SURE SHOT OF XII CHEMISTRY

1 MARK QUESTIONS

1. What are f-centres?
Ans- The free electron trapped in the anionic vacancies are called F-centres.

2. Name one solid in which both frenkel and schottky defects occur.
Ans- AgBr

3. Why is vapour pressure of a solution of glucose in water lower than that of water?
Ans- This is due to decrease in escaping tendency of water molecules from the surface of solution as some of surface area is occupied by non- volatile solute particles such as glucose.

4. Why is glycol and water mixture used in a car radiators in cold countries?
Ans- Ethylene glycol lowers the freezing point of water, due to this, coolant in radiators will not freeze. Otherwise radiators will burst due to freezing of coolant.

5. What is the function of salt bridge?
Ans- It completes the circuit in the electrochemical cell and maintains electrical neutrality.
6. Write any two advantages of fuel cells.
Ans-(I) they do not cause any pollution.
(ii) They have high efficiency of 60-70%

7. What will be the effect of temperature on rate constant?
Ans- Rate constant of the chemical reaction increase with the raise of temperature. It is observed that the rate constant of a reaction is nearly doubled when the temperature increased by 10°C.

8. Give an example of pseudo first order reaction.

Ans- acid catalyzed hydrolysis of an ester.

$$CH_3COOC_2H_5 + H_2O \xrightarrow{H^+} CH_3COOH + C_2H_5OH$$

$$\text{Rate} = k_3 [\, CH_3COOC_2H_5] [H_2O]^0$$

9. What do you mean by the term electrophoresis?
Ans. The movement of colloidal particles under an applied electric potential is called electrophoresis.
10. Define gangue.
Ans - The undesirable materials present in ore are known as gangue.
11. What is meant by term pyrometalurgy?
Ans- The process of extracting the metal by heating the metal oxide with a suitable reducing agent is called pyrometalurgy.
12. PH3 has lower boiling point than NH3, Why?
Ans unlike NH3, PH3 molecules are not associated through hydrogen bonding in liquid state. That is why the boiling point of PH3 is lower than NH3.
13. Why are Inter Halogen compounds more reactive than Halogens?
Ans Inter halogen compounds are more reactive than halogens because the X-X bond in inter halogen compounds is weaker than the X-X bonds in halogen compounds.
14. Name the lanthenoid element which exhibit +4 oxidation state.
Ans- Cerium
15. Why does actinoids show variable oxidation states?
Ans- Due to small difference of energy of 6d, 5f, and 7s orbitals

16. Write IUPAC name of $[Co\ Cl_2\ (en)(NH_3)]+$

Ans- amminedichloridoethylenediammine cobalt (III) ion.

17. What is spectrochemical series?

Ans- a series in which ligands are arranged in the order of increasing field strength or in order of increasing magnitude of splitting the produce.

The order is: $I^- < Br^- < S^{2-} < SCN^- < Cl^- < F^- < OH^- < C_2O_4^{2-} < H_2O < NCS^- < NH_3 < en < NO_2^- < CN^- < CO$

18.Why are halo alkanes more reactive than haloarenes?.

Ans. In haloarenes, there is double bond character between carbon and halogen due to resonance effect which makes it less reactive.

(ii)In benzene, carbon atom is sp2 hybridised which is shorter than sp3 present in halo alkanes. Hence C-Cl bond in aryl halides is shorter and stronger.

19. Why do halo alkanes undergo nucleophillic substitution where as haloarenes undergo electophillic substitution.
Ans. Due to more electro negative nature of halogen atom in halo alkanes carbon atom becomes slightly positive and is easily attacked by nucleophillic reagents. While in halo arenes due to resonance, carbon atom becomes slightly negative and attacked by electrophillic reagents

20. While separating a mixture of *ortho* and *para* nitrophenols by steam distillation, name the isomer which will be steam volatile. Give reason.
Ans : Intramolecular H-bonding is present in *o*-nitrophenol. In *p*-nitrophenol, the molecules are strongly associated due to the presence of intermolecular bonding. Hence, *o*-nitrophenol is steam volatile.

21. Explain why is *ortho* nitrophenol more acidic than *ortho* methoxy phenol?
Ans: The nitro-group is an electron-withdrawing group. The presence of this group in the ortho position decreases the electron density in the O−H bond. As a result, it is easier to lose a proton.

22. Phenoxide ion has more no. of resonating structures than carboxylate ion, carboxylic acid is a stronger acid why?
Ans:- The phenoxide ion has non equivalent resonance structures in which– vecharge is at less electro negative C atom and +ve charge as at more electronegative O-atom.
In carboxylate ion –ve charge is delocalized on two electronegative O-atoms hence resonance is more effective and a stronger acid

23.Why Carboxylic acid have higher boiling point than alcohols as alcohol forms strongest intermolecular hydrogen bonding?
Ans. As Carboxylic acid forms adimer due to which their surface area increases and forms strong intermolecular H-bonding. It is having higher boiling point than alcohols

24.Arrange the following in decreasing order of the basic strength:
C6H5NH2,C2H5 NH2,(C2H5)2NH,NH3
Ans. The decreasing order of basic strength of the above amines and ammonia follows the following order:
(C2H5)2NH >C2H5NH2>NH3>C6H5NH2

25.Which forces are responsible for the stability of α-helix? Why is it named as 3.613 helix?
Ans.Hydorgen bonds between–N-Hand—C=O groups of peptide bonds give stability to the structure. It is known as3.613 helix, since each turn of helix has approximately 3.6 amino acid residue and a 13 member ring is formed by hydrogen bonding

26.How do you explain the amphoteric behaviour of amino acids?
Ans. Amino acids have both acidic as well as basic group and they react both with acids as well as bases, therefore they are amphoteric in nature

27.What do you understand by glycosidic linkage?
Ans. During condensation of two monosaccharides, a water molecule given out and two monosaccharides get linked together by an oxide or ethereal linkage (—O—) called as glycosidic linkage.

28.Name polysaccharides that make up starch and what is the difference between them.
Ans. Amylose which is linear polymer of α-glucose and amylopectin which is branched polymer of α-glucose.Amylose is water soluble where as amylopectine is water insoluble.

29.Which α-helix or β-helix is more stable?
Ans. α-helix is right handed and is more stable due to intermolecular H bonding between first and fourth amino acid.

30. The sequence of bases in one strand of DNA is TACGGACAT. What is the sequence of bases of complementary strand of DNA.
Ans. ATGCCTGTA.

31 Name the vitamin whose deficiency causes rickets?
Ans. Vitamin D.

32. Name a polymer used to make unbreakable crockery.
Ans Melamine –formaldehyde polymer.

33. Name the main constituents of Dettol.
Ans Chloroxy lenol and terpeinol.

34. What are tranquilizers? Give an example.
Ans-They is the drug used in stress, mild severe mental disease.

2 MARKS QUESTIONS

35. (a)What happens when a Ferromagnetic or Ferrimagnetic solid is heated ?
(b)What are the coordination numbers of hcp and ccp?
Ans (a)It changes into paramagnetic at hight temperature due to randomization of spins.
(b)12

36.Classify each of the following as either a p-type or n-type semiconductor:
(a) Ge dopped with In (b) B dopped with Si
Ans (a) p-type (b) n- type

37. How many atoms can be assigned to its unit cell in an element from
(a) Body centred cubic cell (b)face –centred cubic cell
Ans- (a) 2 (b)4

38. State Henry's law and mention some important applications?
Henry's law : The solubility of a gas in a liquid is directly proportional to the pressure of the gas

Applications of Henry's law :
(i) In the production of carbonated beverages (as solubility of $CO2$ increases at high pressure)
(ii) In the deep sea diving
(iii) In the function of lungs
(iv) For climbers or people living at high altitudes.

39. Differentiate between ideal and non ideal solutions.

Ans-

Ideal solutions	**Non-ideal solutions**	
	Positive deviation from Raoult's law	**Negative deviation from Raoult's law**
1.Obey Raoult's law at every range of concentration.	1. Do not Obey Raoult's law.	1. Do notObey Raoult's law.
2.ΔHmix = 0; neither is evolved nor absorbed during dissolution.	2.ΔHmix >0; Heat is absorbed during dissolution.	2.ΔHmix < 0; Heat is evolved during dissolution.
3.$P_T = p_A + p_B = p_A^0X_A + p_B^0X_B$	3.$P_T > p_A + p_B$	3.$P_T < p_A + p_B$
4. A—A, A—B, B—B interactions should be same, i.e., 'A' and 'B' are identical in shape, size and character. Examples: dilute solutions, benzene + toluence, n-hexane + n-heptane;	4. A—B attractive force should be weaker than A—A and B—B attractive forces. 'A' and 'B' have different shape, size and character. Examples: acetone + ethanol water + ethanol, CCl4 + CHCl3	4. A—B attractive force should be greater than A—A and B—B attractive forces. 'A' and 'B' have different shape, size and character. Examples: acetone + aniline; acetone + chloroform, H2O + HNO3

40. The conductivity of 0.20 M solution of KCl at 298 K is 0.0248 Scm^{-1}. Calculate its molar conductivity.

Answer:

Given, k = 0.0248 S cm^{-1}

c = 0.20 M

Molar conductivity, $A_m = (k \times 1000) / c$

= 0.0248 x1000 / 0.20
124 $Scm^2\ mol^{-1}$

41. How much charge is required for the following reductions:
(i) 1 mol of Al^{3+} to Al.
(ii) 1 mol of Cu^{2+} to Cu.

Answer: (i) $Al^{3+} + 3e^- \rightarrow Al$
Required charge = 3 F
= 3 × 96487 C = 289461 C

(ii) $Cu^{2+} + 2e^- \rightarrow Cu$
Required charge = 2 F
= 2 × 96487 C
= 192974 C

42. Time required to decompose $SO_2Cl_2$to half of its initial amount is 60 minutes. If the decomposition is a first order reaction, calculate the rate constant of the reaction.
Answer: We know that for a 1st order reaction,

$t½ = 0.693 / k$
It is given that $t_{1/2}$= 60 min
k = 0.693 / $t½$
= 0.693 / 60
= 0.01155 min^{-1}
= 1.155 min^{-1}
Or
k = 1.925 x 10^{-4} s^{-1}

43. The rate law for the reaction: ester + H^+ ----------→ acid + alcohol is:
$dx/dt = k\ [ester\ ][\ H^+]^0$

What would be the effect on the rate if (a) concentration of ester is doubled.
(b)concentration of H^+ is doubled.

Ans-(a) ROR becomes doubled (b)(No effect on ROR

44. Write any four points of differences between phyisorption and chemisorption
Ans.

Physical adsorption or physorption	Chemical adsorption of chemisorption
1. It arises because of van der Waals' forces. 2. It is not specific in nature. 3. It is reversible in nature. 4. Enthalpy of adsorption is low . 5. Low temperature is favourable for adsorption. It decreases with increase of temperature. 6. No appreciable activation energy is needed. 7. It results into multimolecular layers on adsorbent surface under high pressure.	1. It is caused by chemical bondformation. 2. It is highly specific in nature. 3. It is irreversible. 4. Enthalpy of adsorption is high . 5. High temperature is favourable for adsorption. It increases with the increase of temperature. 6. High activation energy is sometimes needed. 7. It results into unimolecular layer.

45. Explain I) Shape- Selective Catalysis
ii) Coagulation.

Ans i)) Shape- Selective Catalysis : The catalytic reaction that depends upon the pore structure of the catalyst and the size of the reactant and product molecules is called shape-selective catalysis. Zeolites are good shape-selective catalysts.

ii) Coagulation : The process of aggregation of colloidal particles of a sol a into an insoluble precipitate by the addition of some suitable electrolyte is called coagulation.

46. Explain the principle of
(i) Zone Refining
(ii) Vapour Phase Refining

Ans- (i) It is based on the principle that impurities are more soluble in the melt than in the solid state of the metal.

ii) The vapour phase refining is the refining process of metals, in this chemical reaction the metal is converted to a compound, which form vapours, & decomposed to get pure metal at higher temp.

47.(i)What is principle of Froth Floatation process?
(ii) What is the role of depressant? Explain with example.

