

3. The building unit of all proteins is

   1) monosaccharides 2) lipids

   3) amino acids 4) primary amines

4. Number of peptide links in a tripeptide

   1) 3 2) 2 3) 6 4) 4

5. The structural feature which distinguishes proline from α - amino acids is

   1) It is optically inactive 2) It contains aromatic group

   3) It is a dicarboxylic acid 4) It is a secondary amine

6. Which of the following amino acids possesses a non-polar side chain ?

   1) isoleucine 2) serine 3) cysteine 4) glutamic acid

7. Which of the following amino acids contains a thiol group in the side chain ?

   1) methionine 2) cysteine 3) valine 4) serine

8. The amino acid which contains a hydroxy group in the side chain

   1) cysteine 2) glutamine 3) serine 4) leucine

9. Essential amino acid among the following is

   1) Glycine 2) Tryptophan 3) Alanine 4) Proline

10. The number of amino acids found in proteins that a human body can synthesize is

    1) 20 2) 10 3) 5 4) 14

11. Which one of the following is not an essential amino acid ?

    1) Valine 2) Leucine 3) Lysine 4) Alanine

12. Among the following the basic amino acid is

    1) Glycine 2) Argenine 3) Proline 4) Cysteine

13. Which of the following statement is not correct ?

    1) proteins are polyamides formed from amino aicds

    2) except glycine, all other amino acids show optical activity

    3) natural proteins are made up of L -isomers of amino acids

    4) in α amino acids, - NH_2 **and** $-COOH$ groups are attached to different carbon atoms

14. For an aminoacid ‘X is

    1) Acidic amino acid 2) Basic amino acid

    3) Neutral amino acid 4) Acidic or basic amino acid

15. Which of the following statements is not correct ?

1) amino acid can exist as inner salt

2) each polypeptide has one C - terminal and other N - terminal

3) enzymes are naturally occurring simple proteins

4) the union of two amino acids produces two peptide linkages

16. The primary structure of a protein tells about

1) 3D arrangement of all atoms 2) shape of poly peptide chain

3) specific sequence of amino acids 4) 3D arrangement of oligo peptide chains

17. The dipeptide glycylalanine contains

1) glycine as C-terminal residue 2) glycine as N-terminal residue

3) alanine as N-terminal residue 4) either (1) or (2)

18. β -pleated structure of proteins is

1) Primary structure 2) Secondary structure

3) Tertiary structure 4) Quaternary structure

19. The back bone for different segments in a protein is in the following form

1) α -helix 2) α -pleated 3) coil 4) 1 or 3

20. The helical structure of proteins is stabilized by

1) H-bonding 2) van der Waals' forces

3) ionic bond 4) peptide bond

21. Secondary structure of protein refers to

1) Mainly denatured proteins and structure of prosthetic groups

2) Three-dimensional structure, especially the bond between amino acid residues that are distinct from each other in the polypeptide chain

3) Linear sequence of amino acid residues in the polypeptide chain

4) Regular folding patterns of continuous portions of the polypeptide chain

22. The bond that determines the secondary structure of a protein is

1) Co-ordinate bond 2) Covalent bond

3) Hydrogen bond 4) Ionic bond

23. Which of the following is a globular protein?

1) Collagen 2) Myoglobin and Haemoglobin

3) Myosin 4) Enzymes

24. Tertiary structure of a protein will lead the polypeptide chains to get the following shapes

1) linear, octahedral 2) angular, tetrahedral

3) fibrous, globular 4) fibrous, planar

25. Maximum possible hydrogen bonds are present in

1) 3.6_{13} Helix 2) Keratin 3) Silk fibroin 4) β - D - fructose

26. Mark the wrong statement about denaturation of proteins

1) The primary structure of the protein does not change

2) Globular proteins are converted into fibrous proteins

3) Fibrous proteins are converted into globular proteins

4) The biological activity of the protein is not cancelled

27. The restriction of the biological nature and activity of proteins by heat or chemical agent is called

1) dehydration 2) denaturation

3) deoxidation 4) denitrogenation

28. Addition of an electrolyte such as sodium dodecyl sulphate causes

1) renaturation of proteins since it stabilises hydrophobic interactions

2) denaturation of proteins since it disturbs hydrophobic interactions

3) renaturation of proteins since it maintains necessary isoelectric point

4) denaturation of proteins since it causes cleavage of O = C – N – H bonds

29. Which of the following is an example of Nucleic acids "irreversible denaturation" of a protein ?

1) boiling egg 2) change of amino acid

3) enzymatic action 4) its synthesis

30. Enzymes are

1) Complex nitrogenous substances produced in living cells

2) Steroids 3) Living organisms 4) Dead organisms

31. Nuclear types of proteins based on molecular shape

1) 1 2) 2 3) 3 4) 4

32. Structure that gives the sequence of amino acids of a protein

1) Primary 2) Secondary 3) Tertiary 4) Quaternary

33. The function of enzymes in the living system is to

1) transport oxygen 2) provide immunity

3) catalyse biochemical reactions 4) provide energy

34. Which one of the following is not a protein?

1) Wool 2) Nail 3) Hair 4) DNA

35. Enzymes belong to which class of compounds ?

1) Polysaccharides 2) Polypeptides

3) Polynitro heterocyclic compounds 4) Hydrocarbons

36. Enzymes are made up of

1) Edible proteins 2) Proteins with specific structure

3) Nitrogen containing carbohydrates 4) Carbohydrates

37. Regarding enzymes, incorrect statement is

1) an enzyme is generally a protein

2) an enzyme may be a conjugated protein

3) ensyme gets deactivated during reactions

4) enzyme gets activated during reactions

Nucleic acids

38. Which of the following constitutes the genetic material of the cell ?

1) Nucleic acids 2) Proteins

3) Lipids 4) Carbohydrates

39. Nucleic acids are called acids mainly because of the presence of

1) -COOH group 2) - OH group of sugar unit

3) - OH group of the heterocyclic base 4) -OH group of phosphate unit

40. Wich of the following is not a pyrimidine base ?

1) Uracil 2) Thymine 3) Cytosine 4) Guanine

41. Th| following does not belong to either purine or pyrimidines

1) Tryptophan 2) Cytosine 3) Uracil 4) Adenine

42. Purine without ketonic group is

1) adenine 2) adenosine 3) cytidine 4) thymidine

43. The purine base present in RNA is

1) Guanine 2) Thymine 3) Cytosine 4) Uracil

44. 6 - amino purine is commonly called

1) Adenosine 2) Adenine 3) Cytosine 4) Thymine

45. The bases that are common in both RNA and DNA are

1) adenine, guanine, cytosine 2) adenine, guanine, thymine

3) adenine, uracil, cytosine 4) guanine, uracil, thymine

46. Adenosine monophosphae (AMP) is a

1) nucleotide 2) nucleoside 3) insecticide 4) antibacterial

47. The phosphodiester linkage in a nucleotide is between

1) 5' and 1' carbons 2) 5' and 3' carbons

3) 1' and 5' carbons 4) 3' and 5' carbons

48. Which one of the following is not present in DNA?

1) adenine 2) ribose 3) cytosine 4) guanine

49. The pentose sugar in DNA and RNA has

1) Open chain structure 2) Pyranose structure

3) Furanose structure 4) None of the above

50. Adenosine is an example of a

1) Nucleotide 2) Nucleoside 3) Purine base 4) Pyridine base

51. Nucleoside on hydrolysis gives

1) Pentose sugar and purine base

2) Pentose sugar, phosphoric acid, purine or pyrimidine base

3) Pentose sugar and a heterocyclic base

4) Heterocyclic base and phosphoric acid

52. In nucleic acids, the sequence is represented as

1) Phosphate - base - sugar 2) Sugar - base - phosphate

3) Base - sugar - phosphate 4) Base - phosphate - sugar

53. In nucleic acids, the nucleotides are linked to one another through

1) Hydrogen bond 2) Peptide bond

3) Glycosidic linkage 4) Phosphate groups

54. In a nucleotide the phosphate linkage is generally attached to

1) C - 1 of sugar 2) C - 2 of sugar
3) C - 5 of sugar 4) N - of base

55. Adenine pairs with thymine through

1) two hydrogen bonds 2) one hydrogen bond
3) three hydrogen bonds 4) four hydrogen bonds

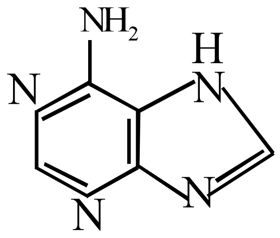
56. Primary & secondary structures of Nucleic acid reveals

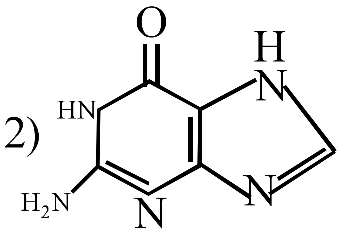
1) Nucleotide sequence & Single or double helix structure
2) Amino acid sequence & 3D-folding
3) Amino acid sequence & shape of protein
4) Single/double helix structure and Nucleotide sequence.

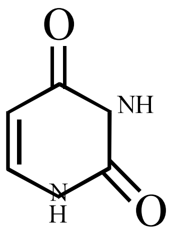
57. Hydrolysis of adenosine triphosphate involves rupture of

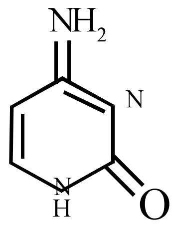
1) Base-sugar bond 2) Sugar-phosphate bond
3) P-O-P bond 4) P-N-P bond

58. The base present in Cytidine :

1) 

2) 

3) 

4) 

59. The backbone of a nucleotide strand contains the following sequence of arrangement

1) Base-Sugar 2) Sugar-Phosphate
3) Base-Phosphate 4) Base$_1$-Base$_2$

60. The couplings between base units of DNA is through

1) Hydrogen bonding 2) Electrostatic bonding
3) Covalent bonding 4) vander Waals forces

61. The main role of DNA in a living system is

1) It is the structural material of cell walls
2) It is an enzyme
3) It carries the hereditary characteristics of the organism
4) It participates in cellular respiration

62. Synthesis of identical copies of DNA is called

1) transcription 2) replication
3) translation 4) reverse transcription

KEY

1) 2 2) 2 3) 3 4) 2 5) 4 6) 1 7) 2 8) 3
9) 2 10) 2 11) A 12) 2 13) 4 14) 3 15) 4 16) 3
17) 2 18) 2 19) 4 20) 1 21) 4 22) 3 23) 2 24) 3
25) 1 26) 4 27) 2 28) 2 29) 1 30) 1 31) 3 32) 1
33) 3 34) 4 35) 2 36) 2 37) 4 38) 1 39) 4 40) 4
41) 1 42) 1 43) 1 44) 2 45) 1 46) 1 47) 2 48) 2
49) 3 50) 2 51) 3 52) 3 53) 4 54) 3 55) 1 56) 4
57) 3 58) 4 59) 2 60) 1 61) 3 62) 2

Question Bank - III

SET - I

1) Both A & R are true and R is the correct explanation of A
2) Bom A & R are true, but R is not the correct explanation of A + B
3) A is true. R is false
4) A is false, R is true

1. (A) : Guanine unites with Cytosine but not with Thymine
   (R) : Guanine and Cytosine are purine bases while Thymine is a pyrimidine base
2. (A) : Adenine pairs up with thymine but not with cytosine
   (R) : With cytosine, no hydrogen bonds are possible for adenine
3. (A) : Proteins are made up of a -amino acids
   (R) : During denaturation, secondary and tertiary structures of proteins are destroyed.
4. (A) : The pyrimidine base thymine is present in RNA
   (R) : RNA controls the synthesis of proteins.
5. (A) : The simplest α-amino acid is optically inactive
   (R) : Simplest α-amino acid has no chiral carbon centre
6. (A) : The folding of polypeptide chains leads to globular proteins
   (R) : Globular structure is a part of secondary structure of protein
7. (A) : The synthesis of proteins is governed by DNA
   (R) : DNA has the deoxyribose sugar molecule as a part of the structural unit
8. (A) : All DNA and RNA molecules contain adenine, guanine and cytosine base molecules
   (R) : Adenine, guanine and cytosine molecules are examples of the same base type
9. (A) : Enzymes are globular proteins
   (R) : Enzymes are consumed during reactions.

SET - II

1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true, but R is not the correct explanation of A
3) A is true but R is false
4) Both A and R are False

10. (A) : Denaturation of a protein can be done on heating or by adding a suitable solvent
(R) : Denaturation of a protein effects its primary structure explanation of A
11. (A): All enzymes are proteins but all proteins are not enzymes
(R) : Keratin is an enzyme
12. (A) : At isoelectric point an amino acid has highest solubility
(R) : Isoelectric point of an amino acid is usually at a pH value of 7.
13. (A) : Amino acid that can be synthesised by human body is called essential amino acid
(R) : All a -amino acids are essential amino acids
14. (A) : The acidic nature of glycine is due to $-NH_3^+$ group
(R) : $-NH_3^+$ group acts as a proton donor group
15. (A) : At isoelectric point, the amino group does not migrate under the influence of electric field.
(R) : At isoelectric point, amino acid exists as a zwitter ion.

KEY

1) 3 2) 2 3) 3 4) 4 5) 1 6) 3 7) 4 8) 3
9) 3 10) 3 11) 3 12) 4 13) 4 14) 1 15) 1

Question Bank - IV

Vitamins and Hormones

1. Water soluble vitamins are
1) A,D 2) E,K 3) D,E 4) C,B
2. Which one of the following is not a source of vitamin “A”
1) Milk 2) Liver 3) Yeast 4) Egg
3. Night blindness is due to the deficiency of
1) Vitamin A 2) Hormones 3) Vitamin B_{12} 4) Riboflavin
4. The chief source of vitamin D is
1) Fish liver oil 2) Spinach 3) Cow dung 4) Citrous fruit
5. Antiricketic vitamin is
1) Vitamin A 2) Vitamin B_{12} 3) Vitamin C 4) Vitamin D
6. Deficiency of Vitamin E leads to
1) Neurosis of heart muscles 2) Degeneration of lacrymal gland
3) Beri-Beri 4) Dermatitis
7. In all green leaves and vegetables,which of the following vitamin is available ?
1) Vitamin A 2) Vitamin D 3) Vitamin K 4) Vitamin B_{12}
8. Which of the following vitamin is Naphthaquinone derivative ?
1) A 2) B 3) D 4) K
9. Anti haemorrhagic vitamin is
1) A 2) B 3) D 4) K

10. Deficiency of Vitamin B_2 leads to

1) Bow legs 2) Cheilosis 3) Pellegra 4) Vision loss

11. The following vitamin plays a role in transportation of amino acids across the cell membrane.

1) B_1 2) B_2 3) B_3 4) B_6

12. Convulsion is due to deficiency of vitamin

1) B_1 2) B_2 3) B_5 4) B_6

13. Which of the following is not a source of vitamina-A

1) Fish oils 2) Carrots 3) Yeast 4) Milk

14. Vitamin B_{J2} is rich in

1) Sewage sludge 2) Liver of pig

3) Egg 4) all

15. Ascorbic acid resembles the structure of

1) Vitamin A 2) Glucose 3) Cellulose 4) Vitamin D

16. Deficiency of Vitamin "C" leads to

1) gum swelling 2) blead easily and teeth become loose

3) delay in wound healing 4) all

17. Dark red tongue, fissuring at corner of mouth and lips are the symptoms of the deficiency of which vitamin

1) C 2) A 3) B_2 4) D

18. Vitamin B_6 is known as

1) Pyridoxine 2) Thiamine 3) Tocopherol 4) Riboflavin

19. Vitamin D is called

1) Ascorbic acid 2) Calciferol or ergocalciferol

3) Thiamine 4) Riboflavin

20. Which of the following vitamins is nos soluble in water ?

1) C 2) B_1 3) B_2 4) D

21. The best source of vitamin C is

1) Cod liver oil 2) Egg yolk

3) Citrous fruits 4) Fish liver oil

22. The deficiency of vitamin K causes

1) Haemorrhage 2) Lengthening time of blood clotting

3) Inflammation of tongue 4) Both (1) and (2)

23. Nervousness anaemia is caused by the deficiency of vitamin

1) B_1 2) B_2 3) B_6 4) B_{I2}

24. Deficiency of vitamin E causes

1) Scurvy 2) Loss of appetite

3) Loss of sexual power and reproduction 4) Beri Beri

25. Which of the following is a fat soluble vitamin ?

l) Vitamin A 2) Riboflavin 3) Pyridoxine 4) Thiamine

26. The metal present in vitamin B_3 is

l) Iron 2) Manganese 3) Cobalt 4) Magnesium

27. The deficiency of which of the following vitamins adversely affects eye sight

1) A 2) D 3) B_{12} 4) E

28. Match List - I with List - II and select the correct answer using the codes given below.

List-I	List-II
I. Anti-beriberi factor	A. Vitamin C
II. Pancreas	B. Glycerides
1II. Palm oil	C. Vitamin B_1
IV. L (+)– Asorbic acid	D. Insulin

1) I - C, II - D; III - B ; IV - A

2) I - C; II - D; III - A ; IV - B

3) I - A; II - B; III - D ; IV - C

4) I - A; II - B; III - C ; IV - D

29. Match the following

List-I	List-II
A) B_1	I) Riboflavin
B) B_2	II) Retinol
C) A	III) Ascorbic acid
D) C	IV) Thiamine

The correct match is

	A	B	C	D
1)	IV	I	III	II
2)	IV	III	I	II
3)	III	IV	II	I
4)	IV	I	II	III

30. Match List - I (name of vitamin) with List - II (deficiency result/disease) and select the correct answer using the codes given below.

List -I	List - II
I) Ascorbic acid	A) Beri-beri
II) It Retinol	B) Cracked lips
III) Riboflavin	C) Scurvy
IV) Thiamine	D) Night blindness

1) I - B; II - A; III-C; IV - D

2) I - A; II - B; III - C ; IV - D

3) I - D; II - C; III - III ; IV - A

4) I - C; II - D; III - B; IV -A

Hormones

31. Which of the following substance acts as stimulator ?

1) Vitamin 2) Enzyme 3) Hormone 4) Carbohydrate

32. Receptors of hormones are generally

1) Carbohydrates 2) Vitamins 3) lipids 4) Protiens

33. Steroid hormones are produced by the

a) Adrenal cortex b) Pancreas c) Thyroid d) Testis e) Pitutary

1) a and d 2) a, b, and c 3) c, d 4) d, e

34. Substances produced by endocrine glands are

1) Vitamins 2) Harmones 3) Herb 4) Drug

35. Which of the following is a derivative of amino acid ?

1) Thyroxin 2) Estradiol 3) Estrogene 4) Progesterone

36. Total number of carbon atoms present in stejoid nucleus.

1) H 2) 17 3) 10 4) 20

37. Which of following hormone is produced by testis ?

1) Progesterone 2) Estradiol

3) Testosterone 4) Estrone

38. Harmone containing only ketonic functional group is

1) Estradiol 2) Progresterone 3) Testosterone 4) Insulin

39. Phosphorylation of glucose is not increased by

1) Auxins 2) Insulin 3) Ethylene 4) Trausmatic acid

40. Thyroxin is

1) Protein type vitamin 2) Aminoacid type nucleic acid

3) Protein type hormone 4) Aminoacid type hormone

KEY

1) 4	2) 3	3) 1	4) 1	5) 4	6) 1	7) 3	8) 4
9) 4	10) 2	11) 4	12) 4	13) 4	14) 2	15) 2	16) 3
17) 3	18) 1	19) 2	20) 4	21) 3	22) 4	23) 4	24) 3
25) 1	26) 3	27) 1	28) 1	29) 4	30) 4	31) 3	32) 4
33) 1	34) 2	35) 1	36) 2	37) 3	38) 2	39) 2	40) 4

10. CHEMISTRY IN EVERY DAY LIFE

Synopsis:

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1. According to ‘WHO’, a drug is defined as a substance or product which is used or intended to be used for modifying or exploring physiological systems or pathalogical states for the benefit of the recipient. Their molecular masses ~ ranging from 100-500 units
2. An ideal drug should satisfy following conditions.
   a) its action should be localised only at the site
   b) it should not be toxic.
   c) its side effects should be tolerable - d) it should not injure host tissues.
3. The drugs which produce therapautic and useful biological response are called medicines. All medicines are drugs. But all drugs need not be medicines.
4. In living organism, histamine is synthesised from the naturally occurring a amino acid histidine by the loss of carboxyl group through bacterial (or) enzymatic decarboxylation. Histamine causes inflammation in the body. Antihistamines inhibit the action of histamine.
5. Drugs havig same structural features will have same physiological and pharmacological effects, eg. Morphine, Heroin and Codeine have same structural features and relieve from pain and produce sleep.
6. Alkaloids like morphine, codeine, papaverine and heroin are commonly used Narcotic drugs (opiates).
7. Narcotic drugs relieve pain by acting on central nervous system and produce sleep.
8. Morphine can be used to Check diarrhoea, ease dyspnea, suppress cough and induce sleep in the presence of pain.
9. Codeine can be obtained by methylation of one of the phenolic groups of morphine with phenyl trimethyl ammonium hydroxide.
10. The analgesic activity of codeine is relatively less than that of morphine.
11. Norcotic drugs tend to produce euphoria which is mainly responsible for their addictive property.
12. Non-norcotic analgesis act as analgesics without any addictive properties.
13. Aspirin is acetyl salicylic acid (or) salicylic acid acetate(or) O - acetyl salicylic acid. It was first prepared by Kolbe by refluxing salicylic acid with acetic anhydride or acetic acid in the presence of H_2SO_4 (conc).
14. Aspirin is analgesic (pain reliever) and antipyretic (body temperature reducer). It also acts as antirheumatic and anti-inflammatory. It inhibits platelet function.

Used to minimize the incidence of myocardial intraction and t- transient ischemic attacks.

