LEARNING ENHANCEMENT PROGRAM
STUDY MATERIAL (2025-26)
CLASS-12TH
CHEMISTRY

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(KEY POINTS) CHAPTER1 – SOLUTION

1. **Solution :**A solution is a homogeneous mixture of two or more substances.

2. **Solute and Solvent :**In a solution the component which is present in small amount is called solute while the component which is present in large amount is called solvent.

3. The concentration of solution is expressed with respect to that of solute and solvent.

4. **PPm :**PPm is used to express the concentration of the solution in which solute is present is very small amount.

5. 1 molar solution is normally more concentrated than 1 molal solution.

6. **Saturated solution :** Solubility is the maximum amount of solute is 1000g of the solvent is a saturated solution.

7. **Henry's law** : According to Henry's law at a given temperature the solubility of a gas in a liquid is directly proportional to partial pressure on the liquid surface.

8. **Ideal Solution :** Ideal solution obeys Raoult's law at all the temperature and at all the concentration.

9. **Colligative properties :** Colligative properties are those properties which depend upon the no. of solute particles and not upon their nature.

10. Ethylene glycol is used as a antifreeze for car radiator

CHAPTER2. ELECTROCHEMISTRY

1.Electrochemistry : It is defined as the branch of science which deals with the conversion of chemical energy into electrical energy and how chemical reaction is carried out by passing current.

2. **Electrochemical Cell :**Device which convert the chemical energy into the electrical energy.

3. **Electrochemical Series :**It is the series in which the elements are arranged in order of their increasing reduction potential.

4. **Nernst Equation :** $E_{cell} = E^{o}_{cell} - \dfrac{0.0591}{n} \log \dfrac{[\text{Product}]}{[\text{Reactant}]}$

5. **Conductance :**The Reciprocal of resistance is called conductance.

6. **Degree of Dissociation :**The degree of dissociation of an electrolyte is the fraction of electrolyte existing as Ions in the solution.

7. **Equivalent Conductance :**It is the conductance of all the ions produced by dissolving one gram equivalent of ion in the solution. It is denoted by $\wedge_{eq}$.

8. **Primary Cell :**A cell which can be used only once and cannot be recharged is called primary cell. **e.g.** Dry cell.

9. **Secondary Cell :**A cell which can be used again and again, *i.e.,* can be recharged again and again are called secondary cell example Lead storage Battery.

10. **Fuel Cell :**A fuel cell is a device which convert chemical energy of fuel directly into electrical energy.

11. **Corrosion :** It is a process of slow eating up of metal by gases and water vapour present in the air due to the formation of certain chemical substances.

12.Oxidation Potential : It is the tendency of an electrode to get oxidised by losing electron

CHAPTER3. CHEMICAL KINETICS

1. Rate of Chemical Reaction :It is the change in molar concentration of the species taking path in the reaction per unit time.

2. Moderate Speed Reaction :These are the chemical reaction which neither proceed very fast no very slow.

3. Average Rate of Reaction :It is the change in molar concentration of the reactant specific divided by the time taken for the change.

4. Instantaneous Rate of Reaction :It is defined as the rate of reaction at any instant of time.

5. In general average rate is expressed as Δ while instantaneous rate is expressed as d.

6. Low of Mass action :According to this law, at a given temperature the rate of a chemical reaction is directly proportional to the product of molar concentration of the reacting species raised to power their numerical coefficient called Stoichiometric coefficient.

7. Rate Law :It is the expression which describes the reaction rate in term of molar concentration of the reactants as determined experimentally.

8. Rate Constant :It is the rate of reaction when the molar concentration of each reactant is take as unity.

9. Molecularity of a Reaction :It is the number of the reacting spices that are colloid simultaneously in a chemical reaction.

10.Order of Chemical Reaction :It is the sum of the coefficients of reacting species that involved in the rate equation of the reaction

CHAPTER4. d AND f BLOCK ELEMENTS

1. Transition Elements : The transition elements (T.E.) are those elements which have partially filled d-orbital.

2. Electronic Configuration :The general configuration of transition elements is $(n-1)\ d^{1-10}\ ns^{1-2}$.

3. Atomic Radii :In general in a Transition series the atomic radii decrease in the start of series remain constant and in the end again increases.

4. The transition elements are highly metallic in nature and its character increase up to mid series and then decreases.

5. Melting or Boiling Point :In a transition series the melting and boiling point first increase up to middle of series and then decreases.

6. Ionisation Enthalpy :The following trend are observed in the ionization enthalpy of d-elements.

  (*a*) The 1[st]ionisation enthalpy increases as we move across the series.

  (*b*) The element like chromium and copper have very high ionisation enthalpy. It is due to stable half filled and fully filled configuration.

7. Element Zn, Cd and Hg have completely filled d-orbitals therefore their characteristic different from d block elements.

8.	Coloured Complexes :The *d* block elements are generally coloured. It is due to presence of one or more unpaired electrons. So it is seen that in the transition element *d-d* transition takes place as a result they are generally coloured but Zn salt are colourless due to fully filled configuration.