Ans i) The principle of froth floatation process is that sulphide ores are preferentially wetted by the pine oil, whereas ore is wetted with water.

ii)Depressant is the substance which is used to separate two sulphide ores from one another.

Example-NaCN . In a mixture of ores of ZnS and PbS ,NaCN combines with ZnS to form a complex This prevents the froth formation of ZnS

48. Give reasons:

(i) O_2 molecule has formula O_2 while S has S_8

(ii) N does not form any pentahalide like P

Ans (i) Due to formation of pπ- pπ bond oxygen exists in diatomic form whereas other elements do not.

(ii) Due to absence of vacant d- orbital in nitrogen.

49. Write the formula & structure of noble gas species which are iso structural with ICl_4^- & BrO_3

Ans ICl_4^-- XeF_4- Shape is squire planar

BrO_3^-- XeO_3- Shape is Pyramidal

50. Name the alloy formed by lanthenoid elements. Mention its two important uses.

Ans Misch metal . It is mixture of lanthenoids and iron. It is used in bullet and lighter flint.

51. Complete and balance the following equations:

(i) $MnO_4^- + Fe^{2+} + H^+$ --------→

(ii) $MnO2 + KOH + O_2$----------→

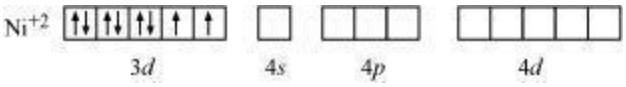
Ans i) $MnO_4^- + 5Fe^{2+} + 8H^+$ --------→ $Mn^{2+} + 5Fe^{3+} + 4H_2O$

ii) $2MnO2 + 4KOH + O_2$----------→ $2K_2MnO4 + 2H_2O$

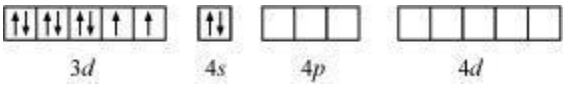
52. $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CO)_4]$ is diamagnetic though both are tetrahedral. Why?

Answer

Though both $[NiCl_4]^{2-}$ and $[Ni(CO)_4]$ are tetrahedral, their magnetic characters are different. This is due to a difference in the nature of ligands. Cl^- is a weak field ligand and it does not cause the pairing of unpaired 3d electrons. Hence, $[NiCl_4]^{2-}$ is paramagnetic.



In $Ni(CO)_4$, Ni is in the zero oxidation state i.e., it has a configuration of $3d^8\ 4s^2$.



But CO is a strong field ligand. Therefore, it causes the pairing of unpaired *3d* electrons. Also, it causes the *4s* electrons to shift to the 3d orbital, thereby giving rise to sp^3 hybridization. Since no unpaired electrons are present in this case, $[Ni(CO)_4]$ is diamagnetic.

53. Give evidence that $[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5SO_4]Cl$ are ionization isomers.

Answer

When ionization isomers are dissolved in water, they ionize to give different ions. These ions then react differently with different reagents to give different products.

$$[CO(NH_3)_5Cl]SO_4 + Ba^{2+} \longrightarrow BaSO_4\downarrow$$

White precipitate

$$[CO(NH_3)_5Cl]SO_4 + Ag^{+} \longrightarrow \text{No reaction}$$

$$[CO(NH_3)_5SO_4]Cl + Ba^{2+} \longrightarrow \text{No reaction}$$

$$[CO(NH_3)_5SO_4]Cl + Ag^{+} \longrightarrow AgCl\downarrow$$

White precipitate

54. Calculate the overall complex dissociation equilibrium constant for the $Cu(NH_3)_4^{2+}$ ion, given that β_4 for this complex is 2.1×10^{13}.

Answer

$\beta_4 = 2.1 \times 10^{13}$

The overall complex dissociation equilibrium constant is the reciprocal of the overall stability constant, β_4.

$1/\beta_4 = 1 / 2.1 \times 10^{13}$

$= 4.7 \times 10^{-14}$

55.Arrange the following sets of compounds in order of their increasing boiling points:
(a) Pentan-1-ol, butan-1-ol, butan-2-ol, ethanol, propan-1-ol, methanol.
(b) Pentan-1-ol, n-butane, pentanal, ethoxyethane.
Ans
(a) Methanol, ethanol, propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol.
(b) n-Butane, ethoxyethane, pentanal and pentan-1-ol.

56. Arrange the following compounds in increasing order of their acid strength:
Propan-1-ol, 2,4,6-trinitrophenol, 3-nitrophenol, 3,5-dinitrophenol, phenol, 4-methylphenol.
Ans: Propan-1-ol, 4-methylphenol, phenol, 3-nitrophenol, 3,5-dinitrophenol, 2,4, 6-trinitrophenol

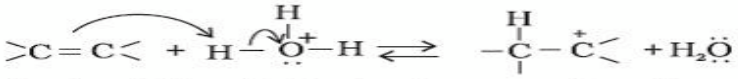
57.Write the mechanism of hydration of ethene to yield ethanol

Mechanism

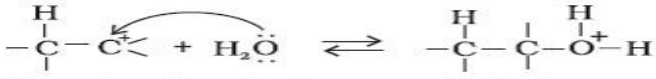
The mechanism of the reaction involves the following three steps:

Step 1: Protonation of alkene to form carbocation by electrophilic attack of H_3O^+.

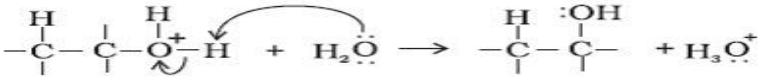
$H_2O + H^+ \rightarrow H_3O^+$



Step 2: Nucleophilic attack of water on carbocation.

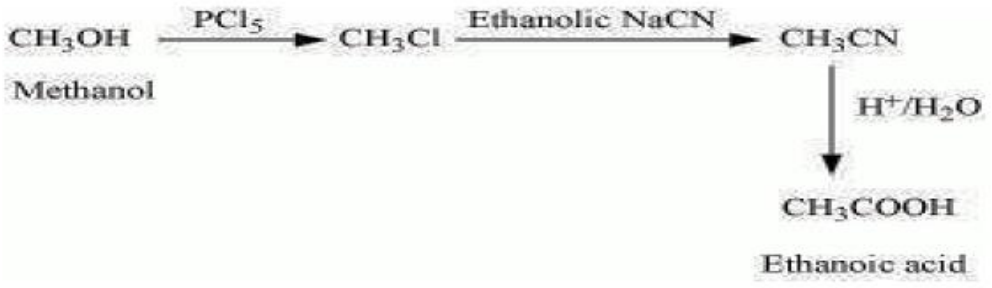


Step 3: Deprotonation to form an alcohol.

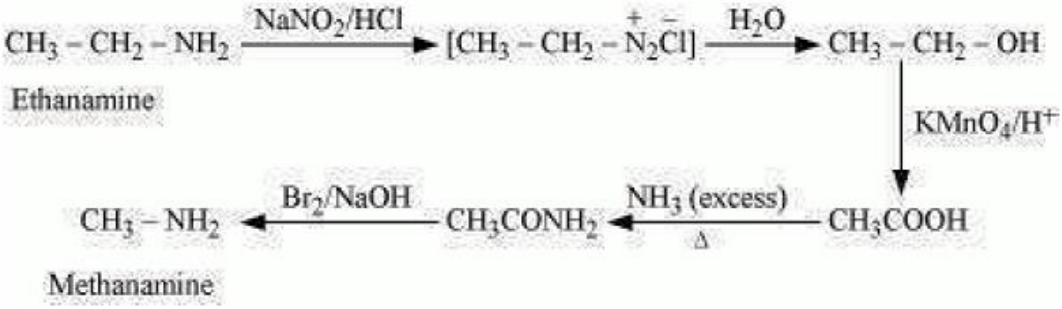


58.How will you convert:
(i) Methanol to ethanoic acid
(ii) Ethanamine into methanamine

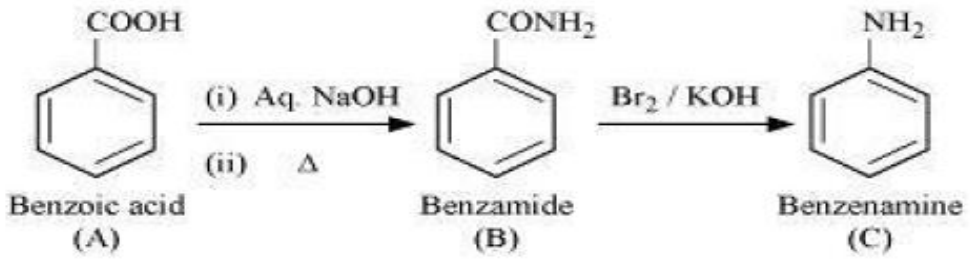
ANS. (i)

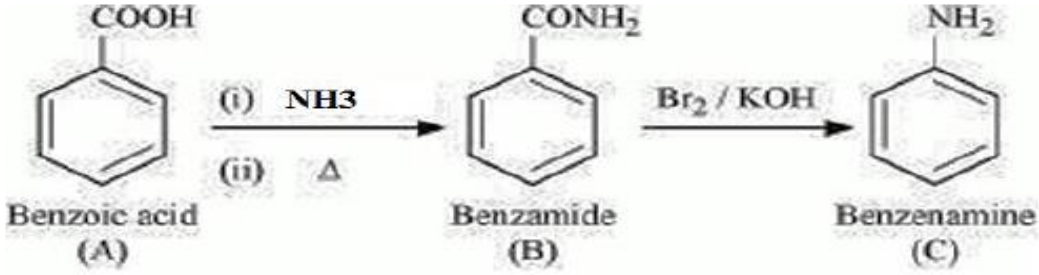


(ii)



59. An aromatic compound Aon treatment with aqueous ammonia and heating forms compound Bwhich on heating with Br2and KOH forms a compoundC of molecular formula C6H7N. Write the structures and IUPAC names of compounds A, B and C.





60.What deficiency diseases are caused due to lack of vitamins B1, B6 and K in human diet.

Ans.

Vitamins	Deficiency Disease
B_1	Beriberi(loss of appetite)
B_6	Convulsions
K	Increased blood clotting time

61.Give the differences between DNA and RNA.

DNA	RNA
1. Pentose sugar is deoxyribose 2. It contains thymine along with adenine, cytosine and guanine as bases. 3. It is responsible for maintaining heredity traits from generation to generation. 4. It is double stranded 5. Mostly seen in nucleus 6. Responsible for the transfer of hereditary characteristics	1. Pentose sugar is ribose. 2. It contains uracil in place of thymine with other bases 3. It is responsible for protein synthesis. 4. It is single stranded 5. Usually seen in the cytoplasm 6. Involved in Protein synthesis is

62.

2. Difference between globular protein and fibrous protein.

GlobularProtein	Fibrous Protein
1. They form α-helix structure. 2. They are water soluble. 3. They involve H bonding.	1. They have β-pleated structure. 2. They are water insoluble. 3. They have strong intermolecular forces of attraction.

63. Distinguish between the terms homopolymer and copolymer with an example of each .

Ans Homo-polymer →Polymer of a single monomeric species. Example : Polythene , PVC

Co-polymer→ Polymer of more than one monomer .Example : Nylon6,6 & Bakelite

64. What are biodegradable polymers?

Name the monomers of PHBV .Give its uses.

Ans Biodegradable polymers are polymers which can be decomposed by micro-organisms in the environment. Example PHBV and Nylon 2,6 .
Monomers of PHBV are 3-Hydroxybutanoic acid and 3-Hydroxypentanoic acid
Uses : Specialty packaging, orthopedic devices, In controlled drug release

65.What are thermoplastics and thermosetting plastics ? Explain giving example.
Ans Thermoplastics: Linear or slightly branched / capable of repeatedly softening on heating and hardening on cooling. Example : Polythene, Polystyrene, Polyvinyls, etc
Thermosetting plastics : Cross linked or heavily branched molecules, / on heating undergo extensive cross linking in moulds and again become infusible. These cannot be reused. Examples : Bakelite, Urea-formaldelyde resins.
66. What is artificial sweetening agent? Give two examples?
Ans-The substances which give sweetening to food but don't add calorie to our body.
67. 2 Define the following and give one example- (i)Antipyretics (ii) Antibiotics
Ans- (i) Antipyretics- Those drugs which reduce the temperature of feveral body are called
Antipyretics. Eg - Paracetamol

(ii)Antibiotics-The drugs which prevent the growth of other micro-organisms.
Eg- Pencillin

3 MARKS QUESTIONS

68. An element with molar mass 2.7×10-2 kg mol-1 forms a cubic unit cell with edge length 405 pm. If its density is 2.7×103 kg m-3, what is the nature of the cubic unit cell?