15. Chemically Ibuprofen is a - methyl - 4 - (2-methyl propyl) benzene acetic acid.
16. Ibuprofen can be used as antinflammatory, antipyretic and analgesic. It can be used for the treatment of rheumatoid arthritis and osteoarthritis.
17. Antipyretics can be called as coal tar analgesics since they are obtained from coal tar. Amino phenols are relatively less toxic than aniline, p-aminophenol is least toxic with considerable antipyretic action.
18. Paracetamol is N-acetyl para aminophenol or 4- hydroxy acetanilide or N - (4 - hydroxy phenyl) acetamide.
19. Paracetmol is a synthetic non - opiate and it is used as antipyretic and analgesic.lt is used for arthritic rheumatic condition linked with musculoskeletal pain, headache, neuralgias, myalgias and dysmenorrhea. Paracetamol is a < better drug than aspirin.
20. Phenacetin is [N - (4 - ethoxyphenyl)] acetamide.
21. Phenacetin can be used as analgesic and antipyretic. It is more toxic than paracetmol. Irreversible kidney damage has been established with its prolonged usage.
22. Analgin (or Novalgin) is sodium 1,5- dimethyl - 3-oxo-2 - phenyl -4 pyrazoyl - (methyl) - aminomethane sulphonate. It is prepared from phenyl hydrazine and ethyl acetoacetate units.

    It can be used as antipyretic and analgesic.
23. KBr is a sedative but not hypnotic, Thiopentone sodium is a powerful hypnotic but not a sedative.
24. The sedatives and hypnotics are broadly classified into barbiturates and non barbiturates.

    Derivatives of barbituric acid are called barbiturates which can act as hypnotic drugs. **eg.** veronal, amytal, nembutal, luminal and seconal.
25. Barbituric acid can be obtained by the condensation of malonyldichloride acid and urea in presence of $POCl_3$. Barbituric acid has no central nervous system (CNS) activity but its alkenyl and / or aryl derivatives have CNS activity.
26. Luminal (Phenobarbitone) is 5 - ethyl-5 - Phenyl-Barbituric acid. Seconal (Quinal barbitone) is sodium 5-allyl-5-(l-methyl butyl) barbiturate. Luminal is used as both hypnotic and sedative. It is used in treating grandmal and petimal epilepsy.
27. Valium and serotonin are both tranquilizers. Tranquilizers are drugs essentially used in the management and treatment of psychoses and neuroses. Major tranquilizers are for psychoses and minor tranquilizers are for neuroses.
28. Diazepam is a benzodiazepine. It is used to relieve anxiety and provide sedation and light anaesthesia.
29. Abnormalities in the level of dopamine in the brain cause parkinson's disease.

Abnormalities in the metabolism of serotonin cause schizophemia.

30. Adrenaline and noradrenaline are two hormones secreted in medulla of the adrenal gland. Adrenaline increases the blood pressure, strengthening of heart rate and widening of the passages of the lungs. All of these prepare the animal to fight or to flee.

31. If the level of noradrenaline is low the signal sending activity also would be low and the person suffers from depression. Iproniazid and phenalzine are anti depression drugs.

32. Several body secretions either kill microbes or inhibit their growth. Eg. Lysozyme (lipid splitting enzyme) present in tears, nasal secretion and saliva. Fatty acids and lactic acid in sweat and sebaceous secretions, HC*l* in stomach.

33. Antibiotics, antiseptics and disinfectants are antibacterial (or) antimicrobial drugs.

34. According to Wakesmann an antibiotic is a substance produced by the microorganisms which has the capacity of inhibiting the growth (or) destroying other micro organism.

35. In low concentrations antibiotics inhibit the growth or destroy the micro-organsism by interfering in their metabolic process.

36. Antibiotics are two types Bactericidal (they kill the microbes) eg. Penicillin, Amino glycosides, ofloxacin and Bacteriostatic (they inhibit the growth of microbes) eg. Erythromycin, Tetracycline, Chloramphenicol.

37. Penicillin is the first antibiotic discoverd by Flemming. It is a mixture of natural compounds having molecular formula C_9 Hj O_4N_2SR.

38. Depending on the nature of R, the different penicillines are: If

R = pent -2 - enyl ---pencillin I or F

R = $-CH_2 - C_6H_5$ benzyl penicillin (or) penicilline II or G

R = $-CH_2 - C_6H_4 - OH$ it is P - hydroxy benzyl penicillin (or) penicillin III or X

R = $- (CH_2)_6 - CH_3$--n-heptyl penicillin $_v$

R - $- (CH_2)_4 CH_3$ ---- amyl penicillin l

R = $- CH_2 - O - C_6H_5$ phenoxy methyl - penicillin

39. Sulphadiazine is a sulpha dmg. It has a benzene ring and a hetcrocylic aromatic 6 memberd ring. Its molecular formula is $C_6H_{10}N_4 SO_2$,

40. Broad spectmm antibiotics kill or inhibit a wide range of gram-positive and gram -negative bacteria. Eg.: Synthetic modifications of penicillins like ampicillin and amoxycillin, chloramphenicol, vancomycin, ofloxacin and dysidazirine.

41. Chroamphenical is bacteriostatic and broad spectrum antibiotic. It is rapidly absorbed from gastrointestinal tract hence it can be given orally for typhoid, dysentery, acute fever, meningitis, pneumonia and for urinary infections.

42. Narrow spectmm antibiotics will kill (or) inhibit either gram positive or gram negative bacteria. Ex: penicillin-G.

43. Limited spectrum antibiotics are effective against a single organism or disease.

44. Antiseptics are applied to the living tissues such as wounds, cuts, ulcers and diseased skin surfaces. These are for external use only, cannot be ingested like antibiotics, eg. Dettol - a mixture of chloroxylenol and terpineol, Bithionol - added to soaps, Tincture of Iodine - 2-3 % solution of I_2 in alcohol - water mixture, Boric acid - a weak antiseptic for eyes.

45. Disinfectants are applied to floors, drinage system and such inanimate objects. 40% aq solution of formaladehyde is called formalin. It is used as disinfectant and for preservation of biological specimens. 0.2-0.4 % chlorine water and $S0_9$ in very low concentrations can be used as disinfectants.

46. Same chemicals may be used as antiseptics as well as disinfectants. 0.2 % phenol can acts as antiseptic while 1% phenol is disinfectant.

47. Antifertility Drugs are compounds of progesterone and estrogen hormones. Norethindrone is progesteron derivative. Ethynylestradiol (novestrol) is estrogen derivative.

48. Mifepristone is a synthetic steroid that blocks the effects of progesterone. Hence it is a constituent of morning after pill.

49. Chemicals that remove the excess acid in the stomach and maintain the P^H to normal level are called antacids, $MgCO_3$, $A1PO_4$; NaHCO -. Magnesium trisilicate ; omeprazole and lansoprazole. A mixture of Ah OH and $Mg(OH)_2$ or NaHCO- can be used as antacids as they neutralise the acids.

50. Excess of$NaHCO_3$ makes the stomach alkaline and triggers the over production of acids. $Mg(OH)_2$ and $A1\ (OH)_3$ are insoluble and do not increase the pH above 7. Thus metal hydroxides are better antacids than $NaHCO_{3,}$

51. Mixture of $Mg\ (OH)_2$ and $A1\ (OH)_3$ relieve the patients temporarily from painful effects. It cannot cure ulcers and cannot stop the production of acids.

52. Omeprazole and lansoprazole are antacids used recently. These compounds do not allow the formation of acid in the stomach.

53. Cimetidine (tegament) and ranitidine are antihistanines used as antacids. Bromo or chloro pheniramine (dimetap or dimetane) and terfenadine (seldane) are antihistamines used as antiallergics.

54. Anti oxidants retard the action of oxygen on food since they are more reactive towards oxygen than the food materials. They reduce the rate of involvement of free radicals in the aging process. Generally used anti oxidants are Butylated Hydroxy Toluene (BHT) and Butylated Hydroxy Anisole (BHA). SO_2 and SO_3^{-2} are used as antioxidants for wine, beer, sugar syrup, cut peeled, or dried fruits and vegetables.

55. Food dyes have no nutritive value but sometimes are harmful particularly for children, asthma patients etc.

56. Carotene is safe food colour tetrazine is one such highly used suspect.

57. Food preservatives prevent spoilage of food due to microbial growth. Eg.: $NaCl$, Sugar, Vegetable oils, Salts of sorbic acid & propionic acid.

58. Natural sweetners like sucrose not only gives sweetness but also adds calories. Therefore the diabetic patients prefer to use artificial sweetners insted of sucrose.

59. Ortho-sulphobenzamide is called saccharine. It is 550 times sweeter than cane sugar.

60. Aspartame is 160 times sweeter than cane sugar. Chemically it is methyl ester of dipeptide formed from aspartic acid and phenylalanine

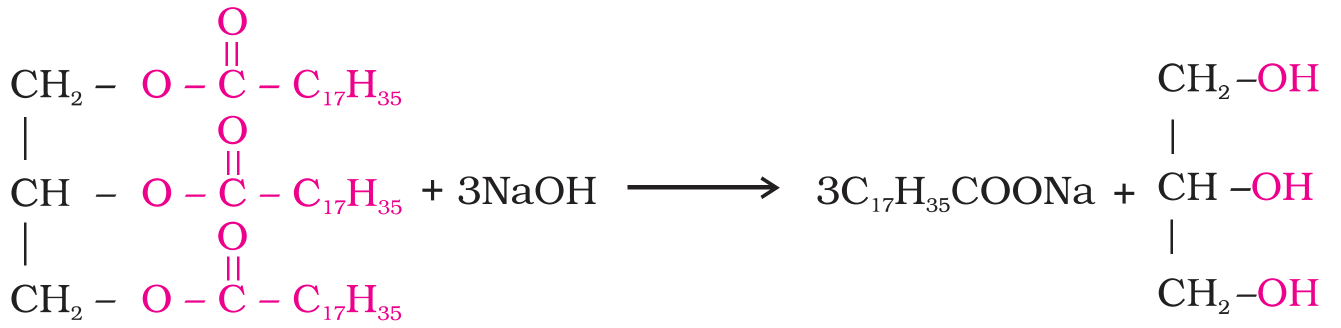
61. Alitame is high potency sweetner which is 2000 times sweeter than sucrose and more stable than aspartame.

62. Sucralose is trichloro derivative of sucrose.

Cleansing Agents

In this Section, we will learn about **detergents**. Two types of detergents are used as cleansing agents. These are soaps and synthetic detergents. These improve cleansing properties of water. These help in removal of fats which bind other materials to the fabric or skin.

Soaps



$$\begin{array}{l} CH_2-O-\overset{\overset{O}{\parallel}}{C}-C_{17}H_{35} \\ | \\ CH-O-\overset{\overset{O}{\parallel}}{C}-C_{17}H_{35} \\ | \\ CH_2-O-\overset{\overset{O}{\parallel}}{C}-C_{17}H_{35} \end{array} + 3NaOH \longrightarrow 3C_{17}H_{35}COONa + \begin{array}{l} CH_2-OH \\ | \\ CH-OH \\ | \\ CH_2-OH \end{array}$$

Glyceryl ester of stearic acid (Fat) — Sodium hydroxide — Sodium stearate — Glycerol (or Glycerine)

Soaps are the detergents used since long. Soaps used for cleaning purpose are sodium or potassium salts of long chain fatty acids, e.g., stearic, oleic and palmitic acids. Soaps containing sodium salts are formed by heating fat (*i.e.*, glyceryl ester of fatty acid) with aqueous sodium hydroxide solution. This reaction is known as **saponification**.

In this reaction, esters of fatty acids are hydrolysed and the soap obtained remains in colloidal form. It is precipitated from the solution by adding sodium chloride. The solution left after removing the soap contains glycerol, which can be recovered by fractional distillation. Only sodium and potassium soaps are soluble in water and are used for cleaning purposes. Generally potassium soaps are soft to the skin than sodium soaps. These can be prepared by using potassium hydroxide solution in place of sodium hydroxide.

Types of soaps

Basically all soaps are made by boiling fats or oils with suitable soluble hydroxide. Variations are made by using different raw materials.

Toilet soaps are prepared by using better grades of fats and oils and care is taken to remove excess alkali. Colour and perfumes are added to make these more attractive.

Soaps that float in water are made by beating tiny air bubbles before their hardening. *Transparent soaps* are made by dissolving the soap in ethanol and then evaporating the excess solvent.

In *medicated soaps*, substances of medicinal value are added. In some soaps, deodorants are added. *Shaving soaps* contain glycerol to prevent rapid drying. A gum called, rosin is added while making them. It forms sodium rosinate which lathers well. *Laundry soaps* contain fillers like sodium rosinate, sodium silicate, borax and sodium carbonate.

Soap chips are made by running a thin sheet of melted soap onto a cool cylinder and scraping off the soaps in small broken pieces. *Soap granules* are dried miniature soap bubbles. *Soap powders* and *scouring soaps* contain some soap, a scouring agent (abrasive) such as powdered pumice or finely divided sand, and builders like sodium carbonate and trisodium phosphate. Builders make the soaps act more rapidly. The cleansing action of soap has been discussed in chapter 4.

Why do soaps not work in hard water?

$$\underset{\text{Soap}}{2C_{17}H_{35}COONa} + CaCl_2 \longrightarrow 2NaCl + \underset{\substack{\text{Insoluble calcium}\\ \text{stearate (Soap)}}}{(C_{17}H_{35}COO)_2Ca}$$

Hard water contains calcium and magnesium ions. These ions form insoluble calcium and magnesium soaps respectively when sodium or potassium soaps are dissolved in hard water.

These insoluble soaps separate as scum in water and are useless as cleansing agent. In fact these are hinderance to good washing, because the precipitate adheres onto the fibre of the cloth as gummy mass. Hair washed with hard water looks dull because of this sticky precipitate. Dye does not absorb evenly on cloth washed with soap using hard water, because of this gummy mass.

Synthetic Detergents

Synthetic detergents are cleansing agents which have all the properties of soaps, but which actually do not contain any soap. These can be used both in soft and hard water as they give foam even in hard water. Some of the detergents give foam even in ice cold water.

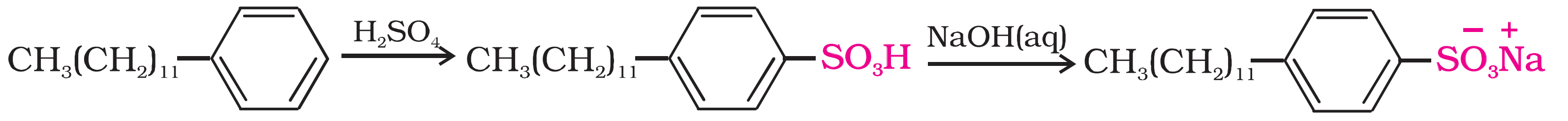
Synthetic detergents are mainly classified into three categories:

(i) Anionic detergents (ii) Cationic detergents and (iii) Non-ionic detergents

(i) *Anionic Detergents:* Anionic detergents are sodium salts of sulphonated long chain alcohols or hydrocarbons. Alkyl hydrogensulphates formed by treating long chain alcohols with concentrated sulphuric acid are neutralised with alkali to form anionic detergents. Similarly alkyl benzene sulphonates are obtained by neutralising alkyl benzene sulphonic acids with alkali.

$$CH_3(CH_2)_{10}CH_2OH \xrightarrow{H_2SO_4} CH_3(CH_2)_{10}CH_2OSO_3H \xrightarrow{NaOH(aq)} CH_3(CH_2)_{10}CH_2OS\overset{-}{O}_3\overset{+}{Na}$$

Lauryl alcohol — Lauryl hydrogensulphate — Sodium laurylsulphate (Anionic detergent)

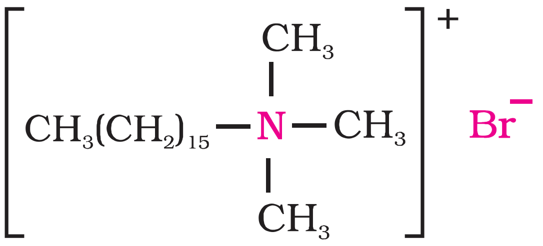


Dodecylbenzene — Dodecylbenzenesulphonic acid — Sodium dodecylbenzenesulphonate

In anionic detergents, the anionic part of the molecule is involved in the cleansing action. Sodium salts of alkylbenzenesulphonates are an important class of anionic detergents.

They are mostly used for household work. Anionic detergents are also used in toothpastes.

(ii) *Cationic Detergents*: Cationic detergents are quarternary ammonium salts of amines with acetates, chlorides or bromides as anions. Cationic part possess a long hydrocarbon chain and a positive charge on nitrogen atom. Hence, these are called cationic detergents. Cetyltrimethyl-ammonium bromide is a popular cationic detergent and is used in hair conditioners.



$$\left[CH_3(CH_2)_{15}-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{N}}-CH_3\right]^+ Br^-$$

Cetyltrimethyl ammonium bromide

Cationic detergents have germicidal properties and are expensive, therefore, these are of limited use.

(iii) *Non-ionic Detergents:* Non-ionic detergents do not contain any ion in their constitution. One such detergent is formed when stearic acid reacts with polyethyleneglycol.

$$CH_3(CH_2)_{16}COOH + HO(CH_2CH_2O)_nCH_2CH_2OH \xrightarrow{-H_2O} CH_3(CH_2)_{16}COO(CH_2CH_2O)_nCH_2CH_2OH$$

Stearic acid — Polyethyleneglycol

Liquid dishwashing detergents are non-ionic type. Mechanism of cleansing action of this type of detergents is the same as that of soaps. These also remove grease and oil by micelle formation.

Main problem that appears in the use of detergents is that if their hydrocarbon chain is highly branched, then bacteria cannot degrade this easily. Slow degradation of detergents leads to their accumulation. Effluents containing such detergents reach the rivers, ponds, etc. These persist in water even after sewage treatment and cause foaming in rivers, ponds and streams and their water gets polluted. So, branched chain detergants are non-biodegradable and unbranched hydrocarbon detergants are biodegradable and hence polution is prevented.

These days the branching of the hydrocarbon chain is controlled and kept to the minimum.

Question Bank – I

1. An ideal drug should not have the following.
(1) Be toxic (2) Be localized at invading gland
(3) Have tolerable side effects (4) Not injure host cells.

2. Secretion of HCl is stimulated by
(1) Histamine (2) Dopamine (3) Noradrenaline (4) Serotinine

3. The substance which effort central nervous system and induce sleep.
(1) Antipyretic (2) Analgesic (3) Tranquilizers (4) Antiseptic

4. The following can act only as sedative but not hypnotic.
(1) Thio pentone (2) KBr (3) Barbiturates (4) Barbituric acid

5. Substances which relieve body pains are
(1) antipyretic (2) antibiotic (3) analgesic (4) antimalarials

6. The drug given during hyper tension is
(1) Streptomycin (2) Chloroxylenol (3) Equanil (4) Aspirin

7. The following drugs cannot be used as anti microbial
(1) antiseptic (2) antipyretic (3) antiobiotic (4) Disinfectant

8. Which of the following is natural product
(1) Asparine (2) Ibuprofen (3) Morphine (4) Paracetamol

9. The anti oxidant for wine is
(1) So_2 & So_3^{-2} (2) BH^+ & BHA (3) Citric Acid (4) Tetrazine

10. Sucrolose structure is similar to
(1) Alitame (2) Asportame (3) Saccharin (4) Sucrose

11. A moxillin is semi synthetic modification of
(1) pencillin (2) streptomycin (3) Tetracycline (4) Chloramphenical

12. A broad spectrum antibiotic is
(1) Paracetamol (2) Pencillin-G (3) Aspirin (4) Chloramphenicol

13. 0.2% solution of phenol is
(1) antiseptic (2) disinfectant (3) antibiotic (4) antifertility

14. Match the following.

I	II
1. Iodoform	A) Anaesthetic
2. Methyl Salicylate	B) Antiseptic
3. Di ethyl ether	C) Insecticide
4. Hexa Chloro Cyclohexane	D) Pain Balm

(1) 2 1 3 4 (2) 4 2 1 3
(3) 2 4 1 3 (4) 3 4 1 2

Radius ratio, the shape of the molecule and coordination number.

KEY

1) **1** 2) **1** 3) **3** 4) **2** 5) **3** 6) **3** 7) **2** 8) **3** 9) **1** 10) **4**
11) **1** 12) **4** 13) **1** 14) **3**

Question Bank - II

Chemistry in medicine

1. The treatment of diseases by using drugs is known as

   1) physiotherapy 2) magneto therapy

   3) chemotherapy 4) occupuncture

2. The classification of drugs in the following manner is most conveniant for doctors

   1) Based on pharmacological effect 2) Based on drug action

   3) Based on chemical structure 4) Based on molecular targets

3. Molecular mass of drugs usually is in the range of

   1) 10 - 100 μ 2) 100 - 500 μ 3) 500 - 1000 μ 4) 1000 - 10000 μ

4. An ideal drug should not have the following quality

   1) Be toxic 2) Be localised at invading gland.