9.	Magnetic properties :The transition elements are generally paramagnetic in nature of presence of one or more unpaired electrons. However the elements with d^{10} configuration diamagnetic in nature.

10.	Tendency to form complexes :*d*-block elements has great tendency to form complex because of small size of atom and ions of transition metal, due to high nuclear charge and the availability of vacant *d* orbitals to accept lone pair of electron denoted by other group.

CHAPTER5. COORDINATION COMPOUNDS

1.	Co-ordination compounds : Co-ordination compounds are the compounds formed by the combination of two or more stable molecule compounds and retain their identity in the solid state as well as in solution.

2.	Double Salt : Double salt are also formed in the same way as the co-ordination complexes. However the salt loose their identity and release constituent ions when dissolved in water.

3.	Coordination complex :These complex are generally formed by transition metal which have vacant-*d*-orbitals accommodate electron donor species called ligand.

4.	Ligands : The electron donar species are called ligands and these are attached to the metal by atom/ ion through co-ordinate bonds.

5.	Lewis Acid and Lewis base :The central metal atom which accept electron pair are regarded as Lewis acid while the ligands which donate electron pair act as Lewis base.

6.	Ligands :Ligands may be monodentate, bidentate, polydentate depending upon the no. of donor atoms.

7.	Chelating Ligand : The ligands resulting in the closed ring structure are called chelating ligand.

8.	Co-ordination number : Co-ordination number of metal ion represent the number of ligand attached to it.

9.	Oxidation number :Oxidation number of central metal atom ion in the co-ordination complex is the net charge which it is expected to carry, when all the ligand attached to it are removed along with their electron pair.

10.	Charge on the complex ion is the algebric sum of the charge carried by the central metal atom ion and the ligand attached to it.

CHAPTER6.HALOALKANES AND HALOARENES

1.	Haloalkanes :These are the organic compound which are formed by substituting the Hydrogen of corresponding alkane by a Halogen atom as

R – H + $X_2 \rightarrow$	R – X + HX
	alkaneHaloalkane
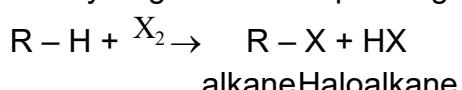
2.	Haloarenes :These are the argonic compound which are formed by substituting one or more hydrogen atom of benzene ring with Halogen atom as
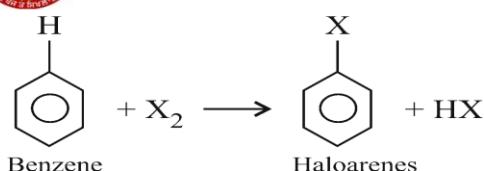
3.   Classification of Haloalkanes :These are of three types :

(*a*)   1º Haloalkanes :It is a Haloalkane in which the carbon which is attached to Halogen atoms attaches to one carbon atom only.

(*b*)   2º Haloalkanes :It is a Haloalkane in which the carbon which is attached to Halogen atom attaches to two alkyl group.

(*c*)   3º Haloalkanes :These are the Haloalkanes in which the carbon which is attached to Halogen atom attaches to three alkyl group.

CHAPTER7.ALCOHOL,PHENOL AND ETHERS

1.Alcohols and Phenols Alcohols and phenols are formed when a hydrogen atom in hydrocarbon, aliphatic and aromatic respectively, is replaced by hydroxyl group (-OR group).

2. Classification of Alcohols and Phenols In alcohols, -OR group is attached to Sp^3hybridised carbon. These alcohols are usually classified as primary, secondary and tertiary alcohols.

3. Physical Properties of Alcohols

a. Lower alcohols are colourless liquids, members from $C_5 - C_{11}$ are oily liquids and higher members are waxy solids.

 b. The hydroxyl groups in alcohols can form H-bonds with water, so alcohols are miscible with water. The   solubility decreases with increase in molecular mass

4.   Boiling points of alkanes are higher than expected because of the presence of intermolecular hydrogen bonding in the polar molecules

5. Physical Properties of Phenols 1. These are colourless liquids or crystalline solids but become coloured due to slow oxidation with air. 2. Phenol is also called carbolic acid. 3. Because of the presence of polar -OH bond,phenols form intermolecular H-bonding with other phenol molecules and with water

CHAPTER8.ALDEHYDE,KETONE AND CARBOXYLIC ACIDS

1.   Aldehydes :These are the organic compounds which have the functional group – CHO.

2.   Ketones :These are the organic compounds which have the functional group >C=O

3.   Carboxylic acid :These are the organic compound which have the functional group   – COOH.

4.   The Secondary suffix used in case of aldehyde is –al.

5.   The Secondary suffix used in case of Ketones is – One.

6.   The Secondary suffix used in case of the Carboxylic acid is –Oic acid.

7.In Hell-Volhard-zelinsky reaction (HVZ-reaction) carboxylic acids containing α-hydrogen are halogenated in the presence of red phosphorus .

$$H_3CCOOH \xrightarrow[\text{H}_2\text{O}]{\text{Cl}_2/\text{Red P}}$$ Cl.CH$_2$COOH + HCl
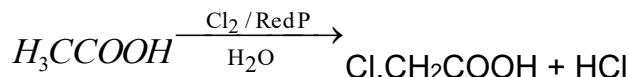
8. A 40% aqueous solution of formaldehyde is called formalin. It is used to preserving biological specimens and distinfectant

CHAPTER9. ORGANIC COMPOUNDS CONTAINING N-COMPOUNDS

1. Amines: Amines are regarded as derivatives of ammonia in which one, two or all three hydrogen atoms are replaced by alkyl or aryl group.