Solution:
By knowing the number of atom in the cubic unit cell of given lattice, its nature can be determined.

$$Given, d\ (density) = 2.7 \times 10^3\ kg\ m^{-3}, M(molar\ mass) = 2.7 \times 10^{-2}\ kg\ mol^{-1}\ and$$

$$edge\ (a) = 405\ pm = \frac{405}{1000000000000} = 405 \times 10^{-12}\ m$$

$$Therefore, z\ (number\ of\ atom) = ?$$

$$We\ know\ that, d = \frac{z \times M}{a^3 \times N_A}$$

$$\Rightarrow 2.7 \times 10^3\ kg\ m^{-3} = \frac{z \times 2.7 \times 10^{-2}\ kg\ mol^{-1}}{(405 \times 10^{-12}\ m)^3 \times 6.022 \times 10^{23}}$$

$$\Rightarrow z = \frac{2.7 \times 10^3\ kg\ m^{-3} \times (405 \times 10^{-12}\ m)^3 \times 6.022 \times 10^{23}}{2.7 \times 10^{-2}\ kg\ mol^{-1}} = 4$$

$$Since, number\ of\ atom\ in\ the\ unit\ cell\ of\ the\ given\ element = 4,$$

$$Thus\ the\ lattice\ is\ cubic\ close\ packed\ (ccp)$$

69. Copper crystallises into a fcc lattice with edge length 3.61×10^{-8} cm. Show that the calculated density is in agreement with its measured value of 8.92 g cm^{-3}.

Solution:

$$Given, edge\ lenght\ (a) = 3.61 \times 10^{-8} cm$$

$$Given\ lattice\ is\ fcc, \therefore no.\ of\ atoms\ per\ unit\ cell\ (z) = 4$$

$$We\ know, atomic\ mass\ of\ copper = 63.5\ g/mol$$

$$Avogadro's\ Number\ (N_A) = 6.022 \times 10^{23} g/mol$$

$$To\ prove, density(d) = 8.92\ g\ cm^{-3}$$

$$We\ know\ that, density\ (d) = \frac{zM}{a^3 N_A}$$

$$\Rightarrow d = \frac{4 \times 63.5\ g\ mol^{-1}}{(3.61 \times 10^{-8}\ cm)^3 \times 6.022 \times 10^{23}\ g\ mol^{-1}}$$

$$\Rightarrow d = \frac{254}{47.0458 \times 10^{-24} \times 6.022 \times 10^{23}\ cm^3}$$

$$\Rightarrow d = \frac{254}{283.30 \times 10^{-1} cm^3} = \frac{2540}{283.30\ cm^3}$$

$$\Rightarrow d = 8.9657 cm^{-3}$$

$$Hence\ calculated\ density \approx 8.96\ cm^{-3}$$

70.Aluminium crystallises in a cubic close-packed structure. Its metallic radius is 125 pm.
(i) What is the length of the side of the unit cell?
(ii) How many unit cells are there in 1.00 cm^3 of aluminium?

Solution: Given, radius of atom (r) = 125

$$r = \frac{a}{2\sqrt{2}}$$

$$Where, r = radius\ and\ a = lenght\ of\ side$$

$$\Rightarrow 125\ pm = \frac{a}{2\sqrt{2}}$$

$$\Rightarrow a = 125 \times 2\sqrt{2}\ pm$$

$$\Rightarrow a = 125 \times 2 \times 1.414\ pm$$

$$\Rightarrow a = 353.5\ pm$$

pm

(i) For ccp structure, we know that

(ii) Volume of 1 unit cell = a^3

$$= (353.5 \times 10^{-3} cm)^3$$

$$= 44192902.36 \times 10^{-30} cm^3$$

$$\approx 442 \times 10^{-25} cm^3$$

Thus, number of unit cell of aluminium in 1 cm^3

$$= \frac{1 cm^3}{442 \times 10^{-25} cm^3}$$

$$\approx 2.27 \times 10^{22} unit\ cell$$

71. The vapour pressure of water is 12.3 kPa at 300 K. Calculate vapour pressure of 1 molal solution of a non-volatile solute in it.
Solution :

1 molal solution means 1 mol of the solute is present in 1000 g of the solvent (water).

Molar mass of water = 18 g mol^{-1}

∴ Number of moles present in 1000 g of water = 1000/18

= 55.56 mol

Therefore, mole fraction of the solute in the solution is
$x_2 = 1 / (1+55.56) = 0.0177$.
It is given that,
Vapour pressure of water, $p_1^0 = 12.3$ kPa
Applying the relation, $(P_1^0 - P_1) / P_1^0 = X_2$
$\Rightarrow (12.3 - p_1) / 12.3 = 0.0177$
$\Rightarrow 12.3 - P_1 = 0.2177$
$\Rightarrow p_1 = 12.0823$
= 12.08 kPa (approximately)
Hence, the vapour pressure of the solution is 12.08 kPa.

72. Vapour pressure of pure water at 298 K is 23.8 mm Hg. 50 g of urea (NH_2CONH_2) is dissolved in 850 g of water. Calculate the vapour pressure of water for this solution and its relative lowering.

Answer
It is given that vapour pressure of water, $P_I^o = 23.8$ mm of Hg
Weight of water taken, $w_1 = 850$ g
Weight of urea taken, $w_2 = 50$ g
Molecular weight of water, $M_1 = 18$ g mol^{-1}
Molecular weight of urea, $M_2 = 60$ g mol^{-1}
Now, we have to calculate vapour pressure of water in the solution. We take vapour pressure as p_1.
Now, from Raoult's law, we have:

$$\frac{p_1^0 - p_1}{p_1^0} = \frac{n_2}{n_1 + n_2}$$

$$\Rightarrow \frac{p_1^0 - p_1}{p_1^0} = \frac{\frac{w_2}{M_2}}{\frac{w_1}{M_1} + \frac{w_2}{M_2}}$$

$$\Rightarrow \frac{23.8 - p_1}{23.8} = \frac{\frac{50}{60}}{\frac{850}{18} + \frac{50}{60}}$$

$$\Rightarrow \frac{23.8 - p_1}{23.8} = \frac{0.83}{47.22 + 0.83}$$

$$\Rightarrow \frac{23.8 - p_1}{23.8} = 0.0173$$

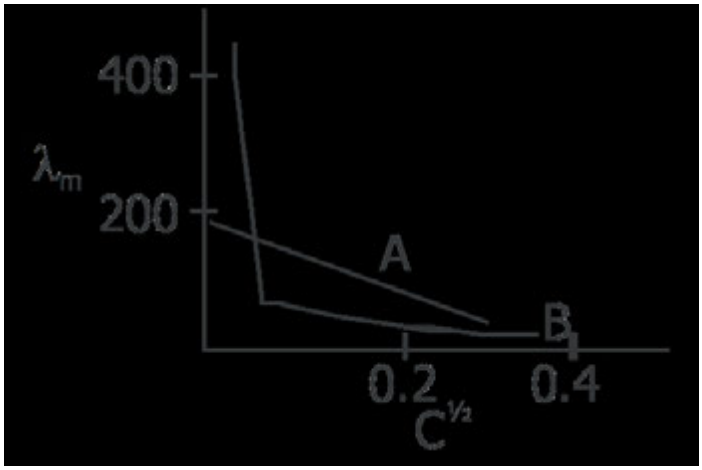
$$\Rightarrow p_1 = 23.4 \text{ mm of Hg}$$

Hence, the vapour pressure of water in the given solution is 23.4 mm of Hg and its relative lowering is 0.0173.

73. The following curve is obtained when molar conductivity (m) is plotted against the square root of concentration for 2 electrolytes A and B.

(a) What can you say about the nature of the two electroyltes A and B ?

(b) How do you account for the increase in molar conductivity m for the electrolytes A and B on dilution ? Describe the charactristics of variation of molar conductivity with dilution for strong and weak electrolytes



Ans. (a) A is a strong electrolyte and B is a weak electrolyte.

(b) Molar conductivity of a strong electrolyte (A) increases with dilution as ionic mobility increases. In a weak electrolyte molar conductivity increases steeply with dilution as degree of dissociation increases and hence no. of ions increases.

82. The molar conductivity of 0.025 mol L-1 methanoic acid is

46.1 S cm2 mol^{-1}. Calculate its degree of dissociation and dissociation constant. Given $\lambda^0(H+)$

= 349.6 S cm^2 mol^{-1} and $\lambda^0(HCOO^-)$ = 54.6 S cm^2 mol

Answer:

C = 0.025 mol L^{-1}

$$\Lambda_m = 46.1\ \text{S cm}^2\ \text{mol}^{-1}$$
$$\lambda^0\left(H^+\right) = 349.6\ \text{S cm}^2\ \text{mol}^{-1}$$
$$\lambda^0\left(HCOO^-\right) = 54.6\ \text{S cm}^2\ \text{mol}^{-1}$$
$$\Lambda_m^0\left(HCOOH\right) = \lambda^0\left(H^+\right) + \lambda^0\left(HCOO^-\right)$$
$$= 349.6 + 54.6$$
$$= 404.2\ \text{S cm}^2\ \text{mol}^{-1}$$

Now, degree of dissociation:

$$\alpha = \frac{\Lambda_m\left(HCOOH\right)}{\Lambda_m^0\left(HCOOH\right)}$$
$$= \frac{46.1}{404.2}$$
$$= 0.114\left(\text{approximately}\right)$$

Thus, dissociation constant:

$$K = \frac{c\,\alpha^2}{(1-\alpha)}$$

$$= \frac{(0.025\,\text{mol L}^{-1})(0.114)^2}{(1-0.114)}$$

$$= 3.67\times10^{-4}\,\text{mol L}^{-1}$$

74.The following data were obtained during the first order thermal decomposition of SO_2Cl_2at a constant volume.

$SO_2Cl_{2(g)} \rightarrow SO_{2(g)} + Cl_{2(g)}$

Experiment	Time/s^{-1}	Total pressure/atm
1	0	0.5
2	100	0.6

Calculate the rate of the reaction when total pressure is 0.65 atm.

Solution: The thermal decomposition of SO_2Cl_2at a constant volume is represented by the following equation.

	$SO_2Cl_{2(g)}$	$\longrightarrow$	$SO_{2(g)}$	+	$Cl_{2(g)}$
At $t = 0$	P_0		0		0
At $t = t$	$P_0 - p$		p		p

After time, t, total pressure,$P_t = (P_\circ - p) + p + p$
$\Rightarrow P_t = (P_\circ + p)$
$\Rightarrow p = P_t - P_\circ$
therefore, $P_\circ - p = P_\circ - P_t - P_\circ$
$= 2\,P_\circ - P_t$
For a first order reaction,
$k = 2.303/t\ \text{Log}\ P_\circ / P_\circ - p$
$= 2.303/t\ \text{Log}\ P_\circ / 2\,P_\circ - P_t$

When t= 100 s,
k = 2.303 / 100s log 0.5 / 2x0.5 - 0.6

$= 2.231 \times 10^{-3} s^{-1}$

When Pt= 0.65 atm,
$P_0 + p = 0.65$
$\Rightarrow p = 0.65 - P_0$
$= 0.65 - 0.5$
$= 0.15$ atm
Therefore, when the total pressure is 0.65 atm, pressure of $SOCl_2$ is
$p_{SOCL2} = P_0 - p$
$= 0.5 - 0.15$
$= 0.35$ atm
Therefore, the rate of equation, when total pressure is 0.65 atm, is given by,
Rate = $k(p_{SOCL2})$
$= (2.23 \times 10^{-3} s^{-1})$ (0.35 atm)
$= 7.8 \times 10^{-4}$ atm s^{-1}

75.The decomposition of hydrocarbon follows the equation
$k = (4.5 \times 10^{11} s^{-1}) e^{-28000 K/T}$
Calculate E_a.
Answer
The given equation is
$k = (4.5 \times 10^{11} s^{-1}) e^{-28000 K/T}$ (i)
Arrhenius equation is given by,
$k = Ae^{-E_a/RT}$ (ii)
From equation (i) and (ii), we obtain
$E_a / RT = 28000K / T$
$\Rightarrow E_a = R \times 28000K$
$= 8.314$ J $K^{-1} mol^{-1} \times 28000$ K
$= 232792$ J mol^{-1}
$= 232.792$ kJ mol^{-1}. Explain what is observed when

(i) An electrolyte, NaCl is added to hydrated ferric oxide sol.
(ii) Electric current is passed through a colloidal sol.
(iii) When a beam of light is passed through a colloidal sol.