   3) Have tolerable side effects 4) Not injure host cells

5. The following can be a drag target

   1) Nucleic acid 2) Paracetmol

   3) Omeprazole 4) Terfenadine

Antacids

6. Secretion of HCl in the stomach is stimulated by

   1) Histamine 2) Dopamine 3) Noradrenaline 4) Serotonine

7. The following anti histamine does not act as antacid

   1) Terfenadine 2) Lansoprazole 3) Cimitidine 4) Rantidine

Tranquilisers

8. Barbituric acid and its derivatives are well knows as

   1) Tranquillizers 2) Antiseptics

   3) Antibiotics 4) Analgesics

9. The substances which affect the central nervous system and induce sleep are called

   1) antipyretics 2) tranquilizers

   3) analgesics 4) anti septic

10. The enzyme which catalyses the degradation of noradrenaline can be inhibited by

    1) Iproniazid 2) KBr 3) Ibuprofen 4) Barbituric acid

11. Which of the following is not a tranquilizer

    1) Luminal 2) Seconal 3) Valium 4) Alitame

12. Which of the following substance may be used as antiseptic as well as disinfectant

    1) formal dehyde 2) chlorine

    3) $KMnO_4$ 4) Phenol

13. The condensation product of malonyl dichloride and urea in presence of $POCl_3$ is

    1) Barbituric acid 2) Ibuprofen

    3) Codine 4) Pencilline

14. Barbiturates exert deppressant action on __

    1) Gut 2) Heart 3) Cerebrospinal axis 4) All the above

Analgesics

15. Which of the following can possibly be used as analgesic without causing addiction and any modification ?

1) Morphine 2) Diazepam

3) N- Acetyl para-aminophenol 4) Tetrahydrocatechol

16. 2-Acetoxy benzoic acid can be used as

1) Antiseptic 2) Antipyretic 3) Antibiotic 4) Mordant dye

17. Substances which relieve body pains are termed as

1) antipyretics 2) antibiotics

3) analgesics 4) antimalarials

18. The drug given during hyper tension is

1) Streptomycin 2) Chloroxylenol

3) Equanil 4) Aspirin

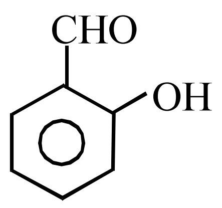
19. Ibuprofen is a

1) non-narcotic drug 2) antibiotic drug

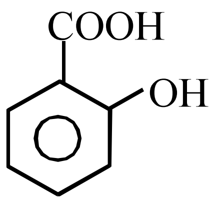
3) analgesic drug 4) 1 and 3

20. Which of the following compounds give aspirin on reacting with acetic anhydride in the presence of cone. H_2SO_4 ?

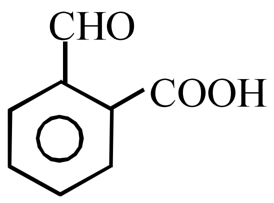
1)



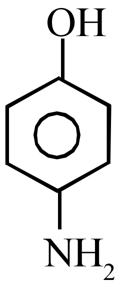
2)



3)



4)



21. Substances which bring down the body temperature during fever are known as

1) antibiotics 2) analgesics 3) antipyretics 4) antimalarial

22. Paracetamol is

1) acetyl derivative of orthohydroxy benzoic acid

2) acetyl derivative of p-amino phenol

3) acetyl derivative of benzoic acid

4) acetyl derivative of para hydroxy benzoic acid

23. Functional groups in aspirin are

1) carboxylic acid 2) ester

3) alcohol 4) 1 and 2

24. The drug used for prevention of heart attacks is

1) Aspirin 2) Valium 3) Chloramphenicol 4) Cephalsoprin

25. Which of the following is a natural

1) Asparine 2) Ibuprofen 3) Morphine 4) Paracetmol

26. Which of the substance added to soap to make it antiseptic

1) Iodine 2) $KMnO_4$ 3) Bithional 4) Cl_2

27. Which of the following is an addictive drug ?

1) Papaverine 2) Pencilline 3) Sulphadiazine 4) Aspirin

28. An example for coal tar analgesic

1) Acetanilide 2) Aniline 3) Analgin 4) Acetanilide + aniline

29. Which of the following is an antacid

1) $Mg(OH)_2$ 2) $Al(OH)_3$ gel 3) $MgCO_3$ 4) All

30. Tincture of iodine (2-3% in water/alcohol) is

1) Antiseptic 2) Disinfectant 3) Analgesic 4) Antipyretic

31. Sulpha drugs are derivatives of

1) Benzene sulphonic acid 2) Sulphanilic acid

3) Sulphanilamide 4) p- Aminobenzoic acid

32. The following drugs cannot be considered as anti microbials

1) Formalin 2) Dettol 3) Boric acid 4) Chlorine water

33. Biological specimens can be preserved in

1) Formalin 2) Dettol 3) Boric acid 4) Chlorine water

34. Urinary infections can be cured by using

1) Chloramphenicol 2) Novestrol

3) Sulphadiazine 4) Dysidazirine

Chemicals in food

35. The anti oxidants forwine are

1) SO_2 & SO_3^{-2} 2) BHT & BHA

3) Citric acid 4) Tetrazine

36. Metabolism of C_6H_5 COONa finally excreated as

1) Benzene 2) Hippuric acid 3) BHT 4) BHA

37. The following substance is more reactive towards oxygen than food meterial

1) Antioxidant 2) Food colour

3) Food sweetner 4) Food nutrients

38. Control of sweetness of food is difficult with

1) Asparatame 2) Sucrolose

3) Fructose 4) Alitame

39. Sucrolose structure is similar to

1) Saccharin 2) Sucrose 3) Fructose 4) Glucose

40. More number of peptide bonds are present in

1) alitame 2) aspartame 3) saccharin 4) sucralose

Miscellaneous

41. Acetylation of the two OH groups of Morphine with acetic anhydride gives

1) Codeine 2) Heroin 3) Cocaine 4) quinine

42. Receptors are

1) Proteins 2) Lipids 3) Carbohydrates 4) Nucleic acids

43. Drugs which supplement or substitute for chemical messengers are

1) antagonists 2) agonists 3) blocking chemicals 4) All

44. List-I contains the names of compounds and List-II contains their functions.

List -I	List - II
A) heroin	1) used as artificial sweetener
B) aspirin	2) used as analgesic and antipyretic
C) analgin	3) to suppress headache, discomfort and fever due to cold
D) barbituric	4) induces sleep in presence of pain
	5) used to prepare sedatives and hypnotics

The correct match is

	A	B	C	D
1)	4	3	1	2
2)	1	2	4	3
3)	4	3	2	5
4)	2	1	5	4

45. The antiseptic used in good quality soaps is

1) Lysol 2) Bithional 3) Boric acid 4) Salol

KEY

1) 3	2) 1	3) 2	4) 1	5) 1	6) 1	7) 1	8) 1
9) 2	10) 1	11) 4	12) 4	13) 1	14) 3	15) 3	16) 2
17) 3	18) 3	19) 4	20) 2	21) 3	22) 2	23) 4	24) 1
25) 3	26) 3	27) 1	28) 4	29) 4	30) 1	31) 3	32) 2
33) 1	34) 1	35) 1	36) 2	37) 1	38) 4	39) 2	40) 2
41) 2	42) 1	43) 2	44) 3	45) 2			

Question Bank - III

SET-I

1) Both A & R sure tnie and R is the correct explanation of A
2) Both A & R are true, bat R is not the correct explanation of A
3) A is true, R is false
4) A is false. R is true

1. (A) : Paracetamol is widely used as analgesic even it is an antipyretic.

(R) : It is administered to aspirin sensitive patients.

2. (A) : The use of the substances isolated from opium poppy as drugs is limited.
   (R) : The side effects due to the prolonged use of opium products are respiratory depression, decreased gastrointestinal motility leading to constipation, increased biliary tract pressure and pruritus due to histamine release.
3. (A) : Same chemicals may be used as antiseptics as well as disinfectants.
   (R) : A chemical which destroys micro-organism can be used as an antiseptic in higher concentration and as disinfectant in lower concentration.
4. (A) : Morphine is an example for narcotic analgesic.
   (R) : Narcotic drugs have no addictive properties but is limited to mild aches and pains.
5. (A) : A mixture of $Mg(OH)_2$ is better antacid than $NaHCO_3$.
   (R) : $NaHCO_3$ makes stomach alkaline and triggers the over production of acid where-as a mixture of $Al(OH)_3 + Mg(OH)_2$ does not increase the pH above 7 in stomach.
6. (A) : Birth control pills suppress ovulation.
   (R) : Birth control pills contain progesterone.
7. (A) : Heroin is morphine diacetate.
   (R) : Morphine is an alkaloid.
8. (A) : Hair washed with soap and hard water looks dull.
   (R) : Calcium and magnesium salts soaps are insoluble in water.
9. (A) : Bithional is added to soap for its beautification and solidification.
   (R) : Bithionol is a sulphadrug.
10. (A) : Synthetic detergents do not contain any soap but exhibit all the properties of soaps.
    (R) : Synthetic detergents give foam even in hard water.
11. (A) : Non-competitive inhibitors occupy allosteric site so that the substrate cannot attach at active site.
    (R) : Non-competitive inhibitors change the shape of active site of enzyme after binding at allosteric site.
12. (A) : Detergent contanining more branches in the hydrocarbon part are water polluting.
    (R) : Bacteria cannot degrade detergent containing highly branched hydrocarbon chain.
13. (A) : The drugs which act on the central nervous system and help in reducing anxiety are called antibiotics.
    (R) : Pencillin is an antibiotic.

SET - II

1) Both A and B are true and R is the correct of explanation of A
2) Both A and R are true but R is the correct explanation of A
3) A is true but R is false
4) Both A and R are false

14. (A) : Antacids decrease the pH value
    (R) : Antacids are basic in nature
15. (A) : Food preservatives present the growth of microorganisms

(R) : Food preservatives are antioxidant

16. (A) : Enzymes have active sites that hold substrate molecule for a chemical reaction.
(R) : Drugs compete with natural substrate by attaching covalently to the active site of enzyme.

17. (A) : Transparent soaps are made by dissolving soaps in ethanol.
(R) : Ethanol makes things in the soap as invisible.

18. (A) : Sodium chloride is added to precipitate soap after saponification.
(R) : Hydrolysis of esters of long chain fatty acids by alkali produces soap in colloidal form.

19. (A) : Competitive inhibitors compete with natural substrate for their attachment on the active sites of enzymes.
(R) : In competitive inhibition, inhibitor binds to the allosteric site of the enzyme.

20. (A) : Non-competitive inhibitor inhibits the catalyic activity of enzyme by binding with its active site.
. (R) : Non-competitive inhibitor changes the shape of the active site in such a way that substrate can't recognise it.

21. (A) : Chemical messenger gives message to le cell without entering the cell.
(R) : Chemical messenger is received at the binding site of receptor proteins.

22. (A) : Receptor proteins show selectivity for one chemical messenger over the other.
(R) : Chemical messenger binds to the receptor site and inhibits its natural function.

23. (A) : All chemicals added to food items are called food preservatives.
(R) : All the food preservatives increase the nutritive value of the food.

24. (A) : Artificial sweeteners are added to the food to control the intake of calories.
(R) : Most of the artificial sweeteners are inert and do not metabolise in the body.

25. (A) : Preservative are added to food items.
(R) : Preservatives inhibit the growth of microorganisms.

26. (A) : Ranitidine is used to control the attack of histamine.
(R) : In controls the secretion of acid.

27 (A) : Antiseptics are applied on living tissues.
(R) : Iodine is a powerful antiseptic.

28. (A) : Sulpha drug contains sulphonamide group.
(R) : Salvarsan is a sulpha drug.

KEY

1) 1	2) 1	3) 3	4) 3	5) 1	6) 1	7) 2	8) 2
9) 4	10) 1	11) 1	12) 2	13) 4	14) 4	15) 2	16) 3
17) 3	18) 1	19) 3	20) 4	21) 1	22) 3	23) 4	24) 1
25) 1	26) 1	27) 2	28) 3				

11. ORGANIC CHEMISTRY

Synopsis:

(a) Alkyl and Aryl halides

1. Depending upon the number of halogen atoms present in the structure, alkyl or aryl halides are classified as mono, di, tri or poly halogen compounds.
2. Alkyl halides are also classified as primary, secondary or tertiary depending upon the type of carbon to which halogen is attached.
3. The halogen atom of alkyl halide carries partial negative charge and carbon carries partial positive charge. The polarity of carbon-halogen bond of alkyl halides is responsible for their nucleophilic substitution, elimination and their reaction with metals.
4. Alkyl halides are prepared by the reaction of halogen acids or phosphorus halides or thionyl chloride with alcohols.
5. Alkyl halides are also prepared by the free radical halogenation of alkanes or by the addition of halogen acids to alkenes. Alkyl iodides can be prepared by halide exchange reaction.
6. The boiling points of alkyl halides are slightly higher than the corresponding hydrocarbons or ethers due to strong dipole-dipole interactions and van der Waals forces of attraction but lower than the corresponding alcohols and carboxylic acids.
7. Basing on the kinetic properties, nucleophilic substitution reactions are categorised as S_{N1} and S_{n2} type.
8. The order of reactivity of S_{N1} reactions is $3° > 2° > 1° >$ methyl. S_{N1} reactions are characterised by recemisation.
9. The order of reactivity of S_{N2} reactions is methyl $> 1° > 2° > 3°$. S_{N2} reactions of chiral alkyl halides are characterised by the inversion of configuration.
10. Alcohols are formed from alkyl halides by hydrolysis with aqueous sodium or potassium hydroxide or moist silver oxide.
11. Alcoholic potassium cyanide reacts with alkyl halides to give alkyl cyanides and alcoholic silver cyanide reacts to give alkyl isocyanides as major products.
12. Alkyl halides react with sodium or potassium nitrite to give nitro alkane as the major product whereas silver nitrite gives alkyl nitrite as major product.
13. Ethers are formed by Williamson synthesis from alkyl halides and sodium alkoxide.
14. A mixture of amines and quaternary salt are formed when alkyl halides react with ammonia.
15. When alkyl halides react with alcoholic potassium hydroxide, alkenes are

formed and ${}^{y}{}_{E}$ the products formed depend upon Saytzeff rule.

16. Alkyl halides react with metals like sodium, magnesium, lithium, zinc, etc. They are reduced to alkanes with nascent hydrogen.
17. Chloroform undergoes atmospheric oxidation to poisonous carbonyl chloride.
18. Iodoform is prepared by the reaction of ethyl alcohol or acetone with iodine and alkali.
19. Freons are chlorofluorocarbon compounds of methane and ethane. They are used for aerosol propellants and also for refrigeration.
20. Sandmeyer's reaction is used in the preparation of chlorobenzene form benzene diazonium chloride with cuprous chloride.
21. The formation of chlorobenzene from benzene diazonium chloride and copper metal in presence of hydrochloric acid is called Gattermann reaction.
22. Aryl halides are much less reactive towards nucleophilic substitution reactions than alkyl halides.
23. Chlorine atom in chlorobenzene can be replaced L by hydroxyl group, cyano group, amino group and methoxy group.
24. Wurtz-Fittig reaction is the reaction between aryl halide and alkyl halide in presence of sodium to form alkylarene. In Fittig reaction, biphenyl is formed from phenyl halide.
25. Chlorobenzene undergoes electrophilic substitution reactions. Chlorine atom in chlorobenzene is ortho and para directing and slightly deactivates benzene ring.

(b) Alcohols, Phenols and Ethers

1. Alcohols and phenols are hydroxy compounds. Phenols have -OH group connected to benzene ring.
2. Alcohols are prepared by hydration of alkenes in acid medium.
3. Alcohols are prepared by the action of Grignard reagent on aldehydes and ketones followed by hydrolysis or by the reduction of aldehydes and ketones.
4. Phenol is prepared by the hydrolysis of benzene sulphonic acid or by heating benzene diazonium chloride with water.
5. Phenol is prepared by the oxidation of cumene followed by hydrolysis.
6. Diethylether is prepared by heating ethyl alcohol with con H_2SO_4 at 140°C or with Al_2O_3 at 260°C.
7. Ether is prepared by the action of alkali metal alkoxide on alkyl halides in Williamson's method.
8. Alcohols and phenols are acidic in nature. Phenols are more acidic than alcohols. Phenols are soluble in NaOH and are regenerated by CO_2. Alcohols are insoluble in NaOH.
9. Phenol gives violet colour with neutral ferric chloride.

10. Alcohols have higher boiling points than hydrocarbons, aldehydes, ketones and ethers due to intermolecular hydrogen bonding.
11. Alcohols are more soluble in water due to the formation of intermolecular hydrogen bonding with water.
12. Alcohols give aldehydes, ketones and carboxylic acids on oxidation.
13. Alcohols form esters with acids and also with acid derivatives.
14. Alcohols give alkyl halides on reaction with HX, PCl_5, PCl_3 or $SOCl_2$**.**
15. Dehydration of alcohols produces alkenes and reduction of alcohols with HI/P gives alkanes.
16. Phenols undergo halogenation, nitration and sulphonation more easily than benzene. The - OH group in phenols is ortho and para orienting and activating.
17. Phenol gives salicylaldehyde with chloroform and salicylic acid with $C0_2$ in alkali medium.
18. On heating with zinc dust, phenol gives benzene.
19. Both alcohols and phenols release hydrogen with active metals. Ethers cannot release hydrogen with sodium.
20. Ethers are degraded by HI to alcohol and alkyl iodide. On hydrolysis with dil. acid, ether gives alcohols.
21. Both hydroxy and alkoxy groups connected to benzene ring are ortho and para-orienting.
22. The peroxide formed by the oxidation of ether is destroyed by shaking with $FeSO_4$.
23. The three types of alcohols can be distinguished M with Lucas reagent.
24. Ethanol is used in beverages, solvent, antiseptic and as a component in fuel.
25. Diethylether is used as solvent, medium, anaesthetic and also as refrigerent.

(c) Aldehydes and Ketones

1. Aldehydes and ketones contain the carbonyl functional group.
2. According to IUPAC nomenclature, aldehydes are called as alkanals and ketones as alkanones.
3. Ketones having five or more carbons exhibit metamerism.
4. Primary alcohols on oxidation or on catalytic dehydrogenation give aldehydes and secondary alcohols on similar conditions yield ketones.
5. Dry distillation of calcium salts of fatty acids along with calcium formate give aldehydes and symmetrical ketones may be obtained when calcium salts of fatty acids alone are heated.
6. Vapours of fatty acids mixed with formic acid when passed over heated thoria or alumina or MnO give aldehydes. Vapours of a fatty acid alone give ketones.
7. Alkenes can be oxidised to carbonyl compounds by Wacker process by using

aqueous palladium chloride in presence of cupric chloride catalyst.

8. Depending upon the structure of alkene, different carbonyl compounds are obtained by the reductive ozonolysis.
9. Carbonyls are obtained by the hydration of alkynes or by alkaline hydrolysis of gem dihalides.
10. Reduction of acid chloride with hydrogen in presence of Lindlar's catalyst to give aldehydes is called Rosenmund reduction. Ketones cannot be prepared by this method.
11. Carbonyl compounds are highly polar and boil at high temperatures than the weakly polar ethers of comparable molar masses.
12. Lower carbonyls are more soluble in water due to hydrogen bonding. Due to larger size of hydrophobic alkyl group, higher carbonyls are insoluble in water.
13. The characteristic reactions of carbonyl compounds are nucleophilic addition reactions. Aldehydes are more reactive than ketones. Aliphatic aldehydes are more reactive than aromatic aldehydes.
14. Ammonia reacts with aldehydes and ketones to form imines.
15. Carbonyl compounds condense with derivatives of ammonia, hydroxylamine, hydrazine, phenylhydrazine, 2,4-dinitrophenyl hydrazine, semicarbazide to form the corresponding oximes, hydrazones, phenyl hydrazones, 2,4- dinitrophenyl hydrazones and semicarbazones.
16. Carbonyl compounds react with $PC/_5$ or thionyl chloride to give gem dihalides.
17. Aldehydes are reduced to primary alcohols and ketones to secondary alcohols with $LiAlH_4$, $NaBH_4$ or by catalytic hydrogenation.
18. Carbonyl group is reduced to methylene group, by Clemmensen reduction or by Wolff - Kishner reduction, thereby, carbonyl compounds are reduced to alkanes.
19. Aldehydes are easily oxidised to carboxylic acids by even mild oxidising agents like Tollen's reagent, Fehling's reagent and Benedict's solution. These oxidation reactions are used to distinguish aldehydes from ketones.
20. The a-hydrogens in carbonyl compounds are acidic. Carbonyl compounds having at least one a-hydrogen, undergo Aldol condensation.
21. Aldehydes with no a-hydrogen atom on reaction with concentrated alkali undergo Cannizzaro reaction in which aldehyde undergoes disproportionation to give alcohol and salt of carboxylic acid.
22. Compounds containing methyl keto group or which form these on treatment with halogens give haloform reaction.
23. Aromatic carbonyl compounds undergo electrophilic substitution reactions also. Carbonyl group present in aromatic ring is meta directing and deactivating.
24. Benzaldehyde can be obtained by the oxidation of toluene with chromyl chloride followed by hydrolysis. This is called Etard reaction. It is also obtained from benzene by Gattermann- Koch reaction.

(d) Carboxylic Acids

1. Carboxylic acids are compounds which contain - COOH group as functional group with general formula $C_nH_{2n}0_2$ or $C_nH_{2n+1}COOH$.
2. Trivial names are given based on source, e.g ; HCOOH is named as formic acid because it is obtained by distillation of ants (in Latin formica means ant).
3. The IUPAC name of carboxylic acids is Alkanoic acid.
4. Carboxylic acids release H^+ ions in aqueous solution and so are acidic in nature
5. Carboxylic acids are prepared by oxidation of primary alcohols and aldehydes.
6. Carboxylic acids are prepared by the action of CO_2 on Grignard reagent followed by hydrolysis.
7. Carboxylic acids are prepared by the acidic or alkaline hydrolysis of alky! cyanides and amides.
8. Methyl alcohol on treatment with CO in presence of Co or Rh (catalyst) under high pressure and temperature gives acetic acid.
9. Acetic acid is commercially prepared by the oxidation of acetaldehyde by air in presence of manganous acetate $[(CH_3COO)_2Mnl$ as catalyst
10. Acidic hydrolysis of esters gives directly carboxylic acids while basic hydrolysis gives carboxylates, which on acidification give the corresponding carboxylic acids.
11. Aromatic carboxylic acids are prepared by the oxidation of alkyl benzenes.
12. Acidified $KMnO_4$ or acidified $K_2Cr_2O_7$ oxidises alkenes to ketones and / or acids.
13. Carboxylic acids release H_2 with Na, release CO_2 with $NaHCO_3$ or Na_2CO_3.
14. Carboxylic acids dissolve in NaOH and are regenerated by HCl (not by CO_2).
15. Carboxylic acids form esters with alcohols, acid chlorides with PCl_3, PCl_5 or $SOCl_2$ and amides with NH_3.
16. On heating with Phosphorous pentoxide, Carboxylate acids give anhydrides, on reduction with LiA/H_4, they give primary alcohols.
17. Carboxylic acids give aldehydes and ketones when their calcium salts are heated with calcium formate and alone respectively.
18. Decarboxylation of carboxylic acids gives hydrocarbons in the presence of soda lime.
19. Carboxylic acids with a-hydrogen form a -chloroacids with Cl_2 in the presence of red phosphorus. This is called HVZ reaction.
20. A 6 - 10% dilute aqueous acetic acid is called vinegar. It is used in cooking.
21. Alcohols, phenols and carboxylic acids are acidic because they liberate hydrogen gas on reaction with sodium metal.
22. Alcohols have no reaction with NaOH but phenols and carboxylic acids react with NaOH. Thus alcohols are less acidic than phenols and carboxylic acids.
23. Phenols and carboxylic acids turn blue litmus to red litmus, alcohols cannot give this test.
24. Carboxylic acids decompose $NaHCO_3$ and liberate CO_2 gas, but phenol cannot decompose $NaHCO_3$. Thus phenols are less acidic than carboxylic acids.