2. Gabriel phthalimide synthesis: Gabriel synthesis is used for the preparation of primary amines. When phthalimide is treated with ethanolic potassium hydroxide, it forms potassium salt of phthalimide which on heating further with alkyl halide followed by alkaline hydrolysis produces the corresponding primary amine.

3. Hoffmann bromamide degradation reaction: Primary amines can be prepared from amides by treatment with Br$_2$ and KOH. Amine contains one carbon atom less than the parent amide.

4. Basic character of amines: Amines have an unshared pair of electrons on nitrogen atom due to which they behave as Lewis base. Basic character of amines can be better understood in terms of their K$_b$ and pK$_b$ values.

5. In this case order of basicity in aqueous medium is
$(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$
When alkyl group is ethyl group order of basicity in aqueous medium is
$(C_2H_5)_2NH > (C_2H_5)_3N > C_2H_5NH_2 > NH_3$

CHAPTER10.BIOMOLECULES

1. Biomolecules :These are the lifeless substances or compounds present as essential constitute of the living organism in different cells *e.g.,* carbohydrate, protein etc.

2. Carbohydrates :These are defined as Polyhydroxy aldehydes or polyhydroxy ketonic substances which generally give these on hydrolysis.

3. Monosaccharides :These are the carbohydrates which cannot be further hydrolysed to simpler substances *e.g.,* Glucose.

4. Disaccharides :These are the carbohydrates which can be further hydrolysed to monosaccharide units is called Disaccharides *e.g.,* Sucrose.

5. Polysaccharides :These are the carbohydrates which can be further hydrolysed to large number of monosaccharide units is called polysaccharides *e.g.,* Starch.

6. Reducing sugars :These are the sugars which reduces the Tollen's Reagent and Fehling solution *e.g.,* Glucose.

7. Non Reducing sugars :These are the sugars which do not reduces Tollen's Reagent and Fehling solution *e.g.,* Starch.

8. Anomers :The two cyclic hemiacetal structures differ in the configuration of the –OH and –H atom attached to C, (carbon atom) only. This carbon atom is called anomeric carbon α and β form of glucose are called anomers.

9. Mutarotation :The change of specific rotation when the two anomeric forms are dissolution in water is known as mutarotation.

10. α-Amino acids :These are the organic compounds which contain both amino group and carboxylic group in their molecules.

MULTIPLE CHOICE QUESTIONS :

1. Which of the following aqueous solutions should have the highest boiling point?
   (a)1.0 M NaOH   (b) 1.0M Na_2SO_4 (c) 1.0 M NH_4NO_3 (d) 1.0 M KNO_2

2. The Unit of ebulioscopic constant is…………...
   (a) K kg mol^{-1} (b) Mol Kg K   (c) Kg $mol^{-1}K^{-1}$ (d) K mol Kg^{-1}

3. The Values of Van't Hoff factors for KCl, NaCl and K_2SO_4 respectively, are …………...
   (a) 2, 2 and 2   (b) 2, 2 and 3   (c) 1, 1 and 2   (d) 1, 1 and 1

4. Value of Henry's constant K_H is
   (a) Greater for gases with higher solubility   (c) Constant for all gases
   (b) Greater for gases with lower solubility   (d) not related to the solubility of gases

5. A colligative property of a solution depends on the
   (a) Number of solute particles   (c) Total number of solute and solvent molecules
   (b) Number of atoms in solute molecules   (d) mass of solute particles

6. Colligative property of a solution depends on
   (a)   Molarity   (c) Number of moles of solvent
   (b)   Number of moles of solute   (d) Nature of solute

7. Which of the following solutions will have the least freezing point?
   (a) 0.1M Urea   (b) 0.1M Acetic acid   (c) 0.1M NaCl   (d) 0.1 m Calcium Chloride

8. A semipermeable membrane permits the flow of
   (a) Solution   (b) Solvent   (c) Solute   (d) Neither solute nor solvent

9. The decreasing order of osmotic pressure of 10g glucose(P1) , 10g Urea(P2) and 10g sucrose(P3) at 273K, when dissolved in 400 mL of water separately is.
   (a)   P1> P2> P3   (b) P2> P3> P1   (c)P3> P2> P1   (d) P2> P1>P3