Ans i) Coagulation (ii) Electrophoresis resulting in to coagulation. (iii) Tyndal effect.

76. Write two differences between multimolecular colloids and macromolecular colloids . How are associated colloids different from them ?
Ans

Multimolecular	Macromolecular
On dissolution, a large number of atoms or smaller molecules of a substance aggregate together to form species having size in the colloidal range (diameter<1nm). The species thus formed are called multimolecular colloids. Forexample, a gold sol, a Sulphur sol. Generally lyophilic.	Macromolecules in suitable solvents form solutions in which the size of the macromolecules may be in the colloidal range. Such systems are called macromolecular colloids. These colloids are quite stable and resemble true solutions in many respects. Examples of naturally occurring macromolecules are starch, cellulose, proteins and enzymes; and those of man-made macromolecules are polythene, nylon, polystyrene, synthetic rubber, etc. Generally lyophobic.

Associated Colloids :There are some substances which at low concentrations behave as normal strong electrolytes, but at higher concentrations exhibit colloidal behaviour due to the formation of aggregates. The aggregated particles thus formed are called micelles. These are also known as associated colloids.

Surface active agents such as soaps and synthetic detergents belong to this class.

77. Distinguish between lyophilic and lyophobic colloids.

Ans

Lyophilic sols	Lyophobic sols
The word 'lyophilic' means liquid-loving.	The word 'lyophobic' means liquid-hating.
Particles of the dispersed phase have greater affinity for the dispersion medium.	Particles of the dispersed phase have no affinity for the dispersion medium.
Colloidal sols directly formed by mixing substances like gum, gelatine, starch, rubber, etc., with a suitable liquid (the dispersion medium) are called lyophilic sols.	Substances like metals, their sulphides, etc., when simply mixed with the dispersion medium do not form the colloidal sol. Their colloidal sols can be prepared only by special methods. Such sols are called lyophobic sols.
These sols are quite stable and cannot be easily coagulated.	These sols are readily precipitated (or coagulated) on the addition of small

	amounts of electrolytes, by heating or by shaking and hence, are not stable.
these sols are reversible sols.	these sols are irreversible sols.

78. Explain i) Explain the following colloids around us.

(i) Blue colour of the sky
(ii) Formation of delta
(iii) Electrical precipitation of smoke

Ans (i) Blue colour of the sky: Dust particles along with water suspended in air scatter blue light which reaches our eyes and the sky looks blue to us.

(ii) Formation of delta: River water is a colloidal solution of clay. Sea water contains a number of electrolytes. When river water meets the sea water, the electrolytes present in sea water coagulate the colloidal solution of clay resulting in its deposition with the formation of delta.

(iii) Electrical precipitation of smoke : Smoke is a colloidal solution of solid particles such as carbon, dust, etc., in air. The smoke, before it comes out from the chimney, is led through a chamber containing plates having a charge opposite to that carried by smoke particles. The particles on coming in contact with these plates lose their charge and get precipitated. The particles thus settle down on the floor of the chamber. The precipitator is called Cottrell precipitator.

79. What is the role of i) silica in the metallurgy of copper
ii) CO in Monds process
iii) cryolite in the metallurgy of Al

Ans i) . Silica acts as slag. Copper ore containing iron as impurity is mixed with silica to remove iron oxide as iron silicate (slag).

$FeO + SiO_2 \rightarrow FeSiO_3$ (slag)

ii) In Monds process ,CO reacts with impure Ni to form a volatile complex leaving behind the impurities. This volatile complex is the decomposed to get back pure Ni .

$Ni + 4CO \xrightarrow{330K\text{-}350k} Ni(CO)_4$

Impure complex(volatile)

Leaving behind impurities

$Ni(CO)_4 \longrightarrow Ni + 4\,CO$

iii) Cryolite is used in the metallurgy of Al to lower the melting point of alumina and to increase its conductivity.

80. (i)What is leaching?
(ii)Explain the purification of bauxite ore by leaching: bayer's process?

Ans- (i) Leaching : The process in which ore is treated with suitable reagent which dissolves ore but not the impurities.

ii) Bayers Process :Bauxite ore is treated with caustic soda. Al_2O_3 dissolves in concentrated solution leaving behind impurities.

$$Al_2O_3 + 2NaOH + 3H_2O \rightarrow 2Na[Al(OH)_4]$$

The solution of sodium meta aluminate is filtered off and cooled and its pH is adjusted by dilution or by neutralization with CO_2. White $Al(OH)_3$ is precipitated.

$$2Na[Al(OH)_4] + CO_2 \rightarrow Al_2O_3.xH_2o + 2NaHCO_3$$

The precipitate of $Al(OH)_3$ is filtered, dried and finally heated to about 1473 K to obtain pure Al_2O_3

$$2Al(OH)_3 \xrightarrow{heat} Al_2O_3 + 3H_2O$$

OR

$$Al_2O_3.xH_2o \xrightarrow{heat} Al_2O_3 + xH_2O$$

81. Arrange the following in order of the property mentioned:

(i) PH_3 ,NH_3,SbH_3,AsH_3 (increasing basic strength)
(ii) HCl, HBr, HI,HF (increasing acidic strength)
(iii) $HClO_4$,HClO, $HClO_2$ (increasing oxidizing power)

Ans (i) $SbH_3 < AsH_3 < PH_3 < NH_3$ (increasing basic strength)
(ii) HI < HBr < HCl <HF (increasing acidic strength)
(iii) $HClO < HClO_2 < HClO_4$ (increasing oxidizing power)

82. Account for

(a) Cl_2 water has both oxidizing & bleaching properties
(b) H_3PO_2 &H_3PO_3 act as good reducing agent while H_3PO_4 does not
(c) On oxidation of O_3 gas to KI soln. violet vapours are obtained.

Ans (a) Due to formation of nascent oxygen it has oxidising and bleaching properties.

$Cl_2 + H_2O \rightarrow 2\ HCl + [O]$

(b) H_3PO_2 &H_3PO_3 have P-H bond whereas H_3PO_4 does not have P-H bond.

83. What is meant by lanthanoid contraction?. What are its causes and consequences ?
Ans- It is regular decrease in atomic and ionic size as we move along the lanthanoids series from left to right.
Cause : It is due to the poor shielding by the 4f and 3d orbital electrons.
Consequences : The 3d and 4d series of transition elements have similar atomic radii and show similar properties.

84. Describe the steps involved in the preparation of potassium dichromate from chromite ore.
Ans- it is prepared from chromite ore. Different reaction involved are
$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \text{ ----} \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO2$
$2Na_2CrO_4 + H_2SO_4 \text{-----} \rightarrow Na_2C_{r2}O_7 + Na_2SO_4 + H_2O$
$Na_2Cr2O_7 + 2KCl \text{----} \rightarrow K_2Cr_2O_7 + 2NaCl$

85. Discuss briefly giving an example in each case the role of coordination compounds in:
(i) biological system
(ii) medicinal chemistry
(iii) analytical chemistry
(iv) extraction/metallurgy of metals
Answer
(i) Role of coordination compounds in biological systems:
We know that photosynthesis is made possible by the presence of the chlorophyll pigment. This pigment is a coordination compound of magnesium. In the human biological system, several coordination compounds play important roles. For example, the oxygen-carrier of blood, i.e., haemoglobin, is a coordination compound of iron.

(ii) Role of coordination compounds in medicinal chemistry:
Certain coordination compounds of platinum (for example, cis-platin) are used for inhibiting the growth of tumours.

(iii) Role of coordination compounds in analytical chemistry:
During salt analysis, a number of basic radicals are detected with the help of the colour changes they exhibit with different reagents. These colour changes are a result of the coordination compounds or complexes that the basic radicals form with different ligands.

(iv) Role of coordination compounds in extraction or metallurgy of metals:
The process of extraction of some of the metals from their ores involves the formation of complexes. For example, in aqueous solution, gold combines with cyanide ions to form $[Au(CN)_2]$. From this solution, gold is later extracted by the addition of zinc metal.

86. Give the oxidation state, d-orbital occupation and coordination number of the central metal ion in the following complexes:
(i) $K_3[Co(C_2O_4)_3]$
(ii) cis-$[Cr(en)_2Cl_2]Cl$
(iii) $(NH_4)_2[CoF_4]$
(IV) $[Mn(H_2O)_6]SO_4$

Answer
(i) $K_3[Co(C_2O_4)_3]$
The central metal ion is Co.
Its coordination number is 6.
The oxidation state can be given as:
x - 6 = -3
x = + 3
The d orbital occupation for Co^{3+} is $t_{2g}^6 e_g^0$.

(ii) cis-$[Cr(en)_2Cl_2]Cl$
The central metal ion is Cr.
The coordination number is 6.
The oxidation state can be given as:
x + 2(0) + 2(-1) = +1
x - 2 = +1
x = +3
The d orbital occupation for Cr^{3+} is t_{2g}^3.

(iii) $(NH_4)_2[CoF_4]$
The central metal ion is Co.
The coordination number is 4.
The oxidation state can be given as:
x - 4 = -2
x = + 2

The d orbital occupation for Co^{2+} is $e_g^4\ t_{2g}^3$.

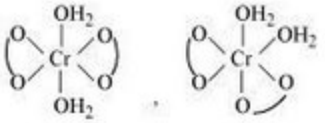
(iv) $[Mn(H_2O)_6]SO_4$
The central metal ion is Mn.
The coordination number is 6.
The oxidation state can be given as:
x + 0 = +2
x = +2
The d orbital occupation for Mn is $t_{2g}^3\ e_g^2$.

87. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers:
(i) $K[Cr(H_2O)_2(C_2O_4)_2$
(ii) $[Co(en)_3]Cl_3$
(iii) $[Co(NH_3)_5(NO_2)](NO_3)_2$
(iv) $[Pt(NH_3)(H_2O)Cl_2]$

Answer

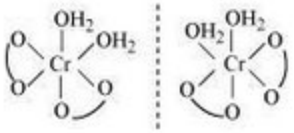
i. Both geometrical (*cis*-, *trans*-) isomers for $K\left[Cr(H_2O)_2(C_2O_4)_2\right]$ can exist. Also, optical isomers for *cis*-ison

Geometrical isomers

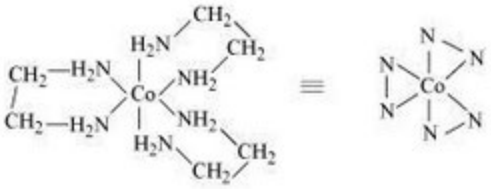


Trans Cis

Trans-isomer is optically inactive. On the other hand, *cis*-isomer is optically active.



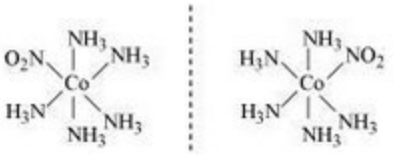
(ii) Two optical isomers for $\left[CO(en)_3\right]Cl_3$ exist.



Two optical isomers are possible for this structure.

(iii) $[CO(NH_3)_5(NO_2)](NO_3)_2$

A pair of optical isomers:



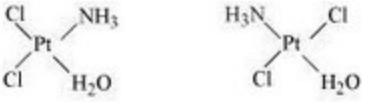
It can also show linkage isomerism.