25. Carboxylic acids are weaker than mineral acids. This can be proved from p^Ka values.
26. The substituents which stabilise the carboxy-late ion will increase the acidic strength of carboxylic acids.
27. Electron withdrawing groups increase the acidic strength of carboxylic acids.
28. Electron donating groups decrease the acidic strength.
29. With increasing the electron withdrawing tendency of groups acidic strength increases. Electron withdrawing tendency of some groups is
$CF_3 > NO_2 > CN > F > Cl > Br > I > C_6H_5$
30. With increasing number of electron withdrawing substituents, acidic strength increases.
31. With increasing the distance of electron I withdrawing group from - COOH, acidic strength decreases.
32. Alkyl substituents have electrons donating nature; with increasing the number of carbons in alkyl substituent, electron donating tendency increases and acidic strength decreases.
33. Direct attachment of C_6H_5 -, $CH_2 = CH$- to carboxylic acids increases the acidity of respective carboxylic acid due to greater electronegativity of sp^2 carbon. This is contrary to the decrease expected due to resonance effect.
34. In benzoic acid also electron withdrawing substituents increases the acidic strength but electron donating substituents like $-CH_3$, -OH, $-NH_2$, etc decreases the acidic strength.
35. Among p- and m-isomers, p-isomer has more acidic character than m-isomer for electron with drawing group but for electron releasing group m-isomer is stronger acid than benzoic acid while p-isomer is weaker than benzoic acid.

    a) o - nitrobenozic acid > p - nitrobenzoic acid > m - nitrobenzoic acid > benzoic acid

    b) salicyclic acid > m - hydroxy benzoic acid > benzoic acid > p - hydroxy benzoic acid.
36. The ortho isomer of every substituted benzoic acid is stronger than benzoic acid. This is called ortho effect.

(e) Amines, Diazonium Salt, Cyanides and Isocyanides

1. Amines are alkyl or aryl derivatives of ammonia,
2. Amines are classified as primary (RNH_2) , secondary (R_2NH) and tertiary (R_3N) amines.
3. Amines are basic in nature, as they can donate a lone pair and accept proton.

4. Basic nature of amines depends on availability of lone pair for donation and stability of conjugate acid.
5. Electron-releasing groups increase the basic strength and electron-withdrawing groups decrease the basic strength.
6. Basic nature of amines in gaseous state :
   3°> 2° > 1° > NH_3
   $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3$
   In aqueous solution, order of basic nature :
   2°> 3° > 1° > NH_3 Ethyl derivatives:
   $(C_2H_5)_2NH > (C_2H_5)_3N > C_2H_5NH_2 > NH_3$
7. Methyl derivatives:
   $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$
8. Alipthatic amines are more basic compared to aromatic amines.
9. Cyclohexyl amine is more basic than aniline.
   $(C_2H_5)_2NH > C_2H_5NH_2 > NH_3 > C_6H_5NH_2$
   $(CH_3CH_2)_2N\text{-}CH_2CN$ is more basic than $(CH_3CH_2)_3N$.
10. Destructive distillation of Indigo gives aniline.
11. Industrially aniline is prepared by the reduction of nitrobenzene with iron, water and small amount of HCl.
12. Nitrobenzene on reduction with Sn/HC/, Zn/HC/ or H_2/Ni gives aniline.
13. Phenol on heating with NH_3 at 300°C in presence of $ZnCl_2$ (catalyst) gives aniline.
14. Phenol, on heating with NH_3 at 200°C in presence of Cu_2O (catalyst) gives aniline.
15. Aniline can be purified by steam distillation.
16. Among isomeric amines, boiling points are in the order: 1° > 2° > 3°. This is due to decreasing ability to form hydrogen bonds.
17. Aniline is a Lewis base. It is almost neutral to litmus.
18. Aniline on treatment with HC/, it forms a salt named aniline hydrochloride.
19. Primary, secondary and tertiary amines form quaternary salts with alkyl halides.
20. Aniline, on treatment with acetyl chloride or acetic anhydride forms acetanilide.
21. Reactivity order of acylating agents is
    $CH_3COC/ > (CH_3CO)_2O > CH_3COOC_2H_5$
22. With benzoyl chloride, in the presence of base aniline gives benzanilide.
23. Aniline, on treatment with benzene sulphonyl chloride gives N-phenyl benzene sulphonamide.
24. Aniline, with benzaldehyde in the presence of conc.H_2SO_4 forms benzylidene aniline known as Schiff's base (also called anil).
25. Primary amines give carbylamine reaction with chloroform and alcoholic potash. Phenyl isocyanide has awaful odour.

26. Aniline, on treatment with HNO_2 ($NaNO_2$ + HCl), undergoes diazotisation to give benzene diazonium chloride [$C_6H_5N_2^+ Cl^-$].
27. Aniline is used in the preparation of dyes, schiff's base and sulphonamide.
28. Primary, secondary and tertiary amines are distinguished using carbylamine test, Hinsberg test, Hoffmann mustard oil reaction.
29. Carbylamine reaction is given only by aliphatic primary amines and aromatic primary amines and not by secondary and tertiary amines.
30. Benzene sulphonyl chloride is called Hinsberg reagent.
31. In Hinsberg's test, primary amines with benzene sulphonyl chloride form N - alkyl benzene sulphonamide which is soluble in alkali.
32. In Hinsberg's test, secondary amines with benzene sulphonyl chloride forms N, N - dialkyl benzene sulphonamide, which is insoluble in alkali while tertiary amines do not react with Hinsberg reagent.
33. Hofmann mustard oil reaction is given only by primary amines. In this reaction alkyl isothiocyanate (smells like mustard oil) and black precipitate (HgS) are formed.
34. On oxidation with $KMn0_4$, primary amines give aldehydes and ketones, secondary amines form tetra alkyl hydrazine while tertiary amines do not react.
35. On oxidation with Caro's acid primary amines form amine, secondary amines form dialkyl hydroxyl amine and tertiary amines give amine oxide.
36. Aromatic diazonium salts like C_6H_5NNCl are stable (due to resonance) than aliphatic diazonium salts like CH_3NNCl.
37. Benzene diazonium chloride is colourless solid, highly soluble in water in dry state, easily decomposes but in the form of benzene diazonium fluoro borate it is water insoluble and stable at room temperature.
38. Benzene diazonium chloride, on.treatment with Cu_2Cl_2 / HCl, Cu_2Br_2 / HBr and $Cu_2(CN)_2$, KCN forms chlorobenzene, bromobenzehe and cyanobenzene respectively.; This is called Sandmeyer reaction.
39. Benzene diazonium chloride with Cu / HC/, Cu /HBr gives respectively chlorobenzene and bromo benzene. This is called Sandmeyer reaction.
40. Iodobenzene is formed when benzene diazonium chloride is treated with aqueous KI.
41. Benzene diazonium chloride with HBF_4 (fluoboric acid) gives benzene diazonium fluoroborate which on heating gives fluorobenzene.
42. Benzene diazonium chloride, on boiling with steam, forms phenol.
43. Benzene diazonium chloride on reduction with hypophosphorous acid solution or ethyl alcohol forms benzene.
44. Benzene diazonium fluoroborate on heating with $NaNO_2$ / Cu forms nitrobenzene.
45. Benzene diazonium chloride, on coupling with phenol in weakly alkaline medium, forms an orange coloured dye namely p - hydroxy azobenzene (electrophilic substitution reaction).
46. Benzene diazonium chloride, on coupling with aniline in weakly alkaline medium, forms an yellow coloured dye namely, p - aminoazobenzene.
47. The azoproducts have extended conjugate system with aromatic rings and - N = N - bond. Hence, these compounds are coloured and used as dyes.

48. The excess acid in diazotisation reaction is necessary to maintain proper acidic medium for -; the reaction and to prevent combination of diazonium salt formed with the undiazotised amine.

Question Bank - I

Alkyl and Aryl halides

1. SN^1 reaction occur through the intermediate formation of
   (1) carbocation (2) carbanion (3) free radical (4)None of these
2. An optically native halide when allowed to react with CN^- gives a racemic mixture. The halide is most likely to be
   (1) 1^o (2) 2^o (3) 3^o (4) 4^o
3. A dexto rotatory optically active alkyl halide alcohol is
   (1) dexto rottory (2) levo rottory (3) both (4) racemic mixture
4. Aryl halides can be prepared by
   (1) Sand mayer's metod (2) Friedel – craft reaction
   (3) 1 & 3 (4) Gattermann's reaction
5. Heating chloro benzene with – yields containing an isocyanide group.
   (1) AgCN (2) KCN (3) HCN (4) HNo_3
6. $C_6H_5 + 2Na + CH_3I \rightarrow C_6H_oCH_3 + 2NoI$ the reaction is
   (1) Wurtz reaction (2) Fitting reaction
   (3) Wurtz-Fittig reaction (4) Ullmann reaction
7. Chloro benzene on fusing with solid NaoH gives
   (1) benzene (2) benzoid acid (3) phenol (4) benzene chloride
8. First chlorinated insecticide is
   (1) DDT (2) Gammaxene (3) BHC (4) Pyrene

9. Pyrene is the trade name of ____ which is used as fire extinguisher
   (1) carbocation (2) carbanion (3) free radical (4)None of these
10. Which is wrong for chloro benzene.
    (1) more reactive than ethyl bromide (2) more reactive than isopropyl chloride
    (3) as reactive as methyl chloride (4) less reactive than benzyl chloride
11. In SN^1 reaction the racemization takes place due to
    (1) inversion of configuration (2) retention of configuration
    (3) conversion of configuration (4) both 1 & 2

KEY

1) **1** 2) **3** 3) **2** 4) **4** 5) **1** 6) **3** 7) **3** 8) **1** 9) **3** 10) **3**

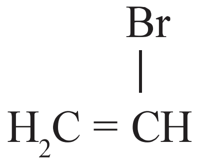
11) **4**

Question Bank - II

Alkyl and aryl halides

1. Allyl bromide is

1) $CH_2=CH–CH_2Br$ 2) $C_6H_5–Br$

3)  $H_2C = \overset{\overset{Br}{|}}{CH}$ 4) $CH_3–CH=CH_2\text{-}Br$

2. In which of the following, chlorine is least reactive ?

1) Ethyl chloride 2) Chlorobenzene

3) Allyl chloride 4) Methyl chloride

3. Which of the following statement is correct?

1) Decreasing order of density of alkyl halides is $RI > RBr > RCl > RF$

2) The stability order of alkyl halides is $RF > RCl > RBr > RI$

3) Among isomeric alkyl halides the decrease in boiling point is $1° > 2° > 3°$

4) All are correct

4. Which of the following order is correct among the following ?

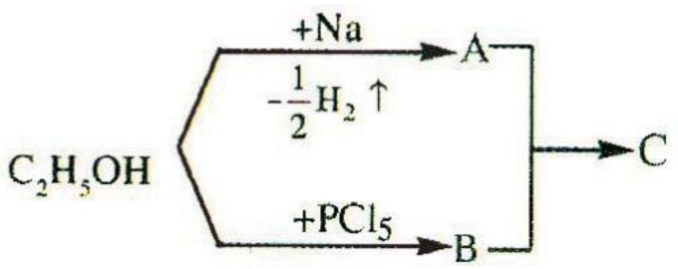
I) C-X Bond length order is $H_3C–F < H_3C–Cl < H_3C–Br < H_3C–I$

II) C-X Bond enthalapies order is $H_3C–F > H_3C–Cl > H_3C–Br > H_3C–I$

II) C-X Bond dipole moment order is $H_3C–Cl > H_3C–F > CH–Br > CH_3–I$

1) Only I & II 2) Only II & III

3) Only I & III 4) All are correct

5. 

Total number of hybrid orbitals involved in bonding in a molecule of ‘C is

1)12 2) 0 3) 18 4) 6

6. $CH_3CH_2Cl \xrightarrow[\Delta]{Alc.KOH} X_{(Org)}$

Wrong statement about the above reaction

1) Hybridization of ‘C’ changed from sp^3 to sp^2 2) C–C bond length is decreased

3) C–H bond length is increased 4) Bond angle is increased

7. Identify Z in the following series

$C_2H_5I \xrightarrow{Alc.KOH} X \xrightarrow{Br_2} Y \xrightarrow{KCN} Z$

1) CH_3CH_2CN 2) $NCCH_2–CH_2CN$

3) $BrCH_2–CH_2CN$ 4) $BrCH = CHCN$

8. Ethyl bromide reacts with lead-sodium alloy to form

1) Tetraethyl lead 2) Tetramethyl bromide

3) Both (a) and (b) 4) None of these

9. i) $CH_3CH_2Cl \xrightarrow{\text{KOH(aqueous)}} X$

ii) $X \xrightarrow[170^0C]{\text{Conc.}H_2SO_4} Y \xrightarrow{Cl_2/H_2O} Z$

What is 'Z' ?

1) Ethylene glycol 2) Ethylene chlorohydrin

3) 1,2-Dichloroethane 4) Ethyl chloride

10. Compound A reacts with PCl_5 to give B which on treatment with KCN followed by hydrolysis gave propionic acid. What are A & B respectively ?

1) C_3H_8 & C_3H_7Cl 2) C_2H_6 & C_2H_5Cl

3) C_2H_5OH & $C_2H_4Cl_2$ 4) C_2H_5OH & C_2H_5Cl

11. What are X and Y respectively in the following reaction ?

$X \xrightarrow{PBr_3} C_2H_5Br \xrightarrow{\text{AgOH(Aq)}} Y$

1) CH_3OH ; C_2H_6 2) C_2H_5OH ; C_2H_5Br

3) CH_3COOH ; CH_3CH_2OH 4) C_2H_5OH ; C_2H_5OH

12. Consider following reaction

$X+HCl \xrightarrow[\text{(addition)}]{\text{Anhydrous } AlCl_3} C_2H_5Cl$; $Y \xrightarrow[\text{substitution}]{\text{Anhydrous } ZnCl_2/HCl} C_2H_5Cl$

Y can be converted to X on heating with at .... temperature

1) ALO_3, 350°C 2) Cu, 300°C

3) $Ca(OH)_2 + CaOCl_2$, 60°C 4) NaOH / I_2, 60°C

13. $C_2H_5C\ell \cdot Mg \longrightarrow x \xrightarrow{H_2O} y$; $C_2H_5C\ell \xrightarrow{LiA\ell H_4} z$, then y and z are

1) same alkenes 2) different alkanes

3) same alkanes 4) alkynes

14. l-Bromopropane on reaction with $LiAlH_4$ yields

1) Propine 2) Hexane 3) Propone 4) Propyne

15. $CH_3-CH_2-CH_2-C\ell \xrightarrow[KOH]{alc} B \xrightarrow{HBr} C \xrightarrow[ether]{Na} D.$

In the above sequence of reactions, the D is

1) Propane 2) 2,3 - Dimethyl butane

3) Hexane 4) Allyl bromide

16. The carbon compound "A" forms "B" with sodium metal and again forms "C" with PCl_5 but "B" reacts with "C" to form diethyl ether. Therefore A, B and C are respectively.

1) C_2H_5OH, C_2H_5OCl, C_2H_5ONa 2) C_2H_5OH, C_2H_6,C_2H_5

3) C_2H_5Cl, C_2H_6, C_2H_5Cl 4) C_2H_5OH, C_2H_5ONa,C_2H_5Cl

17. $CH_4 + Cl_2 \xrightarrow[-HCl]{h\vartheta} A \xrightarrow[-HCl]{+Cl_2} B \xrightarrow[-HCl]{+Cl_2} C \xrightarrow[-HCl]{+Cl_2} D$

Correct order of Dipole moments is

1) D > C > B > A 2) C >B > A > D

3) A > C > B > D 4) A > B > C > D

18. Which of the following is the correct order of decreasing S_N2 reactivity' ? (X=a halogen)

1) RCH_2 X > R_2CHX > R_3CX 2) R_3CX > R_2CHX > RCH_2X

3) R_2CHX > R_3CX > RCH_2X 4) RCH_2X > R_3CX > R_2CHX

19. The ratio of relative rates of isopropyl bromide and ethyl bromide in S_N1 reaction is

1) 11 : 1 2) 1 : 11

3) 1 : 100 4) 1 : 1000

20. Tertiary alkyl halides are practically inert to substitution by S_N2 mechanism because of

1) Insolubility 2) Instability

3) Inductive effect 4) Steric hinderance

21. Of the five isomeric hexanes. the isomer which can give two mono chlorinated compounds is

1) n-hexane 2) 2,3-dimethyl butane

3) 2,2-dimethyl pentane 4) 2-methyl pentane

22. Which of the following reactions will yield 2, 2 - dibramo propane ?

1) $CH_3-CH=CH_2+HBr \rightarrow$ 2) $CH_3-C\equiv CH+2HBr \rightarrow$

3) $CH_3CH=CHBr+HBr \rightarrow$ 4) $HC\equiv CH+2\,HBr \rightarrow$

23. Isopropyl chloride undergoes hydrolysis by

1) SN^1 mechanism 2) SN^2 mechanism

3) SN^1 and SN^2 mechanisms 4) either SN^1 or SN^2 mechanism

24. Among the following which one has weakest carbon-halogen bond ?

1) Benzyl bromide 2) Bromobenzene

3) Vinyl bromide 4) Benzyl chloride

25. The order of reactivities of the following alkyl halides for a S_N2 reaction is

1) RF > RC*l* > RBr > RI 2) RF > RBr > RC*l* > RI

3) RC*l* > RBr > RF > RI 4) RI > RBr > RC*l* > RF

26. Incorrect statement about nudeophilic substitution reaction is

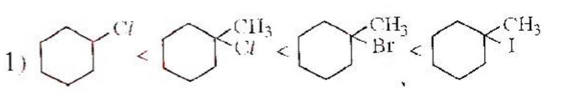
1) Reactivity of halides towards SN^1 mechanism is 3°>2°>1° alkyl halides

2) Polar solvents favour SN^1 reactions

3) Reactivity of halides towards SN^2 mechanism is 1° > 2° > 3° alkyl halide

4) Low concentration of nucleophile

27. Pick up the correct order of reactivit n SN^1 reactions

1)


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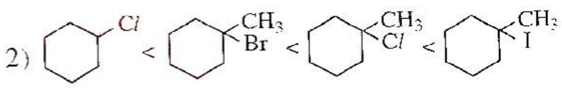

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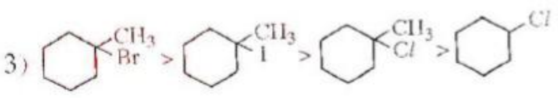

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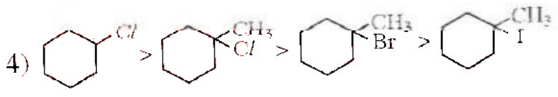


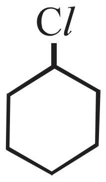
28. Arrangp the following

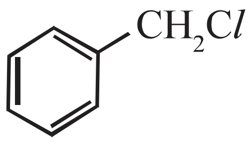
$CH_3CH_2CH_2Cl$(I), CH_3CH_2-$CHCl$-CH_3 (II), $(CH_3)_2CHCH_2Cl$ (III) and $(CH_3)_3$ C-C*l*/(IV) in order of decreasing tendency towards S_N^2 reaction

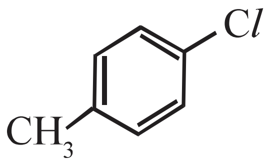
1) I > III > II > IV 2) III > IV > II > I 3) II > I > III > IV 4) IV > III > II > I

29. Whicn of the following will be the least reactive towards nucleophilic substitution?

1) C_2H_5Cl

2)


3)


4)


30. The correct order of reactivity of alkyl halides CH_3CH_2Cl, $CH_3CHClCH_3$ and $(CH_3)_3CCl$ towards dehydrohalogcnation ?

1) $CH_3CH_2Cl > CH_3CHClCH_3 > (CH_3)_3CCl$
2) $CH_3CHClCH_3 > (CH_3)_3CCl > CH_3CH_2Cl$
3) $(CH_3)_3CCl > CH_3CH_2Cl > CH_3CHClCH_3$
4) $(CH_3)_3CCl > CH_3CHClCH_3 > CH_3CH_2Cl$

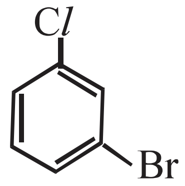
31. Which of the following compounds will react readily with ethanolic KCN ?

1) Chlorobenzene
2) Vinyl Chloride
3) Allyl Chloride
4) 4-Chlorotoluene

32. The reaction of toulene with Cl_2 in presence of $FeCl_3$ gives predominently

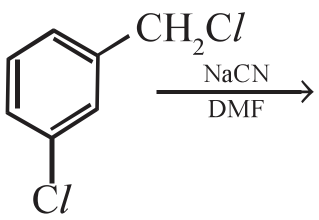
1) m - Chloro toluene
2) Benzoyl chloride
3) Benzyl chloride
4) o - & p - Chloro toulenes

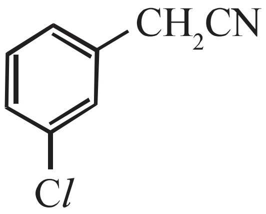
33. The IUPAC name of the compound shown below is

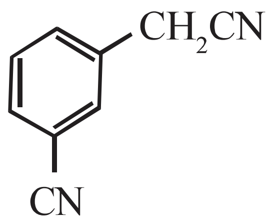


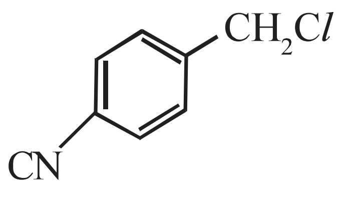
1) 1- bromo-3- chloro cyclohexene
2) 2- bromo-6- chloro cyclohex -1-ene
3) 6-bromo-2-chloro cyclohexene
4) 3-bromo-l-chloro cyclohexene

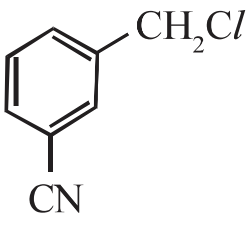
34. The structure of the major product fonned in the following reaction



1)


2)


3)


4)


35. Which of the following is least reactive towards mucleophilic displacement reaction when treated with aqueous KOH?

1) 2, 4, 6-Trinitrochlorobenzene 2) 2, 4-Diintrochlorobenzene

3) 4- Nitrochlorobenzene 4) 3-Nitrochlorobenzene

36. IUPAC name of DDT is

1) l, 1, l-Trichloro-2, 2-bis (4-chlorophenyl) ethane

2) p, p' - Dichloro diphenyl trichloro ethane

3) p, p' - Dichloro diphenyl trichloro benzene

4) Dichloro diphenyl tetrachloro ethane

37. In which one of the followine halides. C_{sp2} – Xbond is present ?

1) Allyl halides 2) Benzyl halide

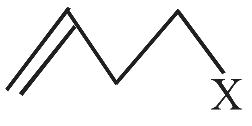
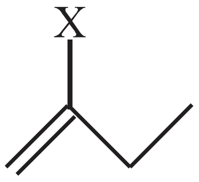
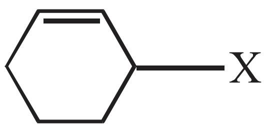
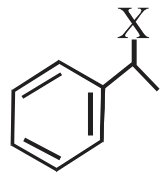
3) Arjyl halide 4) alkyl halide

38. IUPAC name of the compound with the molecular ibimula C_4H_9Br and least possible boiliiig point is

1) 2-Bromo-2-methylpropane 2) 2-Bromobutane

3) 1-Bromobutane 4) l-Bromo-2-methylpropane

39. Match the following

List - I	List - II (type of halide)
1) 	a) Alkyl halide
2) 	b) Aryl halide
3) 	c) Vinyl halide
4) 	d) Benzyl halide
	e) Allyl halide

The correct match among the following is

	1	2	3	4		1	2	3	4
1)	e	c	b	d	2)	a	c	e	d
3)	a	b	c	d	4)	e	b	c	a

40. In S_N^2 reactions the incorrect order of reactivity of nucleophiles is

1) $1^- > Br^- > Cl^- > F^-$ 2) $CH_3O^- > CH_3OH$

3) $RS^- > I^- > CN^- > NH_3 > Cl^-$ 4) $F^- > Cl^- > Br^- > I^-$

41. Incorrect statement about nucleophilic substituition reacitons is
1) A bulky nucleophile prefers elimination
2) Benzyl halides are more reactive in $S_N{}^1$ reactions
3) Aryl halides are more reactive than alkyl halides
4) Nucleophile has no influence on the rate of S_N1 reactions

42. In the reaction with CH_3I, the most reactive nucleophile among the following is
1) F^- 2) I^- 3) RS^- 4) CH_3OH

43. Correct statement about the electrophilic substitution in benzene ring is
1) Halogens are benzene ring deactivating groups due to resonance.
2) Halogens are ortho and para directing groups due to their - I effect.
3) Halogens are ortho and para directing and benzene ring activating groups.
4) Halogens are benzene ring deactivating groups due to their - I effect.