10. Molarity of 900g of pure water is
    (a)   50M   (b) 55.5M   (c) 5M   (d) None of these

11. Mole fraction of a solute in 2.5m aqueous solution is
    (a)   0.43   (b) 0.043   (c) 4.3   (d)   43

12. A H_2SO_4 solution contains 80.0% by weight H_2SO_4 and has a specific gravity of 1.73, itsnormality is approximately?
    (a)   18.0   (b) 1.8   (c) 28.2   (d) 36.0

13. On dissolving common salt in water, the:
    (a)   freezing point of H_2O increases   (c) boiling point of H_2O decreases
    (b)   boiling point of H_2O decreases   (d) boiling point of H_2O remain same

14. The unit of cryoscopic constant is
    (a) K kg mol^{-1} (b) Mol Kg K^{-1} (c) K mol Kg^{-1} (d) none of these

15. An aqueous solution of methanol in water has vapour pressure
    (a)   equal to that of methanol   (c) more than that of water
    (b)   equal to that of water   (d) less than that of water

16. The molality of pure water is
    (a) 55.5   (b) 20   (c)18   (d)10

17. The number of moles of NaCl in 3litres of 3M solution is:
    (a) 1   (b) 3   (c) 9   (d) 27

18. The amount of solute required to prepare 10 litres of decimolar solution is:
    (a) 0.01mole   (b) 0.2 mole   (c)0.05mole   (d)1.0mole

19. One kilogram of water contains 4g of NaOH. The concentration of the solution is best expressed as:

(a)0.1molal   (b)0.1 molar   (c)decinormal   (d)about0.1mole.

20. The number of moles of NaCl in 3 litres of 3M solution is:
    (a) 1   (b) 3   (c) 9   (d) 27

21. Molality is expressed in:
    (a)   Gram/litre   (b) mole/litre   (c) litre/mole   (d) mole/kg

22. Which of the not affected by temperature?
    (a) Normality   (b) Molality   (c) Molarity   (d) Formality

23. Isotonic solution have equal
    (a) vapour pressure   (b) osmotic pressure   (c) boiling point   (d) freezing point

24.   The molal elevation constant depends upon
    (a) nature of solute   (b)nature of the solvent
    (c) vapour pressure of the solution   (d)enthalpy change

25. Molarity is expressed as
    (a)L/mol (b)mol/L   (c)mol/1000g (d)g/L

26. Which of the following is a colligative property?
    (*a*) vapour pressure   (*b*) relative lowering in vapour pressure
    (*c*) lowering in vapour pressure   (*d*) all of these

27. Which one of the following binary liquid mixtures exhibits negative deviation from Raoult's law?
    (*a*) *n*-Hexane-*n*-Heptane   (*b*) Chloroform−Acetone
    (*c*) Carbondisulphide−Acetone   (*d*) Bromoethane−Chloroethene

28. Constant boiling mixtures are called
    (*a*) ideal solution   (*b*) Azeotropes
    (*c*) isotonic solution   (*d*)None of these.

29. Pressure cooker reduces cooking time because
    (a)heat is more evenly distributed.
    (b)the high pressure tend to rises the food
    (c)the boiling point of food under pressure is elevated
    (d)the boiling point of water in cooker is depressed.

30. Camphor is often used in molecular mass determination because.
    (a)it has a high Cryoscopic constant   (c) it is solvent for organic substance
    (b)it is volatile   (d) it is readily available

Answer

1.	(*b*)	2.	(*a*)	3.	(*b*)	4.	(*b*)	7.	(*a*)
6.	(*b*)	7.	(*d*)	8.	(*b*)	9.	(*d*)	10.	(*b*)
11	(*b*)	12.	(*c*)	13.	(*c*)	14.	(*a*)	15.	(*c*)
16	(a)	17.	(c)	18.	(d)	19.	(a)	20.	(c)
21	(d)	22.	(b)	23.	(b)	24.	(b)	25.	(b)
26	(*b*)	27.	(*b*)	28.	(*b*)	29.	(*c*)	30.	(*a*)

(2 OR 3 MARK Numerical QUESTIONS)

1. A commercially available sample of sulphuric acid is 15% H_2SO_4 by weight (density = 1.10 g ml^{-1}) .Calculate Molarity.   [Ans. 1.68M]
2. A commercially available sample of hydrochloric acid is 38% HCl by weight (density = 1.19 g ml^{-1}) .Calculate Molarity of acid.   [Ans. 12.39M]
3. Calculate the mole fraction of ethanol and water in a sample which contain 95% ethanol by mass?   [Ans. $X_{ethanol}$=0.88, X_{waterl}=0.12]
4. 2.82 g of glucose (molar mas = 180) is dissolved in 30g of water. Calculate mole fraction of glucose and water.   [Ans. $X_{glucose}$ = 0.0093, X_{water} = 0.9907]
5. A sugar syrup of weight 214.2 g contains 34.2 g of sugar ($C_{12}H_{22}O_{11}$). Calculate the mole fraction of sugar in the syrup.   [Ans. X_{sugar}=0.01]
6. The osmotic pressure in pascal exerted by a solution prepared by dissolving 1.0 g of polymer of molar mass 185000 in 450 ml of water at 37° C. [Ans 30.95Pa]
7. Calculate the molal elevation constant of water, it is given that the 0.1molal aqueous solutions of the substance boiled at 100.052 degree celcius..[Ans. K_b=0.52 Km^{-1}]
8. Addition of 0.643 g of a compound to 50 mL of benzene (density 0.879 g/mL) lowers the freezing point from 5.51°C to 5.03°C. If K_f for benzene is 5.12, calculate the molecular mass of the compound.   [Ans.M=155.87g/mol]
9. The boiling point of benzene is 353.23K. When 1.80g of a non-volatile non-ionisation solute was dissolved in 90g of benzene, the boiling point raised to 354.11K. Calculate the molar mass of the solute. [K_b for benzene =2.53K Kg mol^{-1}].   [Ans.M=57.5g/mol]
10. A 45 g of ethylene glycol ($C_2H_6O_2$) is mixed with 600 g of water. What is the freezing point of the solution? k_f=1.86 K kg mol^{-1}.   [Ans.-2.25°C or 270.9K]