$[CO(NH_3)_5(NO_2)](NO_3)_2$ and $[CO(NH_3)_5(ONO)](NO_3)_2$

It can also show ionization isomerism.

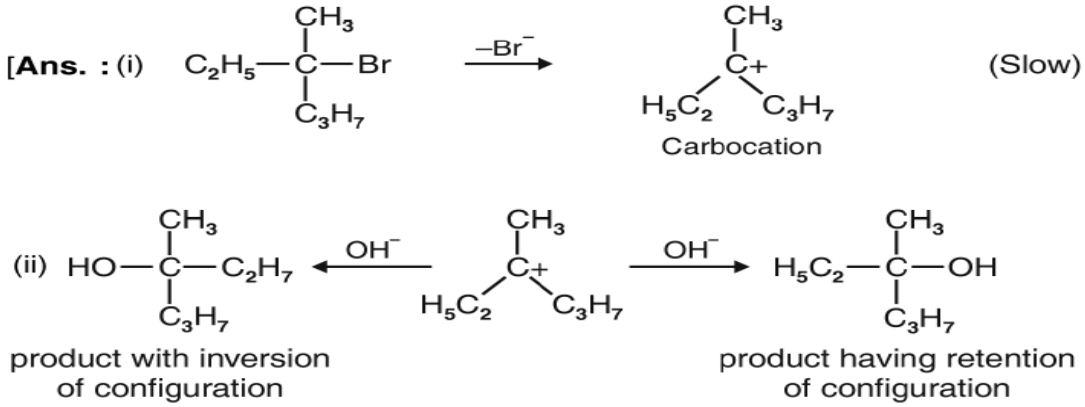
$[Co(NH_3)_5(NO_2)](NO_3)_2$ $[CO(NH_3)_5(NO_3)](NO_3)(NO_2)$

(iv) Geometrical (*cis*-, *trans*-) isomers of $[Pt(NH_3)(H_2O)Cl_2]$ can exist.



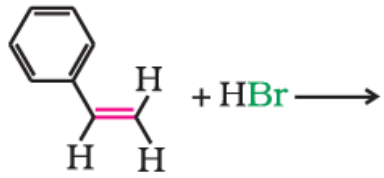
Cis Trans

88.An optically active compound having molecular formula C7H15Br reacts with aqueous KOH to give C7H15OH, which is optically inactive. Give mechanism for the reaction

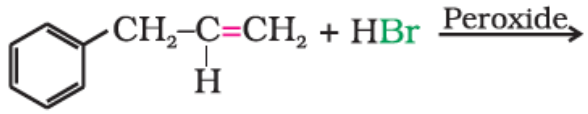


89.

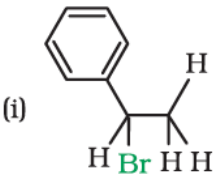
Write the products of the following reactions:

(i)  + HBr ⟶

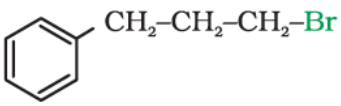
(ii) $CH_3–CH_2–CH=CH_2 + HCl \longrightarrow$

(iii) 

Ans:

(i) 

(ii) $CH_3–CH_2–\underset{\displaystyle Cl}{\underset{|}{CH}}–CH_3$

(iii) 

90.Convert

(i)Propene to Propan-2-ol

(ii)Benzyl chloride to Benzyl alcohol

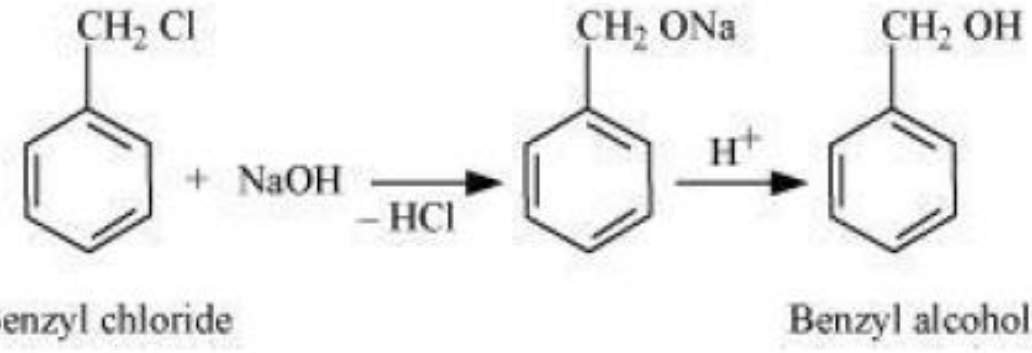
(iii)Ethyl magnesium chloride to Propan-1-ol.

Ans :

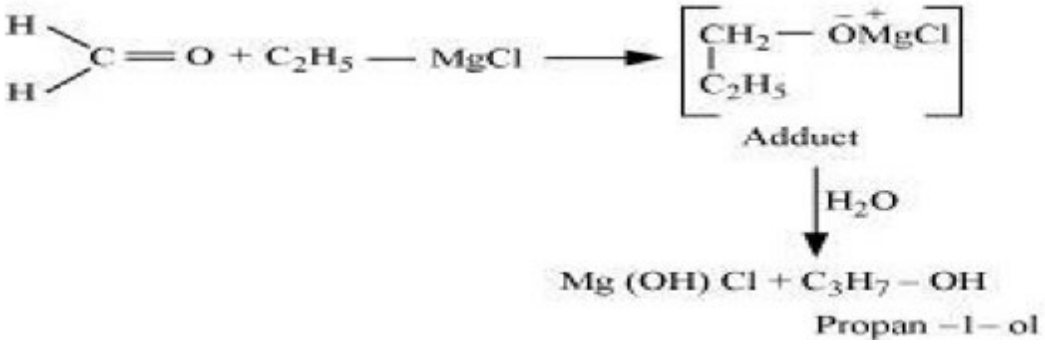
1

$$CH_3-CH=CH_2 + H_2O \underset{}{\overset{H^+}{\rightleftharpoons}} CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$$

Propene — Propan – 2 – ol



2



3.

91. An alcohol A (C4H10O) on oxidation with acidified potassium dichromate gives carboxylic acid B (C4H8O2). Compound A when dehydrated with conc. H2SO4 at 443 K gives compound C. Treatment of C with aqueous H2SO4 gives compound D (C4H10O) which is an isomer of A. Compound D is resistant to oxidation but compound A can be easily oxidised. Identify A, B, C and D and write their structures.
[Ans. :
[A] : (CH3)2CHCH2OH
[B] : CH3CH(CH3)COOH
[C] : (CH3)2C = CH2 [D] : (CH3)3C – OH

92.

Arrange the following compounds in increasing order of their property as indicated: (i) Acetaldehyde, Acetone, Di-tert-butyl ketone, Methyl tert-butyl ketone (reactivity towards HCN)

(ii) CH3CH2CH(Br)COOH, CH3CH(Br)CH2COOH, (CH3)2CHCOOH, CH3CH2CH2COOH (acid strength)
(iii) Benzoic acid, 4-Nitrobenzoic acid, 3,4-Dinitrobenzoic acid, 4-Methoxybenzoic acid (acid strength)

Ans :

$(CH_3)_2CHCOOH < CH_3CH_2CH_2COOH < CH_3CH(Br)CH_2COOH < CH_3CH_2CH(Br)COOH$

Di-*tert*-butyl ketone < Methyl *tert*-butyl ketone < Acetone < Acetaldehyde

4-Methoxybenzoic acid < Benzoic acid < 4-Nitrobenzoic acid < 3,4-Dinitrobenzoic acid

93. Arrange the following:

(i)In decreasing order of the pKbvalues:

C2H5NH2, C6H5NHCH3 , (C2H5)2NH and C6H5NH2

(ii) In increasing order of basic strength:

C6H5NH2,C6H5N(CH3)2,(C2H5)2NH and CH3NH2

(iii) In increasing order of basic strength: Aniline, p-nitroaniline and p-toluidine

ANS.(i) The order of increasing basicity of the given compounds is as follows:

C6H5NH2<C6H5NHCH3<C2H5NH2<(C2H5)2NH

We know that the higher the basic strength, the lower is the pKb values.

C6H5NH2>C6H5NHCH3>C2H5NH2>(C2H5)2NH

(ii)The increasing order of the basic strength of the given compounds is as follows:
C6H5NH2<C6H5N(CH3)2 <CH3NH2<(C2H5)2NH

(iii) The increasing order of the basic strengths of the given compounds is:

p-Nitroaniline< Aniline<p-Toluidine

94. Arrange the following

(i) In decreasing order of basic strength in gas phase:

C2H5NH2, (C2H5)2NH , ,(C2H5)3N and NH3

(ii)In increasing order of boiling point:

C2H5OH, (CH3)2NH, C2H5NH2

(iii) In increasing order of solubility in water: C6H5NH2,(C2H5)2NH,C2H5NH2.

ANS.(i)The given compounds can be arranged in the decreasing order of their basic strengths in the gas phase as follows:

(C2H5)3N>(C2H5)2NH>C2H5NH2>NH3

(ii)The given compounds can be arranged in the increasing order of their boiling points as follows:

(CH3)2NH<C2H5NH2<C2H5OH

(iii)The more extensive the H−bonding, the higher is the solubility. C2H5NH2contains two H-atoms whereas (C2H5)2NH contains only one H-atom. Thus, C2H5NH2undergoes more extensive H−bonding than (C2H5)2NH .Hence, the solubility in water of C2H5NH2 is more than that of (C2H5)2NH.

95. Differentiate primary, secondary and tertiary structure of protein.

Ans–-In primary structure specific sequence of amino acid are present joined by covalent bonds.
-Secondary structure is responsible for the shape of a protein. α-helix and β-pleated in which poly peptide chains have peptide bonds.
-Tertiary structure represents overall folding of polypeptide chain and give rise to the fibrous or globular molecular shape

96.. What happens when glucose reacts with a) HI b) HNO3 c) Br2 water
(a) C6H12O6 + HI -------> n-hexane
(b) C6H1206+HNO3------->saccharic acid
(c) C6H1206+Br2water--------> gluconic acid

97.Write the names and structures of the monomers of the following polymers:
(i) Teflon (ii) Nylon 6,6 (iii) Buna S

Ans i) Tetrfluoroethene $CF_2=CF_2$

ii) Hexamethylenediamine and Adipic acid

NH2(CH2)6NH2 HOOC(CH2)4COOH

iii) Buta-1,3-diene and Styrene

$CH_2=CH-CH=CH_2$ $C_6H_5CH=CH_2$

98. Describe the following with suitable example- (i) Disinfectant (ii) Analgesics (iii) Broad spectrum antibiotics

Ans. (i) Disinfectant- chemicals used to kill the micro-organisms can applied on non living articles.

(ii) Analgesics- They are the drugs which are used to relieve pain . eg – Aspirin , Ibuprofen.

(iii) Broad spectrum antibiotics- They kill the wide range of gram positive and gram negative bacteria. Eg- Chloramphenicol , ofloxacin.

99.Write the names and structures of the monomers of the following polymers:

(i) Teflon (ii) Nylon 6,6 (iii) Buna S

Ans i) Tetrfluoroethene $CF_2=CF_2$

ii) Hexamethylenediamine and Adipic acid

NH2(CH2)6NH2 HOOC(CH2)4COOH

iii) Buta-1,3-diene and Styrene

5 MARKS QUESTIONS

100. (a) Define : (i) Mole fraction (ii) van't Hoff factor

(b)Calculate the mass of a non-volatile solute (molar mass 40 g mol^{-1}) which should be dissolved in 114 g octane to reduce its vapour pressure to 80%.

Answer: (a) (i)mole fraction- *Mole fraction* is another way of expressing the concentration of a solution or mixture. It is equal to the *moles* of one component divided by the total *moles* in the solution or mixture.

(ii)Van't hoff factor- The van't Hoff factor, symbol i, expresses how may ions and particles are formed (on an average) in a solution from one formula unit of solute. Examples: One formula unit of NaCl will create two particles in solution, a Na^+ ion and a Cl^- ion

(b)Let the vapour pressure of pure octane be p_1^0.

Then, the vapour pressure of the octane after dissolving the non-volatile solute is 80/100 $p_1^0 = 0.8\ p_1^0$.