44. $CH_3 - Br \xrightarrow[\text{ether}]{Mg} X \xrightarrow{(CH_3)_3C\text{-}OH} A.$
Product A is
1) CH_4 2) $(CH_3)_3CH$ 3) $(CH_3)_3C\text{-}O\text{-}Br$ 4) $(CH_3)_3C\text{-}O\text{-}CH_3$

45. Halide most readily hydrolyses is
1) C_6H_5Cl 2) $(C_6H_5)_2CHCl$ 3) $C_6H_5CH_2Cl$ 4) $(C_6H_5)_3CCl$

46. Which of the following compounds would be hydrolysed most easily ?
1) C_2H_5Br 2) CH_3Br 3) $CH_2 = CH - Br$ 4) $CH_2 = CH - CH_2Br$

47. An alkyl halide on reaction with sodium in the presence of ether gives 2, 2, 5, 5, - tetramethyl hexane. The alkyl halide possibly is
1) 1 - Chloropentane 2) 1 - Chloro - 2, 2 - dimethyl propane
3) 3 - Chloro - 2. 2 - dime thy lbutane 4) 2 - Chloro - 2 - methylbutane

48. Neo Pentyl chloride on dehydrohalogenation (using low conc, of base) yields mainly
1) 2 - Methyl but - 2 - ene 2) 2 - Methyl but - 1 - ene
3) 3 - Methyl but - 1 - ene 4) 2 - pentene

49. 1 - Phenyl - 2 - chloropropane when treated with alcoholic KOH gives ... as the major product
1) 1- Phenylpropene-1 2) 3 - Phenylpropene-1
3) 1 - Phenyl - 2 - propanol 4) 3 - Phenyl - 1 - propanol

50. Identify 'Z' in the following sequence of reactions :

$$C_3H_7I \xrightarrow{\text{KOHalc.}} X - \xrightarrow[\Delta]{Br_2} Y \xrightarrow{\text{KCNalc.}} Z$$

1) $(CH_3)_2CH\text{-}CN$ 2) $Br\text{-}CH - CH\text{-}CN$
3) $CH_2 = CH\text{-}CH_2CN$ 4) $CH_2 = CH\text{-}CHBr\text{-}CN$

51. An unknown alkyl halide (A) reacts with alcoholic KOH to produce a hydrocarbon (C_4H_6). Ozonolysis of the hydrocarbon forms one mole of propionaldehyde and one mole of formaldehyde. Suggest which organic structure among the following is the correct structure of the above alkyl halide (A)?
1) $CH_3CH_2CH_2CH_2Br$ 2) $CH_3CH(Br)CH(Br)CH_3$
3) $CH_3CH_2CH(Br)CH_3$ 4) $Br(CH_2)_4Br$

52. Neopentyl alcohol $\xrightarrow{+HCl/anlydrousZnCl_2}$ A; Here 'A' is

1) Neopentyl chloride 2) n-pentyl chloride
3} 2-chloropentane 4) ter-pentyl chloride

53. Allyl chloride on dehydrochlorination gives

1) Propadiene 2) propylene
3) Allyl alcohol 4) Acetone

54. Bottles containina C_6H_5I and $C_6H_5CH_2I$ lost their original labels. They were labelled A and B for testing. A and B were separately taken in test tubes and boiled with NaOH solution. The end solution in each tube was made acidic with dilute HNO_3, and some $AgNO_3$ solution added. Solution B gave an yellow precipitate. Which one of the following statements is true for the experiment?

1) Addition of HNO_3 was unnecessary
2) A was C_6H_5I 3) A was CH_6CH_2I
4) B was C_6H_5I

55. 'Pyrene' is the trade name of ...... which is used as fire extinguisher

1) CO_2 2) $CHCl_3$ 3) CCl_4 4) CH_5Cl_2

56. Which of the following is the correct order of decreasing reactivity towards nucleophilic substitution reaction ?

1) n-Propyl chloride > Allyl chloride > Vinyl chloride
2) Allyl chloride > n-Propyl chloride > Vinyl chloride
3) Allyl chloride > Vinyl chloride > n-Propyl chloride
4) Vinyl chloride > Allyl chloride > n-Propyl chloride

57. S_N2 reactions are

1) Stereospecific but not stereoselective
2) Stereoselective but not stereospecific
3) Stereoselective as well as stereospecific
4) Neither stereoselective nor stereospecific

58. Methyl butane on reacting with bromine in the presence of sunlight gives mainly

1) 1-bromo -2-methyl butane 2) 2-bromo -2-methyl butane
3) 2-bromo -3-methyl butane 4) 1-bromo -3-methyl butane

59. Which of the following halides would undergo nucleophilic substitution most readily?

1) 1 - Chloro - 1 - butene 2) 2 - Chloro - 1 - butene
3) 3 - Clhloro - 1 - butene 4) 4 - Chloro - 1 - butene

60. Which branched chain isomer of the hydrocarbon with molecular mas 72u gives only one isomer of mono substituted alky! halide ?

1) Tertiary butyl chloride 2) Neopentane
3) Isohexane 4) Neohexane

61. What is DDT among the following ;

1) Greenhouse gas 2) A felrtilizer
3) Biodegradable pollutant 4) Non-biodegradable pollutant

62. 2-methylbutane on reacting with bromine in the presence of sunlight gives mainly :

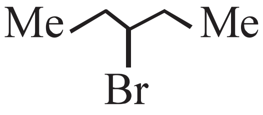
1) l-bromo-3-methylbutane 2) 2-bromo-3-methylbutane

3) 2-bromo-2-methylbutane 4) l-bromo-2-methylbutane

63. Consider the following bromides

A) 

B) 

C) 

The correct order of S_N1 reactivity is

1) A > B > C 2) B > C > A 3) B > A > C 4) C > B > A

KEY

1) 1	2) 2	3) 4	4) 4	5) 3	6) 3	7) 2	8) 1
9) 2	10) 4	11) 4	12) 1	13) 3	14) 1	15) 2	16) 4
17)4	18)1	19)1	20) 4	21) 2	22) 2	23) 4	24) 1
25)4	26) 4	27) 1	28) 1	29) 4	30) 4	31) 3	32) 4
33) 4	34) 1	35) 4	36) 1	37) 3	38) 1	39) 2	40) 4
41) 3	42) 3	43) 4	44) 1	45) 4	46) 4	47) 2	48) 1
49) 1	50) 3	51) 1	52) 4	53) 1	54) 2	55) 3	56) 2
57) 3	58) 2	59) 3	60) 2	61) 4	62) 3	63) 2	

Question Bank - III
Alcohols

1. Identify Z in the following sequence of reactions

$$\text{Ethanol} \xrightarrow{PBr_3} X \xrightarrow{\text{Alc.KOH}} Y \xrightarrow[\text{ii)}H_2O,\text{heat}]{\text{i)Conc.}H_2SO_4} Z$$

1) $CH_2{=}CH_2$ 2) CH_3CH_2OH 3) $CH_3CH_2\text{-}O\text{-}CH_2CH_3$ 4) $CH_3CH_2\text{-}OSO_3H$

2. In India, ethyl alcohol is mainly manufactured by

1) Destructive distillation of wood 2) Hydrogenation of oils

3) Fermentation of molasses 4) Catalytic oxidation of ethane

3. $$C_2H_4 \xrightarrow[AlCl_3]{HCl} A \xrightarrow{\text{KOH(aq.)}} B \xrightarrow[140^\circ C]{\text{Conc.}H_2SO_4} C$$

What is the final product ?

1) C_2H_4 2) $C_2H_5 - O - C_2H_5$ 3) C_2H_5OH 4) $C_2H_5\text{-} O - SO_3H$

4. The compound with formula $C_4H_{10}O$ yields a compound C_4H_8O on oxidation, the compound $C_4H_{10}O$ is

1) an aldehyde 2) an alcohol

3) a ketone 4) an anhydride

5. When a mixture containing PCl_3 and PCl_5 is heated with ethyl alcohol, a total of 4 moles of ethyl chloride is formed. Mole ratio of PCl_3 and PCl_5 in the mixture is

1) 3 : 1 2) 1 : 1 3) 1 : 3 4) 2 : 1

6. $A + SOCl_2 \rightarrow B \bullet SO_2 \bullet HCl$

$X + Na \rightarrow C + H_2$

$B + C \rightarrow (C_2H_5)O \bullet NaCl$

Then A and X are respectively

1) C_2H_5CI and C_2H_5ONa 2) C_2H_5ONa and C_2H_5Cl

3) C_2H_5OH and C_2H_5OH 4) C_2H_5 OH and C_2H_5ONa

7. In the Lucas test, terbidity is not shown by

1) l°Alcohol 2) 2°Alcohol 3) 3°Alcohol 4) Phenol

8. There are four alcohols P,Q,R and S which have 3,2,1 and zero alpha hydrogen atom(s) Respectively. Whcih one of the following will give an alkene when heated with copper

1) P 2) Q 3) R 4) S

9. Which of the following alcohols on oxidation give carboxylic acids with lesser number of carbon atoms ?

1) $(CH_3)_3C{-}CH_2OH$ 2) $(CH_3)_3COH$

3) $CH_3CH_2CHOHCH_3$ 4) Both (2) and (3)

10. Which of the following alcohols will not be easily oxidised by $K_2Cr_2O_7$ in dil.H_2SO_4?

1) CH_3OH 2) CH_3CH_2OH 3) $(CH_3)_3COH$ 4) $CH_3CHOHCH_3$

11. When vapours of an alcohol are passed over hot reduced copper, it gives an alkene. The alcohol is

1) Primary 2) Secondary 3) Tertiary 4) None of these

12. A convenient reagent to distinguish ethyl alcohol from *n*-propyl alcohol is

1) Lucas reagent 2) Tollen's reagent

3) Schiffs reagent 4) Iodine with aq. NaOH solution

13. Which of the following compounds decol-ourises aqueous bromine and gives white fumes of HCl on reaction with PCl_5?

1) $CH_3CH_2CH_2CH_2OH$ 2) $CH_3COCH_2CH{=}CH_2$

3) $CH_3OCH_2CH_2CH_2OH$ 4) $CH_3CH{=}CHCH_2CH_2OH$

14. The compound that does not respond to haloform reaction is

1) $C_5H_{11}CHOHCH_3$ 2) $CH_3CH_2CHOHC_2H_5$

3) $CH_3CHOHCH_3$ 4) CH_3CH_2OH

15. Tetiary butyl alcohol heated with cone. H_2SO_4 and the alkene thus formed is subjected to ozonolysis. The products of ozonolysis are reduced with $LiAlH_4$. The final products is/are

1) 2-Methylpropan-2-ol 2) Mixutre of methanol + ethanol

3) Mixture of 2-propanol + methanol 4) Mixture of ethanol + formic acid

16. $R{-}CH_2{-}CH_2{-}OH$ can be converted into $R{-}CH_2{-}CH_2{-}COOH$ by the following sequence of steps

1) PBr_3; KCN ; H_3O^+ 2) PBr_3; KCN; H_2/pt

3) KCN ; H_3O 4) HCN ; PBr_3; H_3O^+

17. When ethylhydrogen sulphate is heated with excess of alcohol at 410K, the product obtained is

1) Ethane 2) Ethylene 3) Diethyl ether 4) Diethyl sulphate

18. Maximum number of active hydrogens are present in

1) Acetic acid 2) Methane 3) Glycerol 4) Methanol

19. How many primary structural alcohols isomers are possible for C_5H_{11},OH ?

1) 5 2) 4 3) 2 4) 3

20. Methanol is industrially prepared by

1) Oxidation of CH_4 by steam at 900°C

2) Reduction of HCHO using $LiAIH_4$

3) Reaction HCHO with a solution of NaOH

4) Reduction of CO using $H_2$and $ZnO\text{-}Cr_2O_3$

21. For whicth of the following parameters, the structure! isomers C_2H_5OH and CH_3OCH_3 would be expected to have the same values? (Assume ideal behaviour)

1) Heat df vaporization

2) Gaseous densities at the same temperature and pressure

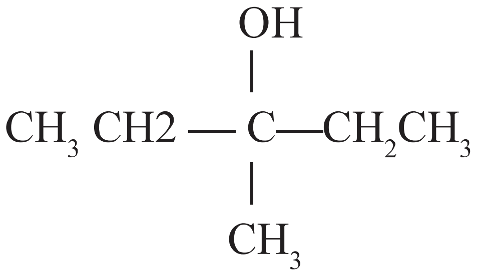
3) Boiling points

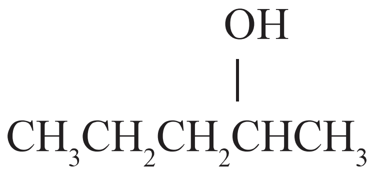
4) Vapour pressure at the same temperature

22. Among the following compounds which can be dehydrated very easily ?

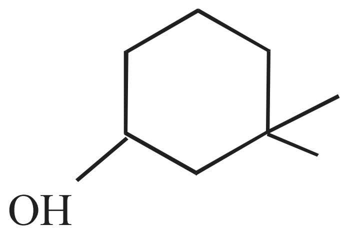
1) $CH_3CH_2CH_2CH_2CH_2OH$

2) $CH_3 - CH_2 - OH$

3)

$CH_3\ CH2 - \overset{\displaystyle OH}{\underset{\displaystyle CH_3}{C}} - CH_2CH_3$

4)

$CH_3CH_2CH_2\overset{\displaystyle OH}{C}HCH_3$

23. The IUPAC name of the compound is



1) 3,3-dimethyl-l -hydroxy cyclohexane 2) l, l-dimethyl-3-cyclohexane

3) 3,3-dimethyl-l-cyclohexanol 4) l.l-dimethyl-3-hydroxy cyclohexane

24. Acid catalyzed hydration of alkenes except ethene leads to the formation of

1) primary alcohol 2) secondary or tertiary alcohol

3) mixture of primary and secondary alcohols

4) mixture of secondary and tertiary alcohols

25. Among the following the one that gives positive iodoform test upon reaction with I_2 and NaOH

1) $PhCHOHCH_3$ 2) $CH_3CH_2CH(OH)CH_2CH_3$

3) $C_6H_5CH_2CH_2OH$ 4) $CH_3CH_2(CH_3)CH_2OH$

26. In the following sequence of reactions

$C \xrightarrow{H_2O} D$. The compound is ‘D’

1) n-butyl alcohol 2) n- propyl alcohol

3) propanal 4) butanal

27. Acid catalysed hydration of alkenes is

1) Electrophilic addition and intermediate is carb anion

2) Electrophilic addition and intermediate is carbonium ion

3) Nucleophilic addition and intermediate is carbonium ion

4) Freeradical addition

28. Ethyl alcohol acts as nucleophile when it reacts with

1) Conc.$HCl/ZnCl_2$ 2) PCl_3 3) Cone. H_2SO_4 4) CH_3COOH/H^+

29. An organic compound ‘A’ with the molecular formula $C_4H_{10}O$ on oxidation with acidified $K_2Cr_2O_7$ gives compound B’ with the formula C_3H_6O. Again ‘B’ on oxidation with acidified $K_2Cr_2O_7$ gives ‘C’ with the molecular formula $C_2H_4O_2$. IUPAC name of ‘A’ is

1) 1-Butanol 2) 2-Butanol

3) 2-Methyl-2-propanol 4) 2-Methylbutanol-l

30. When phenyl magnesium bromide reacts with ter. butyl alcohol, which of the following is formed ?

1) Tert-butyl methyl ether 2) Benzene

3) Tert-butyl benzene 4) Phenol

31. $CH_3CH_2CH_2OH \xrightarrow{X} CH_3CH = CH_2$; The reagent ‘X’ is

1) 5% H_2SO_4 at 50°C 2) 75% H_2SO_4 at 100°C

3) 95% H_2SO_4 at 170°C 4) $A1_2O_3$, 170°C

32. $(CH_3)_3$ C - OH $\xrightarrow{H_2SO_4 \Delta}$ $(CH_3)_2C - CH_2$; This reaction takes place through

1) S_N1 mechanism 2) S_N2 mechanism

3) Dehydration 4) Dehydrogenation

33. The final product in the fermentation of riped grapes in aerobic conditions is

1) Ethanoic acid 2) Ethanal

3) Ethanol 4) Ethane

34. Denaturation of ethyl alcohol is made by adding

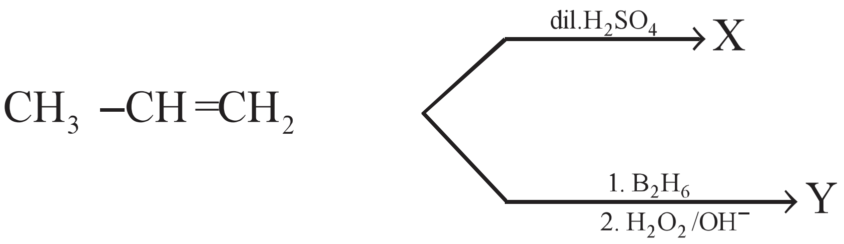
1) methanol only 2) Pyridine only

3) methanol and pyridine 4) zinc sulphate

35. $CH_3CH_2CH = CH\ CH_2OH \xrightarrow{PCC} A$, Here “A’ is

1) $CH_3CH_2COOH + HOOC - COOH$ 2) $CH_3CH_2CH = CH - COOH$

3) $CH_3CH_2CH(OH)CH(OH)CHO$ 4) $CH_3CH_2CH = CHCHO$

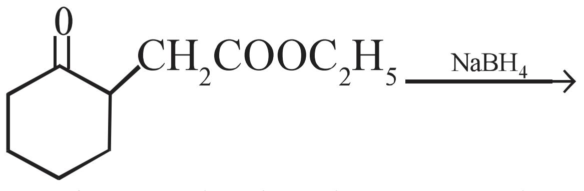
36. 

Here, the products X and Y are

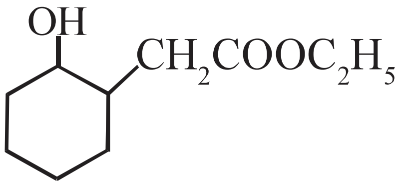
	X	Y
1)	n - propyl alcohol	n - propyl alcohol
2)	iso - propyl alcohol	iso-propyl alcohol
3)	n -propyl alcohol	iso-propyl alcohol
4	iso-propyl alcohol	n-propyl alcohol

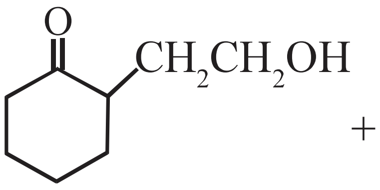
37. An organic compound ‘X’ with the molecular formula C_3H_6O, reacts with CH_3MgBr and then hydrolised to give ‘Y’, Y gives turbidity immediately with Lucas reagent. Structural formula of compounds X and Y are :

	X	Y
1)	CH_3CH_2CHO	$CH_3CH_2CH(OH)CH_3$
2)	CH_3COCH_3	$(CH_3)_3COH$
3)	CH_3CH_2CHO	$(CH_3)_3COH$
4)	CH_3COCH_3	$CH_3CH_2CH(OH)CH_3$

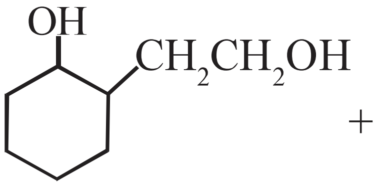
38. 

product(s) in the above reaction is (are)

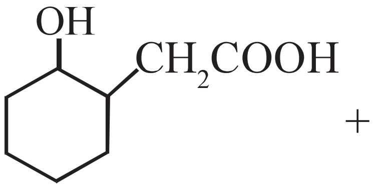
1) 

2) 

$+ C_2H_5OH$

3) 

$+ C_2H_5OH$

4) 

$+ C_2H_5OH$

39. 
$CH_3 - CH_2 - \underset{\underset{O}{\|}}{C} - CHO \xrightarrow{NaBH_4}$

Product(s) in the above reaction is (are)

1) $CH_3CH_2COOH + CO_2$ 2) $CH_3CH_2COCH_zOH$

3) $CH_3CH_2CH(OH)CH_2OH$ 4) $CH_3CH_2CH(OH)CHO$

40. Hydration of 3-phenylbut-l-ene with dil. H_2SO_4 mainly gives

1) 3-Phenylbutan-l-ol 2) 3-Phenylbutan-2-ol

3) 2-Phenylbutan-l-ol 4) 2-Phenylbutan-2-ol

41. The bond cleavages during esterification reaction between

(A) = CH_3COOH and (B) C_2H_5OH

1) C-OinB and O - H in A 2) C - O in A and O - H in B

3) C - O in A and O - H in A 4) O - H in B and O - H in A

42. HBr reacts fastest with

1) 2-Methylpropan -l-ol　　2) 2-Methylpropan -2-ol

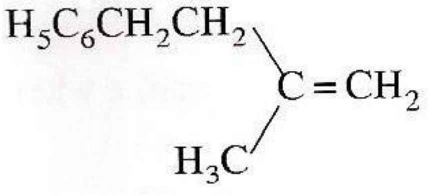
3) Propan-2-ol　　4) propan-l-ol

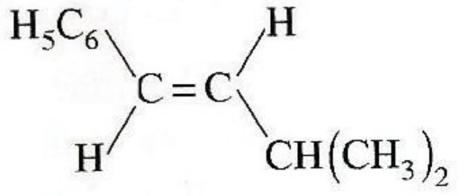
43. $CH_3CH_2OH \xrightarrow{Conc.H_2SO_4,413K} C_2H_5OC_2H_5$

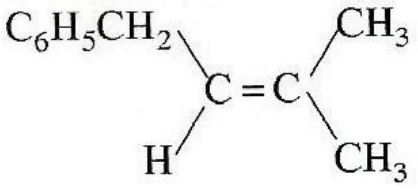
It follows which mechanism?