(2 MARK Theory QUESTIONS

1. Define colligative properties ?
2. What is molal elevation constant or ebullioscopic constant and cryoscopic constant ?
3. Write the difference between the osmosis and diffusion .
4. What is Van't Hoff factor ?
5. Write down the factors affecting the solubility of a solid in liquid.
6. What are the factors affecting the solubility of gas in liquid ?
7. Why the vapour pressure of a solution decrease when non-volatile solute is added into it ?
8. What are the conditions to get accurate value of Molar mass from Colligative Properties ?
9. Define degree of dissociation and association ?
10. Which colligative property is preferred to measure molar mass.
11. Write difference between ideal and non ideal solutions.
12. Write difference between molarity and molality.

CHAPTER – ELECTROCHEMISTRY (ONE MARK MCQ TYPE QUESTIONS)

1. The electrode potential of SHE is fixed as
   (a) 0.34V   (b) —0.44V (c) 0.0V   (d) —0.76V
2. The unit of molar conductivity is
   (a) Scm^2mol^{-1} (b) Scm^2 mol   (c) Scm^2mol (d) Scm^2gmol^{-1}
3. The number of Faradays required to reduce 1 mole of Cu^{2+} to metallic copper is
   (a) One   (b) two   (c) three   (d) four
4. While charging the lead storage battery
   (a) $PbSO_4$ anode is reduced to Pb   (c) $PbSO_4$ cathode is oxidized to Pb

(b) $PbSO_4$ cathode is reduced to Pb   (d) $PbSO_4$ anode is oxidized to PbO

5. The molar conductance of an electrolyte Λ_m (NH_4 OH) is

(a) Λ_m (NH_4OH) = Λ_m(NH_4^+) + Λ_m (OH^-)   (c) Λ_m (NH_4OH) = Λ_m(NH_3^+) + Λ_m ($4OH^-$)

(b) Λ_m ($NH4OH$) = Λ_m ($4H^+$) + Λ_m(OH^-) + Λ_m (NH_3^+)   (d) none of the above

6. Electrode potential is the potential difference that develops on the

(a) Electrodes   (b) Electrolyte   (c) Electrode and its electrolyte   (d) All.

7. Name the cell which was used in Apollo space programme.

(a) Fuel cell   (b) Nickel cadmium cell   (c) Mercury cell   (d) Dry cell

8. Galvanic cells are also named as :

(a) electrolytic cells   (b) battery cells   (c) Daniel cells   (d) John's cells

9. A substance with higher reduction potential value means that it is

(a) Weak reducing agent (b) Good reducing agent. (c) Good oxidizing agent.(d) Both (b) and (c)

10. The substances which allow the passage of electricity through them ……………… .

(a) Conductors (b) Semi-conductors (c) Insulators (d) Both (a) and (b)

11. Faraday's first law of electrolysis states that the amount of substance deposited during electrolysis is directly proportional to . . . .

(a) No. of ions obtained (b) Per mole of electrons (c) Equivalent mass (d) Quantity of electricity   passed

12. The charge required for the reduction of 1 mole of MnO_4^- to MnO_2 is

(a) 1F   (b) 3F   (c) 5F   (d) 6F

13. Reduction reaction means :

(a) a process of adding oxygen   (b) a process of removing hydrogen

(c) a process of adding electron   (d) a process of removing electrons

14. Cell constant and specific conductance is related to one another as :

(a)Cell Constant = Conductance × Specific Conductance
(b) Conductance = Cell Constant × Specific Conductance
(c) Specific Conductance = Conductance × Cell Constant
(d) Cell Constant = Conductance/Specific Conductance