Molar mass of solute, $M_2 = 40$ g mol $^{-1}$
Mass of octane, $w_1 = 114$ g
Molar mass of octane, (C_8H_{18}), $M_1 = 8 \times 12 + 18 \times 1 = 114$ g mol $^{-1}$
Applying the relation,
$(p_1^0 - p_1) / p_1^0 = (w_2 \text{ x } M_1) / (M_2 \text{ x } w_1)$
$\Rightarrow (p_1^0 - 0.8\ p_1^0) / p_1^0 = (w_2 \text{ x } 114) / (40 \text{ x } 114)$
$\Rightarrow 0.2\ p_1^0 / p_1^0 = w_2 / 40$
$\Rightarrow 0.2 = w_2 / 40$
$\Rightarrow w_2 = 8$ g
Hence, the required mass of the solute is 8 g.

101. (a) state raoult's law for solution containing volatile component.

(b) At 300 K, 36 g of glucose present in a litre of its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of the solution is 1.52 bars at the same temperature, what would be its concentration?

Answer:
(a) It states that the vapour pressure of each component in a binary solution containing volatile components is directly praportional to its mole fraction in the solution.

(b)Here we have given

$\pi_1 = 4.98$

$\pi_2 = 1.52$

$C_1 = 36/180$

C_2 = ? (we have to find)

Now according to van't hoff equation

$\Pi = CRT$

Putting the values in above equation,we get

4.98 = 36/180RT ----------1

1.52 = c_2RT ----------2

Now dividing equation 2 by 1 ,we get

(c_2 x 180) / 36 = 1.52 / 4.98

or

c_2 = 0.0061

Therefore concentration of 2nd solution is 0.0061 M

102. (a)State Kohlrausch's Law of independent migration of ions.

(b)Write the Nernst equation and emf of the following cells at 298 K:

(i) Mg(s) | Mg^{2+}(0.001M) || Cu^{2+}(0.0001 M) | Cu(s)

(ii) Fe(s) | Fe^{2+}(0.001M) || H^+(1M)|H_2(g)(1bar) | Pt(s)

(iii) Sn(s) | Sn^{2+}(0.050 M) || H^+(0.020 M) | H_2(g) (1 bar) | Pt(s)

(iv) Pt(s) | Br_2(l) | Br^-(0.010 M) || H^+(0.030 M) | H_2(g) (1 bar) | Pt(s).

Ans-(a) Kohlrausch's Law -The limiting equivalent conductivity of an electrolyte is the algebraic sum of the limiting equivalent conductivity of it's constituent ions.

(b) Answer

(i) For the given reaction, the Nernst equation can be given as:

$$E_{cell} = E^{\ominus}_{cell} - \frac{0.0591}{n}\log\frac{\left[Mg^{2+}\right]}{\left[Cu^{2+}\right]}$$

$$= \left\{0.34-\left(-2.36\right)\right\} - \frac{0.0591}{2}\log\frac{.001}{.0001}$$

$$= 2.7 - \frac{0.0591}{2}\log 10$$

= 2.7 - 0.02955 = 2.67 V (approximately)

(ii) For the given reaction, the Nernst equation can be given as:

$$E_{cell} = E^{\ominus}_{cell} - \frac{0.0591}{n}\log\frac{\left[Fe^{2+}\right]}{\left[H^{+}\right]^{2}}$$

$$= \left\{0-\left(-0.44\right)\right\} - \frac{0.0591}{2}\log\frac{0.001}{1^{2}}$$

$$= 0.44 - 0.02955\left(-3\right)$$

= 0.52865 V = 0.53 V (approximately)

(iii) For the given reaction, the Nernst equation can be given as:

$$E_{cell} = E^{\ominus}_{cell} - \frac{0.0591}{n}\log\frac{\left[Sn^{2+}\right]}{\left[H^{+}\right]^{2}}$$

$$= \left\{0-\left(-0.14\right)\right\} - \frac{0.0591}{2}\log\frac{0.050}{\left(0.020\right)^{2}}$$

= 0.14 - 0.0295 × log125

= 0.14 - 0.062

= 0.078 V

= 0.08 V (approximately)

(iv) For the given reaction, the Nernst equation can be given as:

$$E_{cell} = E^{\ominus}_{cell} - \frac{0.0591}{n}\log\frac{1}{\left[Br^-\right]^2\left[H^+\right]^2}$$

$$= (0-1.09) - \frac{0.0591}{2}\log\frac{1}{(0.010)^2(0.030)^2}$$

$$= -1.09 - 0.02955 \times \log\frac{1}{0.00000009}$$

$$= -1.09 - 0.02955 \times \log\frac{1}{9\times10^{-8}}$$

$$= -1.09 - 0.02955 \times \log\left(1.11\times10^{7}\right)$$

$$= -1.09 - 0.02955(0.0453+7)$$

$$= -1.09 - 0.208$$

$$= -1.298\ \text{V}$$

Q (a)Write the anodic and cathodic reactions and the overall reaction occurring in lead storage battery.

(b) Depict the galvanic cell in which the reaction $Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$ takes place.

Further show:

(i) Which of the electrode is negatively charged?

(ii) The carriers of the current in the cell.

(iii) Individual reaction at each electrode.

Answer: (a) lead storage battery

At anode: $Pb_{(s)} + SO^{2-}{}_{4(aq)} \rightarrow PbSO_{4(s)} + 2e^-$

At cathode: $PbO_{2(s)} + SO_4^{2-}{}_{(aq)} + 4H^+{}_{(aq)} + 2e^- \longrightarrow PbSO_{4(s)} + 2H_2O_{(l)}$

The overall cell reaction is given by,

$$Pb_{(s)} + PbO_{2(s)} + 2H_2SO_{4(aq)} \longrightarrow 2PbSO_{4(s)} + 2H_2O_{(l)}$$

When a battery is charged, the reverse of all these reactions takes place.

Hence, on charging, present at the anode and cathode is converted into and respectively.

(b) The galvanic cell in which the given reaction takes place is depicted as:

$Zn_{(s)} \left| Zn^{2+}{}_{(aq)} \right\| Ag^+{}_{(aq)} \left| Ag_{(s)} \right.$

(i) Zn electrode (anode) is negatively charged.

(ii) Ions are carriers of current in the cell and in the external circuit, current will flow from silver to zinc.

(iii) The reaction taking place at the anode is given by,

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

The reaction taking place at the cathode is given by,

$Ag^+{}_{(aq)} + e^- \rightarrow Ag_{(s)}$

103. (a)explain the following terms: (i) rate of reaction (ii) activation energy of reaction

(b) first order reaction takes 40 min for 30% decomposition. Calculate $t_{1/2}$.

Answer: (a) (i) **Rate of reaction** can be **defined** as the decrease in the concentration of reactants per unit time

(ii)) **activation energy** -the minimum quantity of energy which the reacting species must possess in order to undergo a specified reaction.

(b) For a first order reaction,

$t = 2.303/k \text{ Log } [R]_\circ / [R]$

k = 2.303/*40min* Log 100 / 100-30

= 2.303/*40min* Log 10 / 7

= 8.918 x 10^{-3} min^{-1}

Therefore, $t_{1/2}$ of the decomposition reaction is

$t_{1/2}$ = 0.693/k

= 0.693 / 8.918 x 10^{-3} min

= 77.7 min (approximately)

112. (a) Differentiate molecularity and order of a reaction.

(b) The rate of a reaction quadruples when the temperature changes from 293 K to 313 K. Calculate the energy of activation of the reaction assuming that it does not change with temperature.

Answer:

(a)

ORDER OF A REACTION	MOLECULARITY OF A REACTION
It is sum of the concentration terms on which the rate of reaction actually depends or it is the sum of the exponents of the concentrations in the rate law equation.	It is the number of atoms, ions or molecules that must collide with one another simultaneously so as to result into a chemical reaction.
It need not be a whole number i.e. it can be fractional as well as zero.	It is always a whole number.
It can be determined experimentally only and cannot be calculated.	It can be calculated by simply adding the molecules of the slowest step.
It is for the overall reaction and no separate steps are written to obtain it.	The overall molecularity of a complex reaction has no significance. It is only slowest step whose molecularity has significance for the overall reaction.
Even the order of a simple reaction may not be equal to the number of molecules	For simple reactions, the molecularity can usually be obtained from the Stoichiometry of the equation.

of the reactants as seen from the unbalance equation.	

(b)From Arrhenius equation, we obtain

$$\log\frac{k_2}{k_1}=\frac{E_a}{2.303\,\mathrm{R}}\left(\frac{T_2-T_1}{T_1T_2}\right)$$

It is given that, $k_2=4k_1$

$T_1=293\,\mathrm{K}$

$T_2=313\,\mathrm{K}$

$$\text{Therefore, } \log\frac{4k_1}{k_2}=\frac{E_a}{2.303\times8.314}\left(\frac{313-293}{293\times313}\right)$$

$$\Rightarrow 0.6021=\frac{20\times E_a}{2.303\times8.314\times293\times313}$$

$$\Rightarrow E_a=\frac{0.6021\times2.303\times8.314\times293\times313}{20}$$

$$=52863.33\ \mathrm{J\,mol^{-1}}$$

$$=52.86\ \mathrm{kJ\,mol^{-1}}$$

Hence, the required energy of activation is 52.86 kJ mol $^{-1}$.

104.(a) Draw shapes of the following molecules- (i) H_3PO_2 (ii) $H_2S_2O_7$

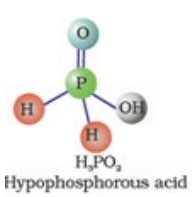
(b) Complete the following reactions-

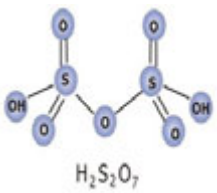
(i) I_2 +HNO_3 (conc.) →

(ii) NaOH (hot and conc.)+ Cl_2 →

(iii) XeF_4 + H_2O →

Ans a)





b) (i) I_2 + 10HNO_3 (conc.) → 2 HIO_3 + 10 NO_2 +4H_2O

(ii) $6NaOH$ (hot and conc.)$+ 3Cl_2 \rightarrow NaClO_3 + 5\ NaCl + 3H_2O$

(iii) $6XeF_4 + 12\ H_2O \rightarrow 4Xe + 2XeO_3 + 24\ HF + 3O_2$

105. a) Account for the following :

i) Although electron gain enthalpy of fluorine is less negative as compared to chlorine, fluorine is a

stronger oxidising agent than chlorine

ii)) NO_2 dimerises to form N_2O_4

b) Draw the structure of) $(HPO_3)_3$

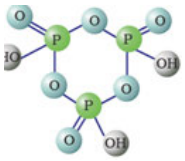
c) i) $P_4 + NaOH + H_2O \rightarrow$

ii) $HgCl_2 + PH_3 \rightarrow$

Ans (a) i) It is due to-(i) low enthalpy of dissociation of F-F bond & (ii) high hydration enthalpy of F^- ion

ii) Due to presence of unpaired electron on nitrogen in NO_2 it dimerises .

b)



c) i) $P_4 + 3NaOH + 3H_2O \rightarrow PH_3 + 3\ NaH_2PO_2$

ii) $3HgCl_2 + 2\ PH_3 \rightarrow Hg_3P_2 + 6HCl$

106.Give reasons :

i) Transition elements have high enthalpy of atomization

ii)Most of transition elements are paramagnetic

iii)Most of transition elements form coloured compounds

iv)Most of transition elements form complex compounds

v)Transition elements form interstitial compounds

Ans

i)Because of large number of unpaired electrons in their atoms, they have str onger interatomic interaction and hence strong metallic bonding is present bet ween atoms. So

Transition elements have high enthalpy of atomization

ii)Most of transition elements are paramagnetic due to presence of unpaired electr ons in (n-1) d orbital.

iii)They

form coloured compounds due to presence of unpaired electrons in d orbital & thus they can undergo d-d electronic transition.

iv) form complexes due to small size, high charge and presence of vacant d-orbital of suitable energy.

v) form interstitial compounds because the

interstitial voids is similar to size of non- metals C, N, O, H.