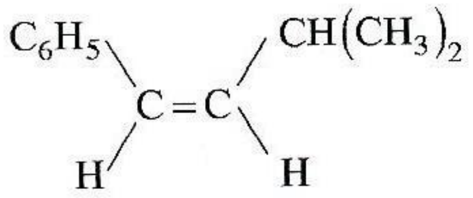
1) S_N1　　2) S_N2　　3) E_1　　4) E_2

44. The main product of the following reaction is $C_6H_5CH_2CH(OH)CH(CH_3)_2 \xrightarrow{Conc.H_2SO_4}$

1) 

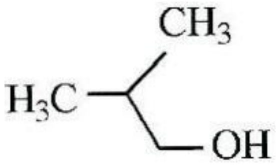
2) 

3) 

4) 

45. Among the following the one that give positive iodoform test upon reaction with NaOH is

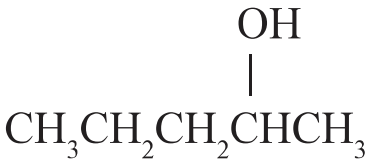
1) $CH_3CH_2CH(OH)CH_2CH_3$　　2) $C_6H_5CH_2CH_2OH$

3) 

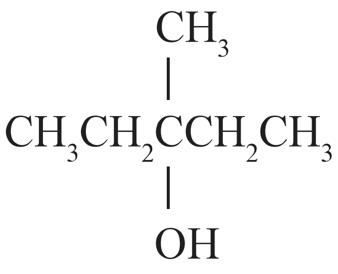
4) $PhCHOHCH_3$

46. Among the following compounds.which can be dehydrated very easily ?

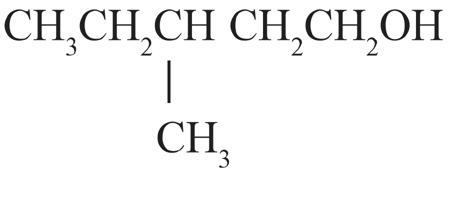
1) $CH_3CH_2CH_2CH_2CH_2OH$

2) 

$CH_3CH_2CH_2\overset{\overset{\displaystyle OH}{|}}{C}HCH_3$

3) 

$CH_3CH_2\underset{\underset{\displaystyle OH}{|}}{\overset{\overset{\displaystyle CH_3}{|}}{C}}CH_2CH_3$

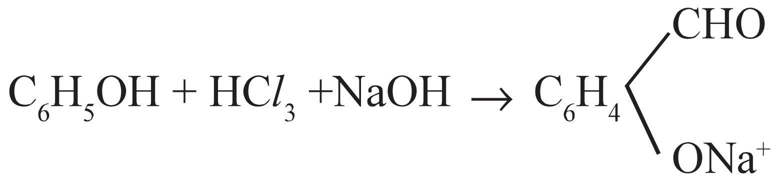
4) 

$CH_3CH_2\underset{\underset{\displaystyle CH_3}{|}}{C}H\ CH_2CH_2OH$

KEY

1) 2	2) 3	3) 2	4) 2	5) 2	6) 3	7) 1	8) 4
9) 4	10) 3	11) 3	12) 4	13) 4	14) 2	15) 3	16) 1
17) 3	18) 3	19) 2	20) 4	21) 2	22) 3	23) 3	24) 2
25) 1	26) 2	27) 2	28) 4	29) 3	30) 2	31) 3	32) 3
33) 1	34) 3	35) 4	36) 4	37) 2	38) 1	39) 3	40) 4
41) 2	42) 2	43) 2	44) 2	45) 4	46) 3		

Question Bank - IV
Phenol

1. 

$C_6H_5OH + HCl_3 + NaOH \rightarrow C_6H_4\begin{cases}CHO\\ ONa^+\end{cases}$

The electrophile involved in the above reaction is

1) Dichloro carbene ($:CCl_2$)

2) Trichloro methyl anion $\left(\overset{(-)}{C}Cl_3\bullet\right)$

3) Formyl cation (C^+HO)

4) Dichloro methyl cation (C^+HCl_2)

2. The reaction, $C_6H_5OH \xrightarrow[\text{Pyridine}]{CH_3COCl} C_6H_5OCOCH_3$ is called

1) Reimer-Tiemann reaction 2) Schotten-Baumann reaction

3) Acetylation 4) Benzoylation

3. Which of the following is most acidic?

1) Phenol 2) CH_3CH_2OH 3) Picric acid 4) p-Nitrophenol

4. The increasing order of boiling points of below mentioned alcohols is

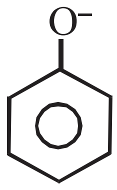
a) 1, 2 - dihydroxy benzene b) 1, 3 - dihydroxy benzene

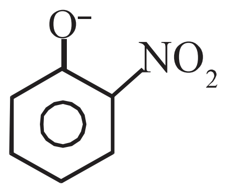
c) 1,4- dihydroxy benzene d) hydroxy benzene

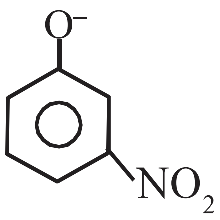
l) $a < b < c < d$ 2) $a < b < d < c$

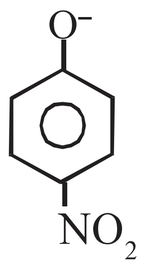
3) $d < a < b < c$ 4) $d < b < a < c$

5. The descending order of k_b values of the following compounds is

1) 

2) 

3) 

4) 

l) $d > b > c > a$ 2) $a > c > b > d$

3) $b > d > c > a$ 4) $a > c > d > b$

6. Phenols are more acidic than alcohols due to

a) In phenols. -OH is attached to sp^z hybri-dised carbon but in alcohols, -OH is attached to sp^2 hybridised carbon

b) Phenoxide ion is more stable than alkoxide due to resonance

c) Phenoxide ion is more stable than phenol

1) only a 2) only b 3) only c 4) a, b and c

7. Arrange the following compounds in the descending order of their pK_a values

a) 2, 4, 6-trinitrophenol b) 3, 4-dimitrophenol

c) m-nitrophenol d) p-cresol e) phenol

1) a > b > c > e > d 2) d > e > c > b > a

3) a > b > c > d > e 4) e > d > c > b > a

8. Phenol $\xrightarrow{conc.H_2SO_4} A \xrightarrow{conc.HNO3} B$

Here A and B are respectively

1) P-Hydroxy benzenesulphonic acid, P-nitrophenol

2) 4—Hydroxybenzene-1,3-disulphonic acid, picric acid

3) 4-Hydroxybenzene-1,3-disulphonic acid, 2,4-dinitrophenol

4) 3-Hydroxybenzene sulphonic acid, picric acid

9. Phenol $\xrightarrow{NaOH} A \xrightarrow[2)H^+]{1)CO_2} B \xrightarrow{(CH_3CO)_2OH^+} C$

Incorrect statement among the following is

1) Preparation of 'B' from phenol is called Kolbe's reaction

2) 'B' is steam volatile

3) 'C' has a free - OH group of 'B'

4) 'C' can be used as antiiflammatory, analgesic and antipyretic.

10. Phenol $\xrightarrow{(CH_3CO)_2O.H^+} A \xrightarrow{AlCl_3.\Delta} B+C$

If 'B' is steam volatile, incorrect statement| among the following is

1) Second step is called Fries rearrangement

2) First step is called acetylation

3) Boiling point of B' is less man that of 'C'

4) 'C' is 3-Hydroxy acetophenone.

11. One mole of phenol is warmed with sodium metal. If we assume 100% yield, volume of H_2 gas liberated at S.T.P is

1) 11.2L 2) 22.4 L 3) 33.6 L 4) 44.8 L

12. When phenol reacts with which one of the following reagents, a conjugate diketone will be formed ?

1) $Na_2Cr_2O_7$ 2) cone. HNO_3 3) Zn, Δ 4) $Na_2Cr_2O_7$+ H_2SO_4

13. Benzene $\xrightarrow{oleum} A \xrightarrow{NaOH} B \xrightarrow[-NaCl]{HCl} C$

Incorrect statement among the following is

1) Aqueous solutions of B is acidic 2) 'A' is Benzene sulphonic acid

3) 0.2% of 'C' can be used as antispectic 4) 'C' is more acidic than water.

14. Phenol gives characteristic colouration with

1) Iodine solution 2) Bromine water

3) Aqueous $FeCl_3$ solution 4) Ammonium hydroxide

15. If we use carbon tetrachloride in Reimer-Tiemann reaction in place of chloroform, the

product formed is

1) Salicylic acid 2) Salicylaldehyde
3) Cyclohexanol 4) Phenolphthalein

16. When beozene sulphonic acid p-nitrophenol are treated with $NaHCO_3$ the gases released respectively are

1) SO_2, NO_2 2) SO_2, NO 3) SO_2, CO_2 4) CO_2, CO_2

17. Ortho-Nitrophenol is less soluble in water than p-and m-Nitrophenol because

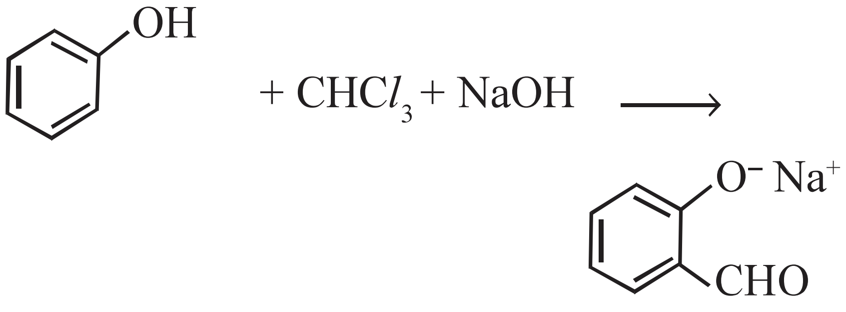
1) o-Nitrophenol is more volatile is steam than those of m- and p-isomers
2) o-Nitrophenol shows Intramolecular H-bonding
3) o-Nitrophenol shows Intermolecular H-bonding
4) Melting point of o-Nitrophenol is lower than those of m- and p-isomers

18. Phenol is heated with an aqueous solution of Bromine. The major product obtained in the reaction is

1) 2-Bromophenol 2) 3-Bromophenol
3) 4-Bromophenol 4) 2, 4, 6-Tribromophenol

19. From amongst the following alcohols, the one that would react fastest with conc.HCl and anhydrous $ZnCl_2$ is

1) 1-Butanol 2) 2-Butanol
3) 2-Methylpropan-2-ol 4) 2-Methylpropanol-l

20. 

The elecrophile involved in the above reaction is :

1) dichloromethyl cation $(\overset{\oplus}{C}HC1_2)$ 2) dichlorocarbene $(:CC1_2)$

3) trichloromethyl anion $(\overset{-}{C}C1_3)$ 4) fonnyl cation $(\overset{\oplus}{C}HO)$

KEY

1) 1	2) 3	3) 3	4) 3	5) 2	6) 4	7) 2	8) 2
9) 3	10) 4	11) 1	12) 4	13) 1	14) 3	15) 1	16) 4
17) 2	18) 4	19) 3	20) 2				

Question Bank - V

Eather

1. Anisole reacts with Br_2 in the presence of CS_2 as solvent to give

1) 2, 4, 6-Tribromoanisole 2) 2-Bromoanisole
3) 4-Bromoanisole 4) A mixture of 2-Bromoanisole and 4- Bromoanisole

2. Anisole wfith HNO_3 and cone H_2SO_4 gives

1) Phenol 2) Nitrobenzene 3) o and p-nitro anisoles 4) o - nitro anisole

3. Ethyl phenyl etlier on reaction with excess HI yields

1) Ethyl iodide and iodobenzene 2) Ethyl iodide and phenol

3) Ethyl alcohol and phenol 4) Ethyl alcohol and iodobenzene

4. An ether is more volatile than an alcohol leaving the same molecular formula. This is due to

1) dipolar character of ethers 2) alcohols having resonance structures

3) inter-molecular hydrogen bonding in ethers

4) inter-molecular hydrogen bonding in alcohols

5. HBr reacts with $CH_2= CH - OCH_3$ under anhydrous conditions at room temperature to give

1) H_3C - CHBr - OCH_3 2) CH_3CHO and CH_3Br

3) $BrCH_2CHO$ and CH_2OH 4) $BrCH_2$ - CH_2 - OCH_3

6. To prepare tert-butyl ethyl ether by Williamson synthesis, the reactants needed are

1) Sodium ethoxide and sodium tert butoxide

2) Sodium ethoxide and tert-butyl bromide

3) Sodium tert-butoxide and ethyl bromide

4) Ethyl alcohol and tert-butyl alcohol

7. The major product obtained when tert-butyl bromide is heated with sodium ethoxide is

1) 2-Methyl-l-propene 2) Ehene

3) tert-Butyl methyl ether 4) Diethyl ether

8. tert-Butyl methyl ether on heating with HI of one molar concentration gives

1) $CH_3OH + (CH_3)_3CI$ 2) $CH_3I + (CH_3)_3COH$

3) $CH_3I + (CH_3)_3CI$ 4) None of these

9. $A + B \rightarrow CH_3\text{-}OC(CH_3)_3 \xrightarrow{HI} X+Y$.

Correct statement among the following is

1) A and B are CH_3ONa and $(CH_3)_3CBr$ 2) X and Y are CH_3I and $(CH_3)_3COH$

3) X and Y are CH_3OH and $(CH_3)_3CCI$ 4) A and B are CH_3OH and $(CH_3)_3COH$

10. $P + Q \rightarrow$ Anisole $\xrightarrow{HI}$ R + S.

Correct statement among the following is

1) P and Q are C_6H_5ONa and C_2H_5Cl 2) R and S are C_6H_5I and CH_3OH

3) R and S are C_6H_5OH and CH_3I 4) P and Q are C_6H_5Cl and CH_3ONa

11. $CH_3OCH_2CH_3 \xrightarrow{+HI} CH_3I + CH_3CH_2OH$

It follows which mechanism ?

1) S_N1 2) S_N2 3) E_1 4) E_2

12. Which one of the following reagents will form diethyl ether from ethanol ?

1) H_2SO_4 at 413 K 2) Cold HI solution

3) H_2SO_4 at 443 K 4) Dilute H_2SO_4 solution

13. In the following reaction

$C_2H_5OC_2H_5 + 4[H] \xrightarrow{RedP+HI} 2X + H_2O$, X is

1) Ethane 2) Ethylene 3) Butane 4) Propane

14. $(CH_3)_3\ COCH_3 \xrightarrow{+HI} (CH_3)_3\ CCI + CH_3OH$

It follows which mechanism ?

1) S_N1 2) S_N2 3) E_1 4) E_2

KEY

1) 4 2) 3 3) 2 4) 4 5) 1 6) 3 7) 1 8) 1
9) 3 10) 3 11) 2 12) 1 13) 1 14) 1

Question Bank - VI

Aldehydes and Ketones

SET-I

1) Both A & R are true and R is the correct explanation of A
2) Both A & R are true, but R is not the correct explanation of A
3) A is true, R is false 4) A is false, R is true

1. (A) : Alcoholic fermentation involves conversion of sugar into ethanol by the action of yeast.
(R) : Fermentation involves the liberation of CO_2 gas.

2. (A) : Ethanol is miscible in all proportions with water.
(R) : Hydrogen bonds are formed between wetter and alcohol molecules.

3. (A) : Sojdium can't be used for drying ethyl alcohol.
(R) : Sodium displaces hydrogen from ethyl alcohol.

4. (A) : Ethyl alcohol is soluble in organic soli vents
(R) : Etjhyl alcohol is having non polar ethyl group.

5. (A) : The boiling point of C_2H_5OH is less than that of H_2O, though the molecular weight of C_2H.OH is more than that of water.
(R): C_2H_5OH molecules are not highly associated through hydrogen bonding as in water.

6. (A) : Addition of C_2H_5OH to CH_3MgI gives methane.
(R) : C_2H_5OH is more acidic than CH_4.

7. (A) : Dehydration of alcohols can be carried out with cone H_2SO_4 but not with cone. HC1.
(R) : H_2SO_4 is dibasic while HC1 is monobaisc.

8. (A) : Alcohols on dehydration can produce ether as well as alkene under different conditions.
(R) : Dehydration of alcohol takes place with conc.H_2SO_4 or $A1_2O_3$.

9. (A) Oxidation of tertiary alcohols requires strong oxidising agent and elevated temperature.
(R) : Oxidation of tertiary alcohols involves cleavage of C - C bond.

SET - II

1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true, but R is not the correct explanation of A
3) A is tbie but R is false 4) Both A and R are

10. (A) : Primary and secondary alcohols can be distinguished by Lucas test.
(R) : An equimolar mixture of anhydrous $ZnCl_2$ and concentrated HCl is called Lucas reagent.

11. (A) : Acetone and propenol-2 are tautomers.
(R) : Propanone and propenol-2 contain different functional groups.

12. (A) : Alcohols act as Bronsted - Lowry bases.
(R) : In alcohols the lone pair of electrons on oxygen forms dative bond with H^+.

13. (A) : Anhydrous $ZnCl_2$ is used in reaction of alcohols with HCl.
(R) : $ZnCl_2$ forms a complex with oxygen of alcohol and converts - OH into a much better leaving group.

KEY

1) 2 2) 1 3) 1 4) 1 5) 1 6) 1 7) 2 8) 2
9) 1 10) 2 11) 2 12) 1 13) 1

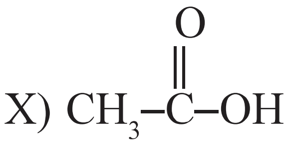
Question Bank - VII

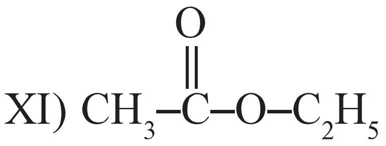
Carboxylic Acid

1. Which of the following can undergo neither aldol condensation nor iodoform reaction?
1) $CH_3 - CHO$ 2) $CH_3 - CO - CH_3$
3) $CH_3 - CO - CH_2 - CH_2 - CH_3$ 4) $CH_3 - CCl_2 - CHO$

2. Diacetone alcohol is obtained when
1) 2 molecules of acetone condense in presence of barium hydroxide
2) 3 molecules of acetone condense in presence of barium hydroxide
3) 3 molecules of acetone polymerise in presence of conc H_2SO_4
4) 3 molecules of acetone condense in presence of conc H_2SO_4

3. I) CH_3OH II) C_2H_5OH
III) $CH_3CH_2CH_2OH$ IV) $CH_3 - CH(OH)CH_3$
V) $(CH_3)_3C - OH$ VI) $CH_3CH(OH)C_2H_5$
VII) CH_3COCH_3 VIII) CCl_3COCH_3
IX) CH_3CHO


X) $CH_3-\overset{\overset{O}{\|}}{C}-OH$


XI) $CH_3-\overset{\overset{O}{\|}}{C}-O-C_2H_5$

XII) $C_2H_5 - CHO$
Which of the above compounds cannot undergo iodoform reaction ?
1) Only II, IV, VI, VII, VIII, IX 2) Only I, III, V, X, XI, XII
3) Only X, XI, XII 4) Only I, V, X, XII

4. Number of σ bonds, π bonds and lone pairs of electrons present in acetone semicarbazone, are
1) 16, 2, 5 2) 16, 2, 2 3) 14, 2, 4 4) 16, 2, 4

5. IUPAC name of dehydration product of compound 'X' which is obtained of condensation of two molecules of acetone dilute NaOH solution is

1) diacetone alcohol 2) mesityl oxide

3) 4 - methyl pent - 3 - en - 2 - one 4) 4 - hydroxy - 4 - methyl - 2 - pentanone

6. Which of the following participate in aldol condensation

1) Formaldehyde 2) Benzaldehyde

3) Methanol 4) Acetaldehyde

7. Acetaldehyde and acetone can be identified by

1) Schiff's reagent 2) 2,4-DNP test

3) Tollen's reagent 4) Lucas test

8. $A \xrightarrow{HBr} B \xrightarrow{AqKOH} C.$ $C \xrightarrow{PDC} CH_3COCH_3$

Identify the organic compounds A. B and C given in the above sequence.

1) CH_3CHO, $C_2H_2Br_2$ and CH_3COOH

2) $CH_3CH = CH_2$, $CH_3CHBrCH_3$ and $CH_3CH(OH)CH_3$

3) $CH_3CH = CH_2$, $CH_3CHBrCH_3$ and $CH_3CH(OH)CH_3$

4) $CH_3CH = CH_2$, $CH_3CHBrCH_3$ and

9. Reduction of $>C = O$ to $>CH_2$ can be carried out with

1) catalytic reduction 2) Na/C_2H_5OH

3) Wolff-Kishner reduction 4) $LiAlH_4$

10. A carbonyl compound can be prepared by hydration of acetylene. It reacts with ammonia to form (X) and with hydroxylamine to form (Y). It undergoes Wolff - Kishner reduction to form Z. X, Y and Z are

1) Acetaldimine acetaldoxime and ethane

2) Diacetone amine, acetoxime and propane

3) Acetaldoxime, semicarbazone and propane

4) Aldol, hydrazone and alcohol.