15. Rusting of iron is quicker in

(a) Saline water   (b) Ordinary water   (c) Distilled water   (d) All of these

16. Rusting is a......................... process.

(a) Chemical   (b) Mechanical   (c) Physical   (d) All of the above

17. Unit of cell constant

(a) ohm cm (b) cm^{-1} (c) mol (d) no unit

18. The process used to deposit one metal over another metal is called

(a) Electrolysis   (b) Electroplating   (c) Carbon plating   (d)None of above

19. Corrosion can be prevented by

(a) Alloying (b) Tinning (c) Galvanizing (d) All of above

20. Kohlrausch's law is applicable :

(a) To electrolytes dissolved in a solvent of low polarity only

(b) To electrolytes at temperature above room temperature

(c) To electrolytic solution at infinite dilution

(d) To aqueous solution of strong electrolyte

21. E^o of three metals A, B, C are −1.4 V, + 0.6 V, − 3.4 V respectively .The reducing power of these metals are in order :

(a) A>B>C   (b) B>C>A   (c) B>A>C   (d) C>A>B

Answers

1. (c)	2. (a)	3. (b)	4. (a)	5. (a)
6. (c)	7. (a)	8. (c)	9. (c)	10. (a)
11. (d)	12. (b)	13. (c)	14. (c)	15. (a)
16.(a)	17. (b)	18.(d) 19 .(c)	20.(c)	21.(d)

(2 OR 3 MARK Numerical QUESTIONS)

1. A cell reaction is Sn (s) | $Sn^{2+}_{(0.50M)}$ // $H^+_{(0.020M)}$ / $H_2(g)$. Calculate E_{cell} of a reaction and also write Nernst equation.   Given : E° = − 0.14 V and E° = 0.00 V. Ans: E_{cell}=0.08V]

2. Calculate the maximum work that can be obtained from the Daniel cells :
Zn I Zn^{2+} (aq) ‖ Cu^{2+} (aq) I Cu Given : E° (Zn^{2+} | Zn) = − 0.76 V,   E° (Cu^{2+} | Cu) = 0.34 V.   [Ans.$\Delta G°$= − 212300 CV]

3. The resistance of 0.5 N solution of an electrolyte in a conductivity cell is found to be 25 Ohm. Calculate equivalent conductivity of the solution of which the cell are 1.6 cm apart and have an area is 3.2 cm^2. [Ans: Λ_{eq} = 40 ohm^{-1}cm^{2}eq^{-1}]

4. The resistance of 0.5 M solution of an electrolyte enclosed between two platinum electrons 1.5 cm apart and having area of 2 cm^2 was fond to be 30 Ohm. Find Molar conductivity of solution.   [Ans. Λ_m = 50 ohm^{-1}cm^{2}eq^{-1}]

5. A cell reaction is Ni (s) | $Ni^{2+}_{(0.01M)}$ // $Cu^{2+}_{(0.01M)}$ / $Cu(s)$. Calculate E_{cell} of a reaction and also write Nernst equation.Given: E° (Ni^{2+} | Ni) = − 0.22 V and E° (Cu^{2+} | Cu) = 0.34 V

   [Ans. E_{cell}=0.56V; Nernst equation E_{cell}= $E^{°}_{(Cu^{2+}|Cu)} - E^{°}_{(Ni^{2+}|Ni)} - \dfrac{0.059}{2}\log\dfrac{[Ni^{2+}]}{[Cu^{2+}]}$]

6. A cell reaction is Zn (s) | $Zn^{2+}_{(0.0004M)}$ // $Cd^{2+}_{(0.2M)}$ / Cd (s). Calculate E_{cell} of a reaction and also calculate ΔG for a cell reaction. Given: E° (Zn^{2+} | Zn) = − 0.76 V and E° (Cd^{2+} | Cd) = -0.40 V.   [Ans. E_{cell}=0.41V, ΔG=-79.13KJmol^{-1}]

7. A cell reaction is Mg (s) | $Mg^{2+}_{(0.001M)}$ // $Cu^{2+}_{(0.000 1M)}$ / $Cu(s)$. Calculate E_{cell} of a reaction and also write Nernst equation.Given: E° (Mg^{2+} | Mg) = − 2.37 V and E° (Cu^{2+} | Cu) = 0.34 V.

   [Ans. E_{cell}=2.68V; Nernst equation E_{cell}= $E^{°}_{(Cu^{2+}|Cu)} - E^{°}_{(Mg^{2+}|Mg)} - \dfrac{0.059}{2}\log\dfrac{[Mg^{2+}]}{[Cu^{2+}]}$]

8. The molar conductance of infinite dilution for sodium acetate (CH_3COONa), Hydrochloric acid (HCl) and sodium chloride (NaCl) are 95.5,426.9 and 120.4 S cm^{2}mol^{-1} respectively at 298 K. Calculate the molar conductance of Acetic Acid (CH_3COOH) at infinite dilution. [Ans Λ_m = 402 Scm^{2}mol^{-1}]

9. What amount of electricity can deposit 1 mole of Al metal at cathode when passed through molten $AlCl_3$?   [Ans.289500C]

10. How much faraday of electricity required to deposit 10 g of calcium from molten calcium chloride using inert electrodes ?(molar mass of calcium=40g mol^{-1}) [Ans.0.5F]

11. What amount of electricity can deposit 1 mole of calcium metal at cathode when

12. passed through molten $CaCl_2$? [Ans.193000C]

(2 MARK THEORY QUESTIONS)

1. Define molar and equivalent conductivity of a cell.
2. Define primary and secondary cell.
3. Write difference between the emf and cell potential.
4. Define the corrosion and give the name of chemical formula of rust.
5. Define the electrochemical cell.
6. Define cell constant and write its units.