107.i) How is KMnO4 prepared from pyrolusite ?

ii) Draw the structures of MnO_4^- and MnO_4^{2-}

iii) Complete the following equations :

$Cr_2O_7^{2-} + 14\ H^+ + 6\ Fe^{2+} \rightarrow$

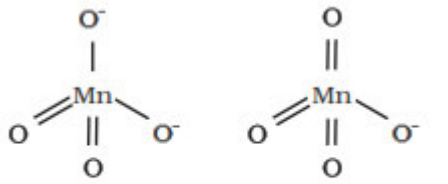
$5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \longrightarrow$

Ans i) KMnO4 is prepared by heating pyrolusite with alkali in air then electrolysis.

$2\ MnO_2 + 4\ KOH + O_2 \longrightarrow 2\ K_2MnO_4 + 2H_2O$

$3\ MnO_4^{2-} + 4H^+ \longrightarrow 2\ MnO_4^- + MnO_2 + 2H_2O$

ii)



Tetrahedral manganate (green) ion

Tetrahedral permanganate (purple) ion

iii)

$Cr_2O_7^{2-} + 14\ H^+ + 6\ Fe^{2+} \rightarrow 2\ Cr^{3+} + 6\ Fe^{3+} + 7\ H_2O$

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

108.Explain the following reactions with suitable example :

(i) Finkelstein reaction.

(ii) Swarts reaction.

(iii) Wurtz reaction.

(iv) Friedel-Craft's alkylation reaction.

(v Sandmeyer reaction

Ans

Finkelstein reaction: $R{-}X + NaI \longrightarrow R{-}I + NaX$

Swart reaction : $R{-}X + AgF \longrightarrow R{-}F + Ag$

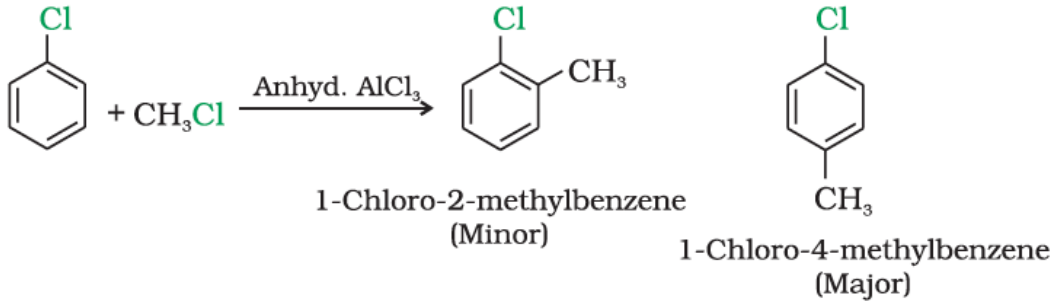
Wurtz reaction

$$R{-}X + 2Na + X{-}R \xrightarrow{\text{Dry ether}} R{-}R + 2NaX$$

sandmeyer Reaction:

$$ArNH_2 + HNO_2 + HCl \xrightarrow{273\ K} ArN_2Cl \xrightarrow{Cu_2X_2 + HX} ArX + N_2$$

(iv) Friedel-Crafts reaction



1-Chloro-2-methylbenzene
(Minor)

1-Chloro-4-methylbenzene
(Major)

109.

How do you convert the following?

(i)Propenetopropan-1-ol

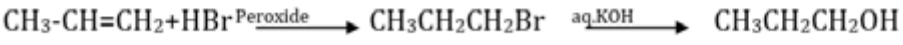
(ii)1-Bromopropaneto2-bromopropane

(iii)Toluenetobenzylalcohol

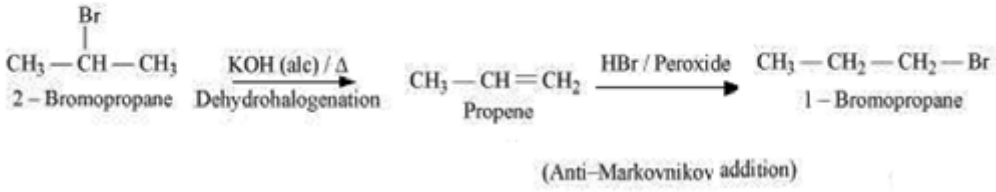
(iv)Benzeneto4-bromonitrobenzene

(v)Benzylalcoholto2-phenylethanoicacid

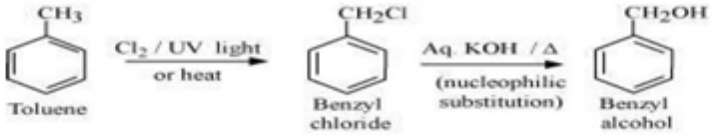
1.



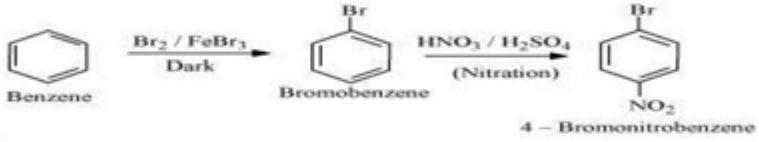
2.



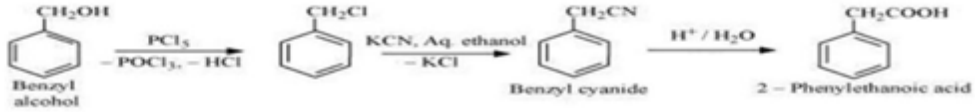
3.



4.



5.



110.Give a chemical test to distinguish between the following pair of compounds.

(i) n-propyl alcohol and isopropylalcohol (Lucas Test)

(ii) methanol and ethanol (Iodoform Test)

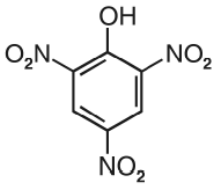
(iii) cyclohexanol and phenol. (FeCl3 Test)

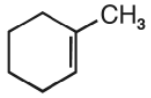
(iv) propan-2-ol and 2-methylpropan-2-ol. (Lucas Test)

(v) phenol and anisole (FeCl3 Test)

111.

Identify the missing reactant or product A to D in the following equations:

(i) $(A) + HNO_3 + H_2SO_4 \longrightarrow$ 

(ii)  $+$ dil. $H_2SO_4 \longrightarrow$ (B)

(iii) $(C) + H_2O \xrightarrow{H^+} CH_3(CH_2)_2\,C(CH_3)\,(OH)\,(CH_2)_2CH_3$

(vi) $CH_3OC_6H_5 + HI \longrightarrow$ (D)

1

Ans A: Phenol , B=1-methyl cyclohexanol C = 3 methyl hept-3-ene D= Methyl iodide And Phenol

112.

Q1..Complete the following reactions:

(i) $C_6H_5NH_2 + CHCl_3 + alc.KOH \rightarrow$

(ii) $C_6H_5N_2Cl + H_3PO_2 + H_2O \rightarrow$

(iii) $C_6H_5NH_2 + H_2SO_4(conc.) \rightarrow$

(iv) $C_6H_5N_2Cl + C_2H_5OH \rightarrow$

(v) $C_6H_5NH_2 + Br_2(aq) \rightarrow$

ANS.

(i) $C_6H_5NH_2 + CHCl_3 + 3alc.\,KOH \xrightarrow{\text{Carbylamine reaction}} 3H_2O + 3KCl + C_6H_5-NC$

Aniline — Phenyl isocyanide

(ii) $C_6H_5N_2Cl + H_3PO_2 + H_2O \rightarrow C_6H_6 + N_2 + H_3PO_3 + HCl$

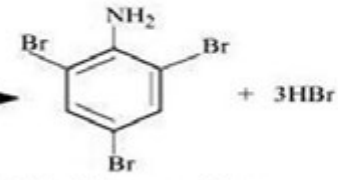
Benzenediazonium chloride — Benzene

(iii) $C_6H_5NH_2 + conc.H_2SO_4 \rightarrow C_6H_5\overset{+}{N}H_3H\overset{-}{S}O_4$

Aniline — Anilinium hydrogen sulphate

(iv) $C_6H_5N_2Cl + C_2H_5OH \rightarrow C_6H_6 + CH_3CHO + N_2 + HCl$

Benzenediazonium chloride — Ethanol — Benzene — Ethanal

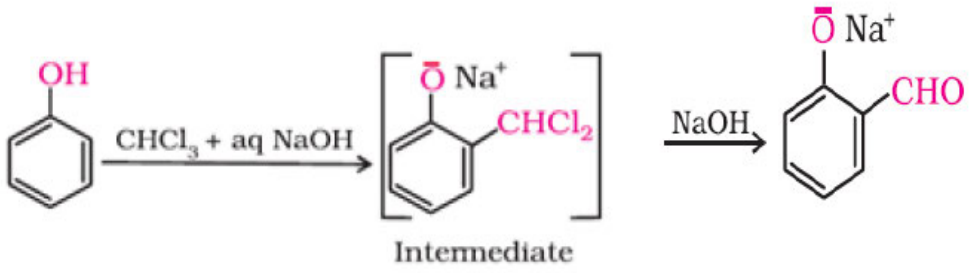
(v) $C_6H_5NH_2 + 3Br_{2\,(aq)} \rightarrow$  $+ 3HBr$

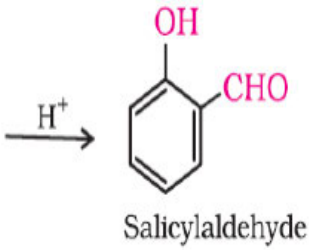
Aniline

2,4,6 – Tribromoaniline

NAME REACTIONS:

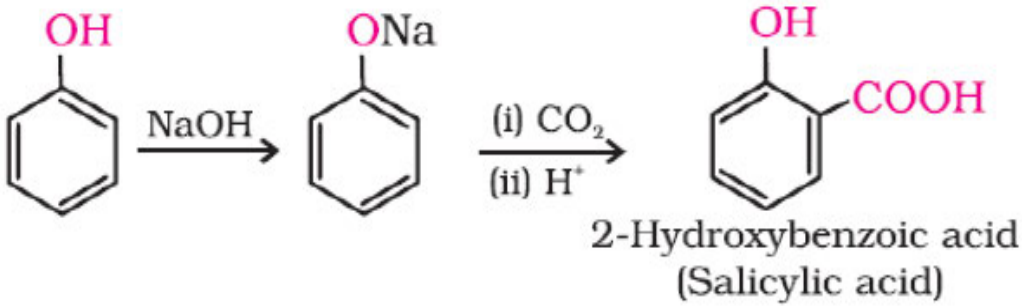
1. Reimer-Tiemann reaction:



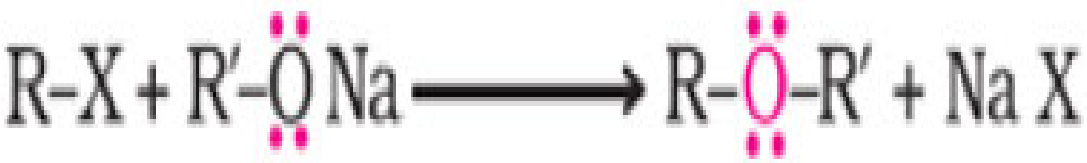


2. Kolbe's reaction :

.