11. $(CH_3)_2CO \xrightarrow[(HCl)]{NaCN} A \xrightarrow[\Delta]{H_2O^+} B.$

In the above sequence of reactions. A and B are

1) $(CH_3)_2\ C(OH)CN$, $(CH_3)_2\ C(OH)COOH$

2) $(CH_3)_2\ C(OH)CN$, $(CH_3)_2\ C(OH)_2$

3) $CH_3CHOHCN$, $(CH_3)_2\ CHCOOH$

4) $(CH_3)_2\ C(OH)CN$, $(CH_3)_2\ C = O$

12. Which one of the following is one of the cross end products formed when a mixture of acetone and acetaldehyde is heated after treating with aqueous sodium hydroxide ?

1) $(CH_3)_2C = CH - CHO$ 2) $(CH_3)C(OH) \bullet CHCOCH_3$

3) $CH_3 - CH = CH - CHO$ 4) $(CH_3)_2CH(OH)CH_2CO - CH_3$

13. $X + RMgX \rightarrow Y \xrightarrow{H_2O.H^+} Z.$

If Z is n-butyl alcohol, 'X' is

1) HCHO 2) CH_3CHO 3) RCHO 4) RCOR

14. When acetaldehyde undergoes reaction with Zn-HCl in the presence of Hg, the product obtained is

1) propane 2) ethane 3) methane 4) butane

15. 2, 3 - dimethyl - 2 - butene, on reductive ozonolysis gives

1) Acetone 2) Acetaldehyde 3) Butanone 4) Formaldehyde

16. HCHO with conc. alkali forms two compounds. The change in oxidation number would be

1) (0 to –2) in both the compounds

2) (0 to +2) in both the compounds

3) (0 to + 2) in one compound and (0 to -2) in the second compound

4) all the above are correct

17. Which of the following compounds would undereo the Cannizzaro reaction ?

1) Acetaldehyde 2) Benzaldehyde

3) Propionaldehyde 4) Anisole

18. Benzaldehyde can be prepared by oxidation of toluene with

1) Acidic $KMnO_4$ 2) $K_2Cr_2O_7$

3) Cr_2Cl_2 4) All

19. Hydrogenation of benzoyl chloride in the presence of Pd and $BaSO_4$ gives

1) Benzyl Alcohol 2) Benzaldehyde

3) Benzoic acid 4) Phenol

20. Benzaldehyde is obtained from toluene by

1) Rosemnund's reduction 2) Cannizzaro reaction

3) Kolbe's reaction 4) Etard reaction

21. $C_6H_6 + CO + HCl \xrightarrow{\text{Anhyd.AlCl}_3} X \bullet HCl$ Compound X is

1) $C_6H_5CH_3$ 2) $C_6H_5CH_2Cl$ 3) C_6H_5CHO 4) C_6H_5COOH

22. In the reaction

$C_6H_5CH_3 \xrightarrow[CrO_3]{(CH_3CO)_2O} M \xrightarrow[\text{Hydrolysis}]{\text{Alkaline}} C_6H_5CHO$

Acetic anhydride is used

1) As a catalyst 2) As an oxidising agent

3) To form a non-oxidizable derivative of benzaldehyde

4) To help the reaction to proceed smoothly

23. Benzaldehyde undergoes oxidation and reduction in the presence of

1) $NaHCO_3$ 2) Concentrated NaOH

3) Na_2CO_3 4) HCl

24. Reaction of C_6H_5CHO with CH_3NH_2 gives

1) C_6H_5COOH 2) $C_6H_5 - N = NCl + 2H_2O$

3) $C_6H_5 - CH = N - CH_3$ 4) $C_6H_5NH_2$

25. Schiffs bases are formed when aniline reacts with

1) Aromatic aldehydes 2) Aryl ketones

3) Arylhalides 4) Aryl alcohols

26. CH_3CHO and C_6H_5CHO can be distinguished by

1) Baeyers reagent 2) Tollens' reagent

3) Schiffs reagent 4) I_2 + NaOH

27. Which does not react with Fehling's solution

1) Acetaldehyde 2) Benzaldehyde

3) Glucose 4) Formic acid

28. A compound reduces Tollen's reagent but does not reduce Fehling's or Benedict solutions. It is

1) Glucose 2) Benzaldehyde 3) Acetophenone 4) Acetaldehyde

29. Benzyl alcohol is obtained from benzaldehyde by

1) Fittig reaction 2) Cannizzaro reaction

3) Kolbe's reaction 4) Wurtz reaction

30. 1 - Phenylethanol can be prepared by reaction of benzaldehyde with

1) Methyl bromide 2) Ethyl iodide and magnesium

3) Methyl bromide and aluminium bromide

4) Methyl iodide and magnesium

31. A substance A containing three carbon atoms gives white crystalline precipitate with sodium bisulphite solution. But does not give red precjpitate with Fehling solution. A on treatment with $NH_2 - NH_2$ / KOH will yield

1) Propene 2) Propane 3) Cycloproapane 4) Propionic acid

32. A certain compound Y has a formula C_3H_6O. It combines with hydroxylamine to form two compounds which are geometrical isomers of each other. Y is

1) CH_3CHO 2) CH_3CH_2CHO 3) CH_3COCH_3 4) $CH_2 = CHCH_2OH$

33. Which of the following compound will give yellow precipitate with I_2 / Na_2CO_3 (aq) but does not respond to Camiizarro reaction ?

1) $(C_2H_5)_2CO$ 2) CH_3CHO 3) CH_2O 4) $C_2H_5CH_2OH$

34. Vinyl alcohol and ethanal are

1) Metamers 2) Tautomers 3) Position isomers 4) chain isomers

35. $C_3H_8O \xrightarrow[K_2Cr_2O_7/H^+]{(O)} C_3H_6O \xrightarrow{I_2/NaOH} CHI_3$

In this sequence, the starting compound is

1) 1 - propanol 2) Propanal

3) 2- propanol 4) Ethyl methyl ether

36. Which among the following gives positive iodoform test as well as positive Fehling test ?

1) Propanal 2) Ethanal 3) Propanone 4) Acetophenone

37. The number of isomeric ketones with formula $C_6H_{12}O$ is

1) six 2) two 3) five 4) four

38. Cannizzaro reaction involves

1) oxidation of aldehydes 2) oxidation as well reduction of aldedhyde molecule

3) Reduction of aldehyde molecule 4) Rearrangement in aldehyde molecule

39. Whichof the following aldehyde contains a -C atom but does not have any a -H atom ?

1) Propionaldehyde 2) Benzaldehyde

3) Isobutyraldehyde 4) Formaldehyde

40. Which of the following compound will not undergo Cannizzaro reaction?

1) Benzaledhyde 2) 2, 2 - Dimethyl propanal

3) Formaldehyde 4) Phenylethanal

41. The reagent used to bring about the transformation : But-2-ene to ethylalcohol.

1) Pyridinumchlorochromate 2) O_3, H_2O and Zn dust

3) Chromium trioxide 4) Acidified dichromate

42. A compound X has molecular formula C_2Cl_3OH. It reduces Fehling solution and on oxidation it gives monocarboxylic acid B. X can also be formed by the action of Cl_2 on ethanol. X is

1) Chloromethane 2) Chloroform

3) Chloroacetic acid 4) Chloral

43. In which of the following process acetone is one of the final products?

1) Ozonolysis of ethyne 2) Oxidation of 2-butene with $KMnO_4$ / H_2SO_4

3) Oxidation followed by hydrolysis of cumene

4) Dehydrogenation of 1 - propanal

44. Which of the following will show disproportionation when treated with 50% aqueous NaOH ?

1) Benzyl alcohol 2) Ethanol 3) Phenyl ethanol 4) m-Nitrobenzaldehyde

45. Which reagent is suitable for one step preparation of n-pentane from 2-pentanone?

1) Zn - Hg/HCl 2) $LiAlH_4$

3) $K_2Cr_2O_7$/ H_2SO_4 4) One step conversion is not possible

46. Which of the following can provide distinction between two functional isomers of C_3H_6O?

1) $NaHSO_3$ 2) HCN 3) $AgNO_3$ 4) $[Ag(NH_3)_2]^+OH^-$

47. 2-Pentanonc and 3-Methylbutan-2-one are

1) optical isomers 2) geometrical isomers

3) chain isomers 4) tautomers

48. An alkene, C_7H_{14} on reductive ozonolysis gave propanal and a ketone. The probable formula of ketone is

1) Acetone 2) Ethyl methylketone

3) 2 - Pentanone 4) 3 - Pentanone

49. Which ketone will form 3 - ethylpentan - 3-ol on treatment with ethyl magnesium bromide?

1) Acetone 2) Ethylmethyl ketone

3) Acetophenone 4) Diethyl ketone

50. Acetone $\xrightarrow{\text{ethylencglycol}}$ X.

The product X in this reaction is

1) Mesitylene 2) Acetylene 3) Ketol 4) Acetol

51. Treatement of propionaldehyde with dilute NaOH solution gives

1) $CH_3CH_2COOCH_2CH_2CH_3$ 2) CH_3CH_2CH (OH) CH (CH_3) CHO

3) CH_3CH_2CH (OH) CH_2CH_2CHO 4) $CH_3CH_2COCH_2CHO$

52. Which of the following conversion can be brought about under Wolff - Kishner reduction?

1) Benzaldehyde to benzyl alcohol 2) Cyclohexanol to cyclohexane

3) Cyclohexanone to cyclohexanol 4) Benzophenone to diphenyl methane

53. $C_6H_5CHO + HCN \rightarrow C_6H_5CH(CN)OH$. The product would be

1) Diastereomer 2) Optically active

3) A meso compound 4) Ethyl formate

54. When acetone undergoes reduction in presence of Zn-HCl/Hg, it is known as

1) Wolf Kishner's reduction 2) Rosenmund's reduction

3) Clemmenson's reaction 4) Gatterman's reaction

55. $C_6H_5CH_3 \xrightarrow{} C_6H_5CHO$. Which one of the following reagents are not suitable for the conversion ?

1) treating with alkaline $KMnO_4$ and heating

2) reaction with CrO_2Cl_2 followed by hyrdrdysis.

3) reaction with CrO_3 in $(CH_3CO)_2O$ followed by hydroysis.

4) both (2) and (3).

56. $R{-}COCl + R_3Cd \xrightarrow{} CdCl_2 + X$. The organic compound 'X' is

1) a ketone 2) an aldehyde 3) an alcohol 4) a phenol

57. Cyanphydrin of which compound on hydrolysis will give lactic acid ?

1) C_6H_5CHO 2) HCHO 3) CH_3CHO 4) $CH_3 - CH_2 - CHO$

58. Whicli of the following products is formed when benzaldehyde is treated with CH_3MgBr and the addition product so obtained is subjeqted to acid hydrolysis ?

1) A secondary alcohol 2) A primary alcohol

3) Phenol 4) Tert-butyl alcohol

59. Which of the following reacts with NaOH to produce an acid and an alcohol ?

1) HCHO 2) CH_3COOH 3) CH_3CH_2COOH 4) C_6H_5COOH

60. The increasing order of the rate of HCN addition to compounds I to IV is

I. HCHO II. CH_3COCH_3

III. $PhCOCH_3$ IV. PhCOPh

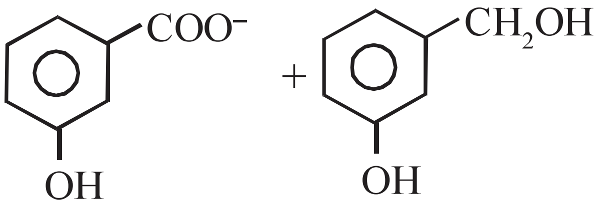
1) III < IV < II < I 2) I < II < III < IV

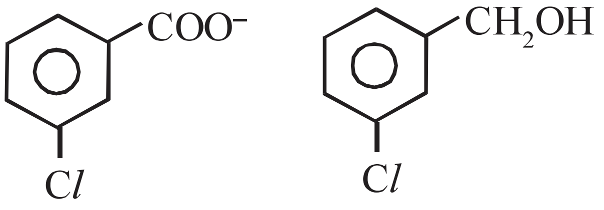
3) IV < II < III < I 4) IV < III < II < I

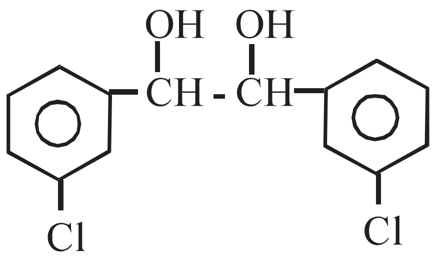
61. Which one of following undergoes reaction with 50% sodium hydroxide solution to give the corresponding alcohol and acid ?

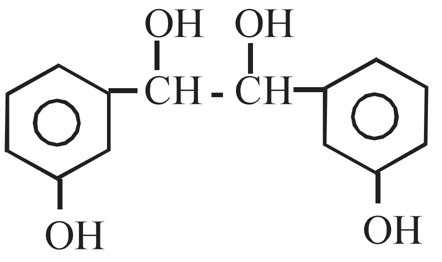
1) Phenol 2) Benzoic acid 3) Butanal 4) Benzaldehyde

62. When m-chlorobenzaldehyde is treated with 50% KOH solution, the product(s) obtained is (are)

1) 

2) 

3) 

4) 

63. Which of the following does not undergo disproportionation with conc. KOH

1) CH_3CHO 2) HCHO 3) C_6H_5CHO 4) Chloral

64. $C_6H_6 \xrightarrow[AlCl_3]{CO,HCl} A \xrightarrow{conc.KOH} B+C$

Correct statement among the following is

1) First step is called Kolbe's reaction

2) B and C are benzaldehyde and benzyl alcohol.

3) Second step is called aldol condensation

4) A is benzene carbaldehyde

65. $CH_3CHO + CH_3CH_2CHO \xrightarrow{NaOH,\Delta}$.

Which one of the following compounds is not the product in the above reaction '.'

1) $CH_3CH = CHCHO$ 2) $CH_3CH_2CH = CHCH_2CHO$

3) $CH_3CH = C(CH_3)CHO$ 4) $CH_3CH_2CH = CHCHO$

66. $C_6H_5\ CHO + C_6H_5COCH_3 \xrightarrow{OH^-,293K} X$;

IUPAC name of cross condensation product X is

1) Benzalacetophenone 2) 1, 3-diphenylpropanone-l

3) 1,3-diphenylprop-2-en-l-one 4) 1,3-diphenyl prop-1 -en-3-one

67. One mole of acetal on complete hydrolysis gives

1) 1 mole of aldehyde, 1 mole of alcohol

2) 1 mole of aldehyde, 2 moles of alcohol

3) 2 moles of aldehyde, 1 mole of alcohol

4) 2 moles of aldehyde and 2 moles of alcohol

68. In Gatterman-Koch reaction, benzene is converted to benzaldehyde. The set of chemicals used for the convertion

1) CO, HC*l*, anhydrous CuC*l* 2) CrO_3, $(CH_3CO)_2)$

3) C_6H_5MgBr, $C_2H_5OC_2H_5$ 4) $C0_2$, HC*l*, anhydrous A*l*C*l*$_3$

KEY

1) 4	2) 2	3) 2	4) 1	5) 3	6) 4	7) 2	8) 3
9) 3	10) 1	11) 1	12) 1	13) 1	14) 2	15) 1	16) 3
17) 2	18) 3	19) 2	20) 4	21) 3	22) 3	23) 2	24) 3
25) 1	26) 4	27) 2	28) 2	29) 2	30) 4	31) 2	32) 2
33) 2	34) 2	35) 3	36) 2	37) 1	38) 2	39) 2	40) 4
41) 2	42) 4	43) 3	44) 4	45) 1	46) 4	47) 3	48) 2
49) 4	50) 3	51) 2	52) 4	53) 2	54) 3	55) 1	56) 1
57) 3	58) 1	59) 1	60) 4	61) 4	62) 2	63) 1	64) 4
65) 2	66) 3	67) 2	68) 1				

Question Bank - VIII
Amines, Diazonium Salt, Cyanides and Isocyanides

1. Which of the following is used as acetylating agent
   1) acetic anhydride 2) glacial acetic acid
   3) ethyl acetate 4) anhydrous sodiumacetate

2. The compound which is widely used as acetylating agent is
   1) glacial acetic acid 2) ethyl acetate
   3) acetic anhydride 4) anhydrous sodium acetate

3. The organic compounds A and B react with sodium metal and release H_2 gas. A and B react together to give ethyl acetate. Then A and B are
   1) HCOOH and C_2H_5OH 2) C_2H_5OH and CH_3COOH
   3) CH_3COOH and CH_3OH 4) CH_3COOH and HCOOH

4. Heating a mixture of ethyl alcohol and acetic acid in presence of cone. H_2SO_4 produces a fruity smelling compound A. Then A is
   1) Ether 2) Ester 3) Aldehyde 4) Ketone

5. Hydrolysis of acetamide produces
   1) Acetic acid 2) Acetaldehyde 3) Methyl amine 4) Formic acid

6. Cyanohydrin of which of the folloiwng forms lactic acid?
   1) HCHO 2) CH_3COCH_3 3) CH_3CHO 4) CH_3CH_2CHO

7. $CaC_2 \xrightarrow{H_2O} A+B.\ A \xrightarrow{HgSO_4+H_2SO_4} C.\ C \xrightarrow{K_2Cr_2O_7+H_2SO_4} D$

   Here A. B, C and D are respectively
   1) $CH \equiv CH$, $Ca(OH)_2$, CH_3CHO and CH_3COOH
   2) $Ca(OH)_2$, $CH \equiv CH$, CH_3CHO and $(CH_3COO)_2Ca$
   3) $CH \equiv CH$, $Ca(OH)_2$, CH_3CHO and $(CH_3COO)_2Ca$
   4) $CH \equiv CH$, CH_3CHO, $Ca(OH)_2$ and $(CH_3COO)_2Ca$

8. Identify Z in the following sequence of reactions

   $CH_3COONH_4 \xrightarrow{\Delta} X \xrightarrow{P_2O_5} Y \xrightarrow{H_2O/H^+} Z$
   1) $CH_3CH_2CONH_2$ 2) CH_3CN
   3) $(CH_3CO)_2O$ 4) CH_3COOH

9. $(CH_3)_2CO \xrightarrow[(HCl)]{NaCN} X \xrightarrow[\Delta]{H_3O^+} Y.$

Here X and Y are respectively

1) $(CH_3)_2C(OH)CN$. $(CH_3)_2C(OH)COOH$ 2) $(CH_3)_2C(OH)CN$, $(CH_3)_2$ $C(OH)_2$

3) $(CH_3)_2CHCN$, $(CH_3)_2$ $CHCOOH$ 4) $(CH_3)_2C(OH)CN$, $(CH_3)_2$ $C = O$

10. Which reagent will bring about the conversion of carboxylic acids into esters ?

1) C_2H_5OH 2) Dry HC*l*+ C_2H_5OH

3) $LiAlH_4$ 4) $Al(OC_2H_5)_3$

11. R - $COCH_3$ $\xrightarrow{X_2/OH^-}$ CHX_3 + Carboxylate ion $\xrightarrow{H^+}$ Carboxylic acid. In the above sequence, the carboxylic acid obtained is

1) CH_3COOH 2) HCOOH

3) RCOOH 4) RCH_2COOH

12. The reaction of acetaldehyde with HCN followed by hydrolysis gives a product which exhibits ?

1) Metamerism 2) Tautomerism

3) Enantiomerism 4) Geometrical isomerism

13. The acid formed when propyl magnesium bromide is treated with carbon dioxide and followed by hydrolysis

1) C_3H_7COOH 2) C_2H_5COOH

3) $CH_3COOC_2H_5$ 4) $C_2H_5COOCH_3$

14. What are A and B in the following reactions ?

I) $CH_3CO_2H \xrightarrow[Red\ P]{HI} A$ II) $2CH_3CO_2H \xrightarrow{P_4O_{10}} B$

1) CH_3COCH_3 $(CH_3CO)_2O$

2) C_2H_6 CH_3COCH_3

3) C_2H_6 $(CH_3CO)_2O$

4) $(CH_3CO)_2$ C_2H_6

15. Which of the following reactions of acetic acid involves C-OH bond ?

I) Action of Na II) Formation of acid chloride

III) Action with $NaHCO_3$ IV) Formation of an ester

1) I,II 2) II,III 3) III, IV 4) II, IV

16. In which of the following, the carbon-oxygen bonds are of equal lengths?

1) CH_3COO— 2) CH_3COOH

3) $CH_3COOC_2H_5$ 4) CH_3COCl

17. Propanoic acid is slightly weaker than acetic acid because

1) methyl group is electron with drawing

2) +1 effect of C_2H_5 is more than $-CH_3$

3) acetic acid is stronger than propanoic acid

4) propanoic acid has three carbon atoms

18. When compound X is oxidised by acidified potassium dichromate, compound Y is formed. Compound Y on reduction with $LiAlH_4$ gives X .X and Y respectively are

1) C_2H_5OH, CH_3COOH 2) CH_3COCH_3, CH_3COOH
3) C_2H_5OH, CH_3COCH_3 4) CH_3CHO, CH_3COOH

19. The correct acidic strength order of the following compounds is

a) CH_3COOH b) H_2CO_3 c) C_2H_5OH d) C_6H_5OH
e) H_2O f) C_2H_2

1) a > b > d > e > c > f 2) a > d > c > b > e > f
3) a > b > c > d > e > f 4) a > b > d > c > e > f

20. Toluene $\xrightarrow[\Delta]{KMnO_4+KOH}$ A $\xrightarrow{H_3O^+}$ C. n-propyl benzene $\xrightarrow[\Delta]{KMnO_4+KOH}$ P $\xrightarrow{H_3O^+}$ Q.