CHAPTER – CHEMICAL KINETICS ONE MARK MCQ TYPE QUESTIONS)

1. The unit of rate constant for a zero order reaction is
   (a)   mol L^{-1} s^{-1} (b) s^{-1} (c) L mol^{-1} s^{-1} (d) L^2 mol^{-2}s

2. The rate of reaction of a zero order reaction is-
   (a) Directly proportional to initial concentration
   (b) Doesn't depend on concentration
   (c) Inversely proportional to initial concentration
   (d) can't say

3. For a second order reaction rate at a particular time x. if the initial concentration is tripled, the rate will become.
   (a) 3x   (b) 6x   (c) 9x   (d) 27x

4. For a reaction having rate law expression Rate = k [A]$^{3/2}$[B]$^{1/2}$ .If the concentration of both A and B becomes four times, the rate of reaction
   (a) becomes four times   (c) decreases four times
   (b) becomes 16 times   (d) Remains same

5. The example for zero order reaction is:
   (a) $2NH_3$ → N_2 (g) + $3H_2$ (g)   (c) H_2 + I_2 → 2HI
   (b) N_2O_5 (g)   → 2 NO_2 (g) + ½ O_2 (g)   (d) $2NO_2$ → 2NO + O_2

6. Order of overall reaction can't be
   (a) Zero   (b)   fractional   (c)   (-ve) (d)   whole no.

7. Unit of rate of reaction is
   (a) Mole/lit   (b) mole/lit/sec   (c)   no unit   (d) depends upon order

8. Rate of a reaction
   (a)   Increases with increase in temperature.   (c) Decrease with increase in temperature
   (b)   Does not depend on temperature   (d) Does not depend upon concentration

9. A catalyst alters, which of the following in a chemical reaction ?
   (a) Entropy   (b) Enthalpy   (c) Internal energy   (d) Activation energy

10. In the presence of a catalyst, the heat evolved or absorbed during the reaction :
    (a)   Increases   (b) Decreases   (c) Remains unchanged   (d) May increase or decrease

11. The effective collisions between the reactant molecules at higher temperatures …………..
    (a) Increase   (b) Decrease   (c) Remains same   (d) First increase then decrease

12. In Bimolecular reaction if one of the reactants is in excess it is called ……………… .

(a) pseudo First order   (b) Zero Order   (c) Second Order   (d) Third Order

13. For which type of reactions, order and molecularity have same value ?

    (a) Bimolecular (b) Elementary   (c) Trimolecular   (d) Tetramolecular

14. The rate of a reaction does not depend upon

    (a) Temperature   (b) Concentration   (c) Catalyst   (d) None of these

15. Which of the following statements is incorrect?

    (a) Activation energy for the forward reaction equals activation energy for the reverse reaction

    (b) For a reversible reaction, an increase in temperature increases the reaction rate for both the forward and the backward reaction

    (c) The larger the initial reactant concentration for a second order reaction, the shorter its half-life.

    (d) When Δ_t is infinitesimally small, the average rate equals the instantaneous rate

16. Order of reaction can be

    (a) 0   (b) fraction   (c) whole number   (d) All of the above

17. The units for the rate constant of first order reaction is

    (a) s^{-1} (b) $mol\ L^{-1}\ s^{-1}$ (c) $mol\ s^{-1}$ (d) $L\ mol^{-1}\ s^{-1}$

18. The rate constant of reaction depends upon

    (a) temperature (b) pressure (c) volume (d) All the these

19. Collision theory is applicable to

    (a) first order reactions (c) bimolecular reactions

    (b) zero order reactions (d) intra-molecular reactions

20. A catalyst increases rate of reaction by

    (a) decreasing enthalpy   (c) decreasing activation energy

    (b) decreasing internal energy   (d) increasing activation energy

21. Activation energy of the reaction is

    (a) the energy released during the reaction

    (b) the energy evolved when activated complex is formed

    (c) minimum amount of energy needed to overcome the potential barrier

    (d) the energy needed to form one mole of the product

22. In a reaction, the threshold energy is equal to

    (a) activation energy + normal energy of reactants

    (b) activation energy - normal energy of reactants

    (c) normal energy of reactants - activation energy

    (d) average kinetic energy of molecules of reactants

Answers

1. (a)	2. (a)	3. (c)	4. (b)	5. (a)
6. (c)	7.(a)	8.(a)	9.(d)	10.(c)
11 (a).	12.(a)	13.(b)	14.(d)	15.(a)
16 (d).	17.(a)	18.(a)	19.(c)	20.©
21 (c).	22.(a)			

(2 OR 3 MARK Numerical+ theory QUESTIONS)