Williamsons Synthesis



DISTINGUISH

Q1:-Distinguish between the following:-

(a)Phenol and alcohol

(b)Benzaldehyde and Propanal

(c)Acetic acid and formic acid

(d)Benzo phenone and acetophenone

(e)Ethanal and propanal

(f)Propanol and ethanol

(g)Pentanone-2 and pentanone-3

(h) 2Alcohol and 3alcohol

(i) 1, 2, 3 amine

(j)Benzoic acid and benzene

(k) Phenol and benzoic acid

(l) Anilineandethyl amine

(m)Aniline and nitrobenzene

(n)Benzaldehyde and acetophenone

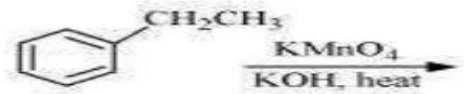
(o)Methanol and benzaldehyde

(p)Chloro benzene and benzylchloride

a	Phenol	It gives $FeCl_3$ test(violet colour)
	Alcohol	It doesn't give this test
b	Benzaldehyde	It gives tollen's test It doesn't give Fehling test
	Propanal	It also give tollen's reagent test It gives fehling solution test
c	Acetic acid	It doesn't gives tollen's reagent . It doesn't give fehling's test
	Formicacid	It gives tollen's test It gives fehling test
d	Benzophenone	It doesn't give iodoform test
	Acetophenone	It gives iodoform test
e	Ethanal	It gives iodoform test
	Propanal	It doesn't gives iodoform test
f	1-Propanol	It doesn't give iodoform test
	Ethanol	It gives iodoform test
g	2-pentanone	It gives iodoform test
	3-pentanone	It doesn't gives iodoform test

h	2^0alcohol	Lucas Test – HCl and an.$ZnCl_2$ It takes 5 minutes to form the turbidity
	3^0alcohol	Lucas Test – HCl and an.$ZnCl_2$ turbidity is formed within no seconds
i	1^0amine	On treating with Hinsberg reagent ($C_6H_5SO_2Cl$) gives white precipitate which dissolves in alkali.
	2^0amine	On treating with Hinsberg reagent ($C_6H_5SO_2Cl$) gives white precipitate which is insoluble in alkali.
	3^0amine	No reaction with Hinsberg reagent
j	Benzoic acid	Add $NaHCO_3$, effervescence obtained (CO_2)
	Benzene	no effervescence obtained
k	Phenol	It gives violet colour with neutral $FeCl_3$ test It doesn't give effervescences of CO_2
	Benzoicacid	It doesn't give violet colour with neutral $FeCl_3$ Effervescence of CO_2evolve when $NaHCO_3$ is added
l	Aniline	It gives azo-dye test(orange dye)
	Ethylamine	It doesn't give azo-dye
m	Aniline	It gives azo-dye test
	Nitrobenzene	It doesn't give azo dye test
n	Benzaldehyde	It gives Tollen's test It doesn't give iodoform test
	Acetophenone	It doesn't give Tollen's test It gives iodoform test
o	Methanal	It gives fehling solution test
	Benzaldehyde	It doesn't give Fehling's test
p	Chlorobenzene	Does't give white curdy ppt on hydrolysisNaOH followed by addition of $AgNO_3$
	Benzylchoride	Gives white curdy ppt on hydrolysis with NaOH followed by addition of $AgNO_3$

Complete the following :

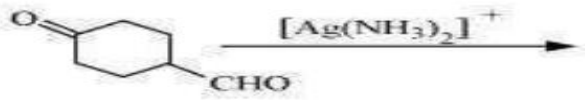


(ii)

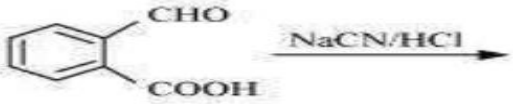
(iii)

(iv)

(v)



(vi)



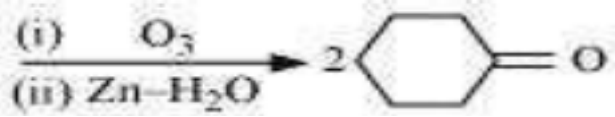
(vii)

(viii)

(ix)

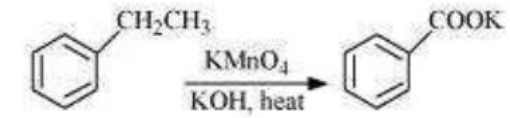
(x)

(xi)



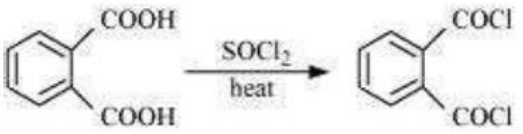
Answer

(i)



Ethylbenzene Pot. benzoate

(ii)

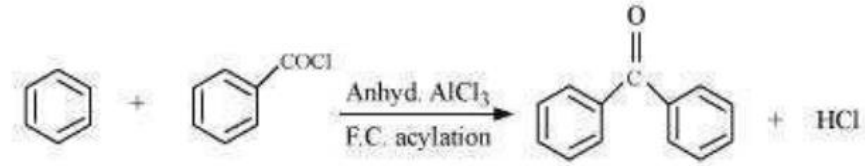


Phthalic acid Phthaloyl chloride

(iii)

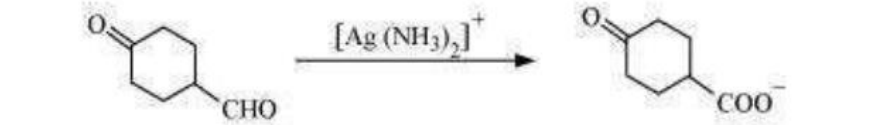
Benzaldehyde Semicarbazide Benzaldehyde semicarbazone

(iv)



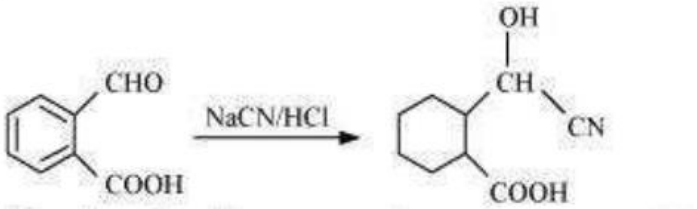
Benzene Benzoyl chloride Benzophenone

(v)



4 – Oxocyclohexanecarbaldehyde 4 – Oxocyclohexanecarboxylate anion

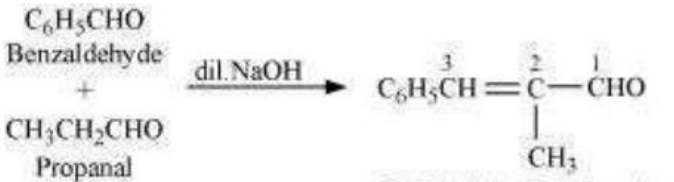
(vi)



2 – Formylbenzoic acid

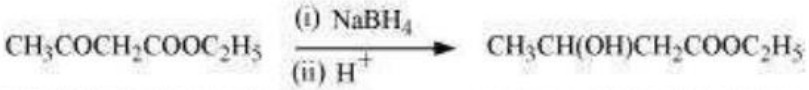
2 – [1 – Hydroxycyanomethyl] benzoic acid

(vii)



2 – Methyl – 3 – phenyl – pro – 2 – enal

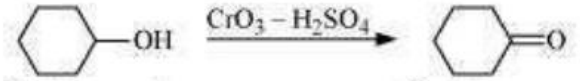
(viii)



Ethyl 3 – oxobutanote

Ethyl 3 – hydroxybutanoate

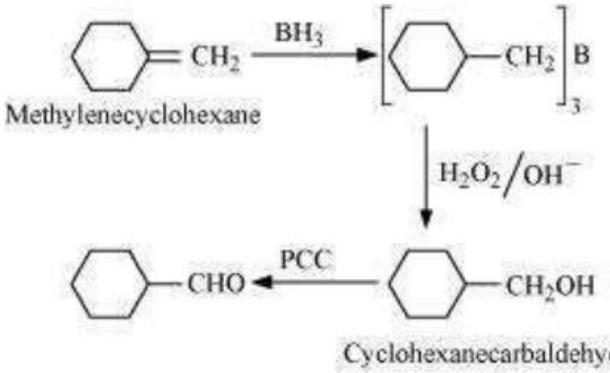
(ix)



Cyclohexanol

Cyclohexanone

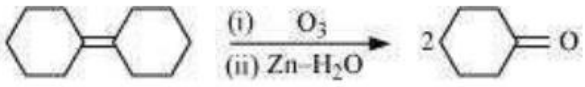
(x)



Methylenecyclohexane

Cyclohexanecarbaldehyde

(xi)



Cyclohexylidenecyclohexane

Cyclohexanone

CONVERSIONS

How will you bring about the following conversions in not more than two steps?

(i) Propanone to Propene

(ii) Benzoic acid to Benzaldehyde

(iii) Ethanol to 3-Hydroxybutanal

(iv) Benzene to *m*-Nitroacetophenone

(v) Benzaldehyde to Benzophenone

(vi) Bromobenzene to 1-Phenylethanol

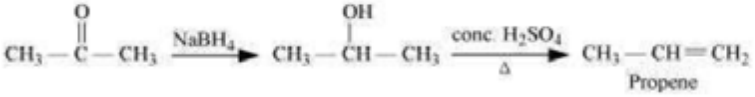
(vii) Benzaldehyde to 3-Phenylpropan-1-ol

(viii) Benazaldehyde to α-Hydroxyphenylacetic acid

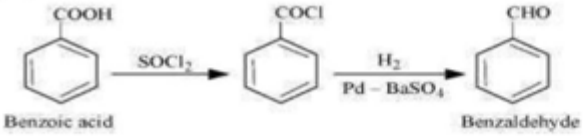
(ix) Benzoic acid to *m*- Nitrobenzyl alcohol

Answer

(i)

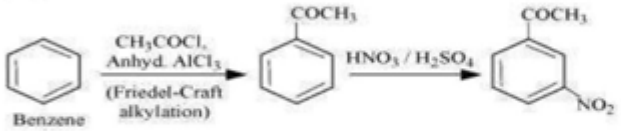


(ii)

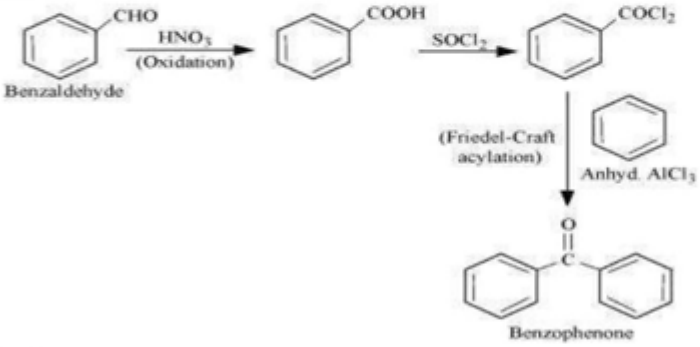


(iii)

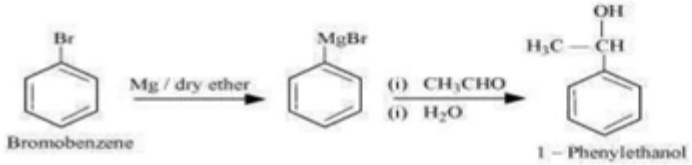
(iv)



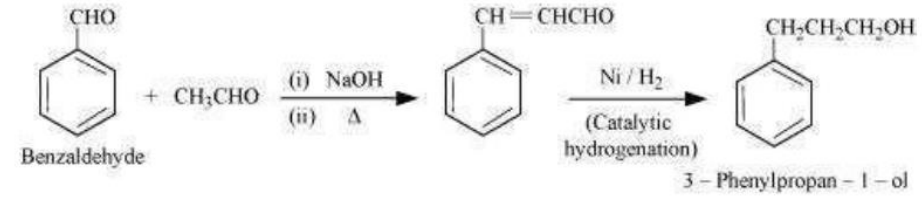
(v)



(vi)

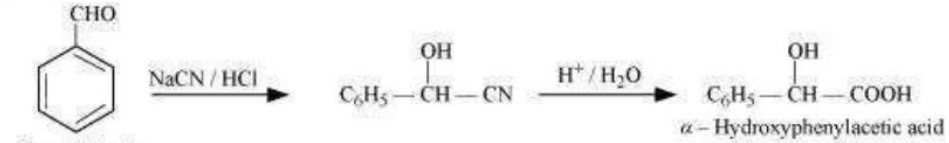


(vii)



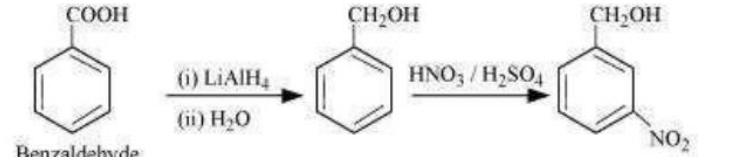
Benzaldehyde — 3 – Phenylpropan – 1 – ol

(viii)



Benzaldehyde — α – Hydroxyphenylacetic acid

(ix)



Benzaldehyde — *m* – Nitrobenzyl alcohol