1) A and P are different but C and Q are same
2) A and P are different and C and Q are different
3) A and P are same and C and Q are same
4) C and Q are benzaldehyde

21. $C_6H_5Br + Mg \xrightarrow{\text{dry ether}} A \xrightarrow{CO_2} B \xrightarrow{H_3O^+} C$. IUPAC name of C is

1) Benzene carboxylic acid 2) Benzene carbaldehyde
3) Phenyl methanol 4) Phenyl ethanoic acid

22. Identify C in the following sequence of reactions:

$CH_3COONH_4 \xrightarrow{\Delta} A \xrightarrow{P_2O_5} B \xrightarrow{H_3O^+} C$

1) $CH_3CH_2CONH_2$ 2) CH_3CN
3) $(CH_3CO)_2O$ 2) CH_3COOH

23. What are A, B, C in the following reactions ?

$CH_3CO_2Na \xrightarrow{\text{Soda lime / }\Delta} A$, $CH_3CO_2H \xrightarrow{LiAlH_4} B$, $CH_3CO_2Na \xrightarrow{\text{Kolbe's selectrolysis}} C$

	A	B	C
1)	C_2H_6	C_2H_5OH	CH_4
2)	CH_4	C_2H_5OH	C_2H_6
3)	C_2H_5	CH_3COCH_3	C_3H_8
4)	$(CH_3CO)_2O$	C_2H_6	C_2H_6

24. Identify A, B and C in the following reactions:

$CH_3Cl \xrightarrow{KCN} A \xrightarrow[H_2O^{\oplus}]{\text{Hydrolysis}} B \xrightarrow[\Delta]{C2H_5OH/H^+} C$

	A	B	C
1)	CH_3NC	CH_3NHCH_3	$CH_3N(CH_3)C_2H_5$
2)	CH_3CN	CH_3CONH_2	CH_3CO_2H
3)	CH_3CN	CH_3CO_2H	$CH_3CO_2C_2H_5$
4)	CH_3CN	CH_3CO_2H	$(CH_3CO)_2O$

25. What is Z in the following sequence of reactions ?

Phenol $\xrightarrow{\text{Zn dust}}$ X $\xrightarrow[\text{anhyd.}AlCl_3]{CH_2Cl}$ Y. Y $\xrightarrow[KMnO_4]{\text{Alkaline}}$ Z

1) Toluene 2) Benzne 3) Benzoic acid 4) Benzaldehyde

26. The major product of nitration of benzoic acid is

1) 3 - Nitro benzoic acid 2) 4 - Nitro benzoic acid
3) 2 - Nitro benzoic acid 4) 2, 4 - Dinitro benzoic acid

27. Which of the following compounds does not have a carboxyl group ?

1) methanoic acid 2) ethanoic acid
3) picric acid 4) benzoic acid

28. Which of the following substances will not give silver mirror with Tollen's reagent?

1) Ethanal 2) Methanoic acid 3) Acetone 4) Propanal

29. Chlorinatton of Toluene in the presence of light and heat followed by treatment with aqueous NaOH gives

1) o - Cresol 2) p - Cresol 3) 2, 4 - Dihydroxytoluene 4) Benzoic acid

30. When $CH_2=CH-COOH$ is reduced with $LiAlH_4$, The compound obtained will be

1) $CH_2=CH-CH_2-OH$ 2) $CH_3-CH_2-CH_2OH$
3) CH_3-CH_2-CHO 4) CH_3-CH_2-COOH

31. In the following reaction. (A) and (B) are respectively

$CH_3COOH + NH_3 \longrightarrow (A) \xrightarrow{\Delta} (B) + H_2O$

1) CH_3CONH_2, CH_4 2) CH_3COONH_4, CH_3CONH_2
3) CH_3CONH_2, CH_3COOH 4) CH_3NH_2, CH_3CONH_2

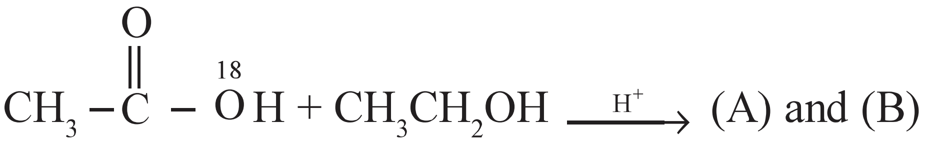
32. Acetic anhydride may be prepared by the reaction of acetic acid with

1) Soda-lime 2) $LiAlH_4$ 3) P_2O_5 4) Na

33. A fruity smell is produced by the reaction of C_2H_5OH with

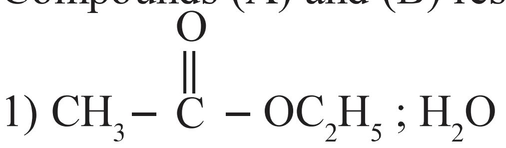
1) PCl_5 2) CH_3COCH_3 3) CH_3COOH 4) NaOH

34. Consider an esterification of isotopically labelled carboxylic acid :

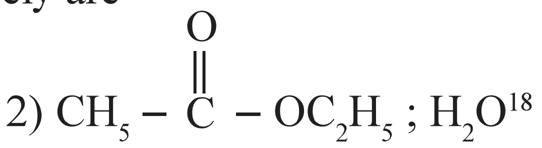


$CH_3-\overset{O}{\overset{\|}{C}}-\overset{18}{O}H + CH_3CH_2OH \xrightarrow{H^+} (A) \text{ and } (B)$

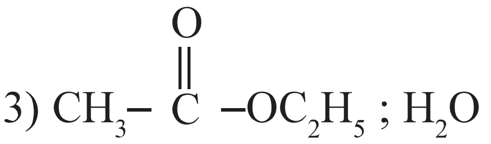
Compounds (A) and (B) respectively are

1) 

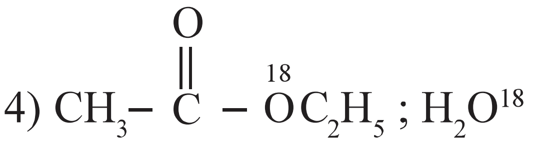
$CH_3-\overset{O}{\overset{\|}{C}}-OC_2H_5\ ;\ H_2O$

2) 

$CH_5-\overset{O}{\overset{\|}{C}}-OC_2H_5\ ;\ H_2O^{18}$

3) 

$CH_3-\overset{O}{\overset{\|}{C}}-OC_2H_5\ ;\ H_2O$

4) 

$CH_3-\overset{O}{\overset{\|}{C}}-\overset{18}{O}C_2H_5\ ;\ H_2O^{18}$

35. The end product in the following series of reactions

is $CH_3COOH \xrightarrow{NH_3} (A) \xrightarrow{\Delta} (B) \xrightarrow{P_2O_5} (C)$

1) CH_4 2) CH_3OH 3) acetonitrile 4) ammonium acetate

36. Hoffmann bromamide or hypobromite reaction is given by

1) amines 2) esters 3) alcohols 4) amides

37. Among the given compounds the most susceptible to nucleopbilic attack at the carbonyl carbon is

1) CH_3COCl 2) CH_3CHO 3) CH_3COOCH_3 4) $CH_3COOCOCH_3$

38. Acetamide produces primary amine with

1) NaOH 2) HCl 3) $NaOH/Br_2$ 4) HgO

KEY

1) 1	2) 3	3) 2	4) 2	5) 1	6) 3	7) 1	8) 4
9) 1	10) 2	11) 3	12) 3	13) 1	14) 3	15) 4	16) 1
17) 2	18) 1	19) 1	20) 3	21) 1	22) 4	23) 2	24) 3
25) 3	26) 1	27) 3	28) 3	29) 4	30) 1	31) 2	32) 3
33) 3	34) 2	35) 3	36) 4	37) 1	38) 3		

Question Bank - IX

1. Aniline is not the major product in one of the following reactions. Identify that reaction

1) $C_6H_5OH + NH_3 \xrightarrow[300^0c]{ZnCl_2}$ 2) $C_6H_5NO_2 +$ Zn powder $\xrightarrow{\text{alcoholic KOH}}$

3) $C_6H_5Cl + NH_3 \xrightarrow[Cu_2O \text{ high pressure}]{200^0}$ 4) $C_6H_5NO_2 + Fe + H_2O \xrightarrow{HCl}$

2. Which of the following is obtained in a carbyl amine reaction ?

1) $C_6H_5NH_2$ 2) $COCl_2$ 3) C_6H_5CN 4) C_6H_5NC

3. Most basic among the following is

1) benzyl amine 2) aniline

3) acetanilide 4) p-nitro aniline

4. In-correct statement about aniline is

1) it is less basic than ethyl amine 2) it is steam volatile

3) on reaction with Na, it gives H_2 4) it is highly soluble in water

5. On reduction, primary amine is formed by

1) 1 -nitroethane 2) ethylnitrite

3) azobenzene 4) ethylcarbylamine

6. Carbylamine reaction is answered by

1) methanamine 2) nitromethane

3) acetamide 4) trimethylamine

7. The sequence of reactions required to convert benzene to p-choronitrobenzene are

1) Nitration followed by treatment with Cl_2 in presence of light

2) Nitration followed by treatment with $Cl_2/AlCl_3$.

3) Chlorination with $Cl_2/AlCl_3$ followed by nitration.

4) Chlorination with $Cl_2/h\vartheta$ followed by nitration.

8. The descending order of boiling points of the following compounds is

a) 1-Butanamine b) N-Ethylethanamine

c) N,N-Dimethyl ethanamine d) n-Butyl alcohol e) iso Pentane

l) d > a > b > c > e 2) d > c > b > a > e

3) a > d > b > c > e 4) a > b > c > d > e

9. In gaseous state, the correct basic strength among the following is

1) $(C_2H_5)_3N>(C_2H_5)_2NH>C_2H_5NH_2>NH_3$

2) $(C_2H_5)_2NH>(C_2H_5)_3N>C_2H_5NH_2>NH_3$

3) $(C_2H_5)_2NH>C_2H_5NH_2>(C_2H_5)_3N>NH_3$

4) $(C_2H_5)_3N>C_2H_5NH_2>(C_2H_5)_2NH>NH_2$

10. An organic compound 'X' with the molecular formula $C_4H_{11}N$ reacts with $C_6H_5SO_2Cl$ and forms die compound 'Y' If 'Y' is soluble in alkali, 'X' may be

1) N-Methyl propanamine 2) N,N-Dimethyl ethanamine

3) 1-Pentanamine 4) Sec-butyl amine

11. $(CH_3)_2NH \xrightarrow{KMnO_4} A$, $(CH_3)_2N \xrightarrow{H_2SO_4} B$. Here A and B are

1) Tetramethylhydrazine, dimethyl hydroxyl amine

2) Dimethylhydroxyl amine, tetramethyl hydrazine

3) Tetramethylhydrazine, Tetramethyl hydrazine

4) Dimethylhydroxyl amine, Dimethyl hydroxyl amine

12. A and B are the compounds with the molecular formula C_3H_9N. These are oxidised by $KMnO_4$ and subjected to hydrolysis. If A gives propanal and B gives propanone, A and B are respectively

1) N-propanamine, 2-propanamine

2) N-methyl ethanamine, 2-propanamine

3) Isopropyl amine, N-methyl ethanamine

4) N-methyl ethanamine, trimethyl amine

13. An organic compound 'X' gives foul odour on heating with $CHCl_3$ and alc.KOH. Correct statements) among the following is (are)

b) 'X' reacts with $C_6H_5SO_2Cl$ give a compound which is insoluble in alkali

b) 'X' on reaction with CS_2 followed by treatment with $HgCl_2$ gives a mustard oil smell compound

3) 'X' on oxidation with $KMnO_4$ followed by hydrolysis gives a carbonyl compound

1) a, b and c are correct 2) b and c are correct

2) only a and b are correct 3) only b is correct

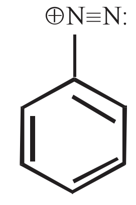
14. $R{-}NC + HgO \longrightarrow Hg + X$. Here, the compound X is

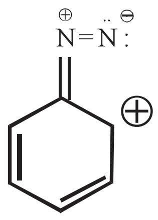
1) R – ONC 2) R – CON 3) R – CNO 4) R – NCO

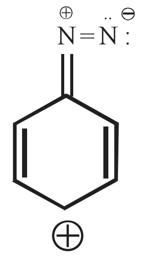
15. Which one of the following is water insoluble and stable at room temperature ?

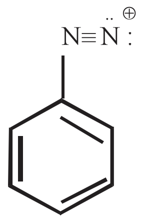
1) $C_6H_5N_2Cl$ 2) $C_6H_5N_2HSO_4$ 3) $C_6H_5N_2BF_4$ 4) $C_6H_5N_2Br$

16. Among the following incorrect resonance structure of benzene diazonium ion is

1) 

2) 

3) 

4) 

17. $C_6H_5N_2Cl + C_6H_5OH \xrightarrow{OH^-}$

Correct statement among the following

1) 'X' is an yellow dye

2) The reaction is electrophilic substitution in $C_6H_5N_2Cl$

3) The reaction is electrophilic substution in phenol

4) The reaction is nucleophilic substituion in phenol

I8. $C_6H_5N_2Cl + X + H_2O \longrightarrow C_6H_6 + N_2 + Y + HCl$. Here X and Y are respectively

1) H_3PO_3, H_3,PO_4 2) H_3PO_2, H_3PO_3

3) H_3PO_2, H_3PO_4 4) H_3PO_3, H_3PO_2

19. I) $C_6H_5N_2Cl \xrightarrow{CuCl/HCl} C_6H_5Cl + N_2$

II) $C_6H_5N_2Cl \xrightarrow{Cu/HCl} C_6H_5Cl + N_2 \bullet CuCl$

Incorrect statement among the following is

1) Reaction ‘I’ is Sandmeyers reaction

2) Reaction ‘II’ is Gattermann reaction

3) Yield of chlorobenzene is more in reaction ‘II’

4) Yied of chlorobenzene is more in reaction ‘I’

20. Benzamide can be converted into aniline by the action of

1) Br_2/CCl_4 2) Br_2/water 3) Br_2/KOH 4) Br_2/red P

21. The process that does not yield an amine is

1) action of ammonia on RX 2) reduction of aldoxime with Na/alcohol

3) acid hydrolysis of alkyl cyanide 4) reduction of amide with LAH

22. Among different aliphatic amines, correct order of basic strengths in vapour state is

1) $3^\circ > 2^0 > 1^\circ$ 2) $1^\circ > 2^\circ > 3^\circ$ 3) $2^\circ > 1^\circ > 3^\circ$ 4) $3^\circ > 1^\circ > 2^\circ$

23. Conversion of a primary amide into a primary amine is called

1) Gabriel’s pthalimide reaction 2) Hoffmann bromamide reaction

3) Carbyl amine reaction 4) Hinsberg’s reaction

24. Ethanamine can be obtained from methyl iodide by the action of alc.KCN followed by

1) hydrolysis 2) oxidation 3) reduction 4) action of NH_3/heat

25. The following amide does not undergo Hoffmann’s degradation

A) Propionamide B) N-methyl butanamide

C) Butanamide D) N,N-dimethyl butanamide

1) D only 2) C only 3) C and D 4) B and D

26. Incorrect statement among the following is

I) $LiAH_4$ can reduce an amide into amine without change in the number of carbon atoms

II) a primary amide can be reduced to a primary amine by Br_2/KOH with same number of carbons

III) a primary amide can be reduced to a primary amine by $LiAlH_4$ with (n-1) carbon atoms

IV) Hoffmann’s bromamide reaction is useful to prepare aniline from benz amide

1) II only 2) I only 3) III and IV 4) II and III

27. N,N-dimethyl ethanamide on reduction with $LiAlH_4$ gives

1) N-methylethanamine 2) N, N-dimethylethanamine

3) ethanamine 4) trimethyl amine

28. Most reactive towards electrophiilic substitution is

1) aniline hydrochloride 2) aniline

3) nitro benzene 4) N-acetyl aniline

29. On reduction, primary amine is formed by
1) nitroethane 2) ethylnitrite 3) azobenzene 4) ethylcarbyl amine

30. Butanone oxime on reduction with Na / C_2H_5OH gives
1) 3° amine 2) 1° amine 3) 2° amine 4) 4° amine

31. Which of the following groups will increase basic strength of aniline?
1) $-NO_2$ in ortho or para 2) -CHO in ortho or para
3) $-SO_3H$ in ortho or para 4) -OH in ortho or para

32. Aniline gives meta derivative as major product with
1) CH_3COCl/pyridine 2) $HNO_3+H_2SO_4$
3) Br,/water 4) CH_3Cl/pyridine

33. Bromination of aniline in acid medium results as major product
1) 2,4,6-tri bromo aniline 2) 3-bromo aniline
3) 2-bromo aniline 4) 4-bromo aniline

34. Ethyl amine can be distingished from aniline by
1) Tollens' reagent 2) Schiff's reagent
3) Azodye test 4) Carbylamine test

35. Which of the following on Hoffmann's bromamide reaction gives alkanamine?
1) RCH_2NH_2 2) RCONHR' 3) $RCONH_2$ 4) $RCOONH_4$

36. A mixture of three amines A,B and C is treated with benzene sulphonyl chloride and filtered. B is obtained in the filterate. The mixture containing A and C is treated with KOH so that A becomes soluble while C does not. Now, A,B and C are
1) aliphatic primary, secondary and tertiary
2) aliphatic secondary, tertiary and primary
3) aliphatic primary, tertiary and secondary
4) aliphatic tertiary, secondary and primary

37. Match the following:

Set-A	Set-B
1) acetanilde	A) acidic
2) benzonitrile	B) basic
3) trimethyl amine	C) neutral
4) phenol	

	1	2	3	4		1	2	3	4
1)	C	C	B	A	2)	B	C	C	A
3)	C	B	B	C	4)	A	A	C	B

38. Dye test is used to distinguish
1) ethanamine and methanamine 2) methanamine and propanamine-1
3) benzenamine and ethanamine 4) urea and acetanilide

39. Aniline is
1) more basic than ammonia 2) more basic than p-amino phenol
3) more basic than p-nitro aniline 4) as basic as methyl amine

40. Acetanilide on nitration followed by hydrolysis yields — as main product.
1) 4-nitro aniline 2) 2,4,6-trinitro aniline
3) 2-nitro aniline 4) 4-nitro aniline

41. Among the following, strongest base is
1) aniline 2) p-nitro aniline 3) m-nitro aniline 4) benzyl amine

42. Phenyl isocyanides are prepared from which of the following reaction?
1) Rosenmund's reaction 2) Carbylamine reaction
3) Reimer - Tiemann 4) Wurtz reaction

43. Gabriel synthesis is used for the preparation of
1) Primary aromatic amines 2) Primary aliphatic amines
3) Secondary amines 4) Tertiary amines

44. Hydrolysis of acetonitrile in acidic medium gives
1) CH_3CH_2OH 2) CH_3NC
3) CH_3CH_2CHO 4) CH_3COOH

45. Alkyl isocyanide on reduction with Zn - Hg / HC*l* / gives
1) Primary amine 2) Tertiary amine
3) N- Alkyl alkanamine 4) N - Methyl alkanamine

46. Cyanide is an
1) Zwitter ion 2) Cation
3) Ambident nulceophile 4) Electrophile

47. Match the following

List - I	List- II
A) Conversion of amide to amine	1) Hinsberg reagent
B) $C_6H_5SO_2Cl$	2) Hoffmann's bromamide reaction
C) Conversion of primary amine to isocyanide	3) Hoffmann's method
D) Diethyl oxalate	4) Carbylamine reaction
	5) Hoffmann mustard oil reaction

The correct match is

	A	B	C	D
1)	2	1	4	3
2)	2	3	4	1
3)	1	5	4	2
4)	3	4	1	2

48. Which of the following reagents can be used to prepare ethyl carbylamine (as a major product) from ethyl iodide
1) HCN 2) KCN 3) CuCN 4) AgCN

49. Treatment of ammonia with excess of ethyl chloride will yield
1) diethylamine 2) methylamine
3) tetraethylammoniumchloride 4) ethane

50. With of the following method is generally employed for the separation of primary, secondary and tertiary amines ?
1) Fractional distillation 2) Hinsberg's method
3) Hoffmann's method 4) Filtration

KEY

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

Question Bank - X

SET - I

1) Both A & R are true and R is the correci explanation of A
2) Both A & R are true but R is not the correct explanation of A
3) A is true, R is false
4) A is false, R is true

1. (A) : Carbylamine reaction involves chemical reaction between primary amines, chloroform in basic medium.
   (R) : In carbylamine reaction, - NH_2 group changes into - NC group.
2. (A) : In strong acidic solutions aniine becomes more reactive toward electrophilic reagents.
   (R) : The amino group is completely protonated in strong acidic solution, the pair of electrons on the nitrogen no longer available for resonance.
3. (A): Methyl isocyanide can be easily hydrolysed by acids but not by alkalies.
   (R): The carbon atom of isocyinide group in methyl isocyanide carried a negative charge which readily accept the proton and repels the OH^- ion.
4. (A) : Aniline does not undergo Friedal-Crafts reaction.
   (R) : $-NH_2$ group of aniline reacts with $A1C1_3$.
5. (A) : Isocyanides are prepared by carbylamine reaction.
   (R) : Carbylamine on reduction aljways gives 2° amines.
6. (A) : Aniline is a weak Lewis base than benzylamine.
   (R) : In aniline, there is mesomeric effect between benzene ring and amino group.
7. (A) : Cyclohexanamine is more basic than aniline.
   (R) : pK_b of cyclohexanamine is less than that of aniline.
8. (A) : With Br_2 water, aniline giyes 2,4,6- tribromoaniline.
   (R) : In aniline, NH_2 group is ring activating and ortho and para directing group.

SET - II

1) Both A and R are true and R is me correct explanation of A
2) Both A and R are true but R is not the correct explanation of A
3) A is true but R is false
4) Both A and R are false

9. (A) : Aniline reacts with $CHC1_3$ in alcoholic KOH solution to give phenyl isocyanide.
(R) : Aniline is a primary aromatic amine.

10. (A) : Aromatic diazonium salts are stable.
(R) : Benzene diazonium ion is stabilised by resonance .

1 l. (A) : Only a small amount of HC1 is required in the reduction of nitro compounds with iron scrap and HC1 in the presence of steam.
(R) : $FeCl_3$ formed gets hydrolysed to release HC1 during the reaction.

12. (A) : Acetanilide is less basic than aniline.
(R) : Acetylation of aniline results in decrease of electron density on nitrogen.

13. (A) : Methyl cyanide has higher boiling point than methyl isocyanide.
(R) : Both alkyl cyanides and isocyanides are soluble in C_6H_6.

14. (A) : Anilinehydrogensulphate on heating forms p-aminobenzenesulphonic acid.
(R) : The sulphonic acid group is electron- withdrawing and ring deactivating group.

KEY

1) 2 2) 1 3) 1 4) 1 5) 2 6) 1 7) 2 8) 1
9) 1 10) 1 11) 2 12) 2 13) 2 14) 2