1. A first order reaction is 20% complete in 10 minutes. Calculate the time for 75% completion of reaction.   [Ans.t=62.18 min]

2. A first order reaction takes 23.1 min for 50% completion. Calculate the time required for 75%, completion this reaction.   [Ans = 46.2 min]

3. The rate constant for a first order reaction in 60 S^{-1}. How much time will it take to reduce the concentration of the reactant to $\dfrac{1}{10^{th}}$ of its initial value ?[Ans = 46.2 min]

4. Calculate two third life a first order reaction having   K = 5.48 $\times 10^{-14}$ s^{-1}.   [Ans = 2.01×10^{13}s]

5. The rate constant of a reaction becomes six times when the temperature is raised from 350K to 400K.Calculate the activation energy of the reaction.   Given R = 8.314 $JK^{-1}mol^{-1}$.
   [Ans = 41.72 KJ mol^{-1}

6. Calculate half life of a first order reaction having   K = 200s^{-1} .   [Ans = 3.47 $\times 10^{-3}$ s]

7. Calculate half life of a first order reaction having   K = 4.93 $\times 10^{-4}$ s^{-1}.   [Ans.t=1405.6s]

8. Calculate half   life of a first order reaction having   K = 5.5 $\times 10^{-14}$ s^{-1}.   [Ans t = 1.26 $\times 10^{13}$s]

9. Define the Pseudo first order reaction. Give its example

10. Define molecularity of a reaction.

11. Write the difference between the order and molecularity of a reaction.

12. Write difference between the rate of reaction and rate constant.

CHAPTER – d AND f BLOCK ELEMENTS (TWO MARK TYPE QUESTIONS

1. What are transition elements ?
2. Write the general electronic configuration of d and f block elements ?
3. Name any three coinage metals ? Are these transition metals ?
4. Zn and Cd are normally not considered transition metals. Why ?
5. Why Zr and Hf show similar chemical properties ?
6. Write the formula of manganate ion and dichromate ion.
7. What is Misch metal ?
8. What are the characteristics of the transition elements ?
9. Why is Cu considered as transition metal ?
10. $[Sc(H_2O)_6]^{3+}$ is colourless while $[Ti(H_2O)_6]^{3+}$ is coloured. Justify.
11. Why are Mn^{2+} compounds more stable than Fe^{2+} compounds towards oxidation to their +3 oxidation State ?
12. Why are Lanthanoids are called as inner transition metals ?
13. Transition metals have high melting points and boiling points. Why ?
14. Why transition metals show variable oxidation state ?
15. The +2 oxidation state of Lead is more stable than +2 oxidation state of Tin. Explain.
16. The melting point and boiling point of Zn, Cd, Hg are low. Why?

(FIVE MARK QUESTIONS)

1.   (i). Why are Zn, Cd and Hg non-transition elements ? (ii). Which transition metal of 3d series does not show variable oxidation states ? (iii). Why do transition metals and their compounds show catalytic activity ? (iv). Why are melting points of transition metals high ? (v). Why is Cu^{2+} ion coloured while Zn^{2+} ion is colourless in aqueous solution ?

2.   (a) Give reasons : (i) Transition metals and their compounds show catalytic activities. (ii) Separation of a mixture of Lanthanoid elements is difficult. (iii) Zn, Cd and Hg are soft and

have low melting point. (b) Write the preparation of the following : (i) $Na_2Cr_2O_7$ from Na_2CrO_4 (ii) $KMnO_4$ from MnO_2

3. (a) What is lanthanoid contraction? Write its one consequence. (b) Write the ionic equation showing the oxidation of Fe(II) salt by acidified dichromate solution.

4. Give reasons : (a) E° value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Fe^{3+}/Fe^{2+} . (b) Iron has higher enthalpy of atomization than that of copper. (c) Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is coloured .

5. (a) Account for the following : (i) Transition metals show variable oxidation states. (ii) Zn, Cd and Hg are soft metals. (iii) E° value for the Mn^{3+}/Mn^{2+} couple is highly positive (+ 1·57 V) as compared to Cr^{3+}/Cr^{2+} . (b) Write one similarity and one difference between the chemistry of lanthanoid and actinoid elements.

6. (a) Account for the following: (i) Cu^+ is unstable is an aqueous solution. (ii) Transition metals form complex compounds. (b) What are the transition elements? Write two characteristics of the transition elements.

7. How would you account for the following? (i) Transition metals exhibit variable oxidation states. (ii) Zr (Z = 40) and Hf (Z = 72) have almost identical radii. (iii) Transition metals and their compounds act as catalyst

8. What is meant by 'lanthanoids contraction'? Explain the cause and consequence of 'lanthanoids contraction'

9. How would you account for the following: (i) Many of the transition elements and their compounds can act as good catalysts. (ii) The metallic radii of the third (5d) series of transition elements are virtually the same as those of the corresponding members of the seconds series.

10. Write the difference between the lanthanoids and Actinoid elements

11. (a) Why do transition elements show variable oxidation state? (i) Name the element showing maximum number of oxidation states among the first series of transition metals form Sc (Z = 21) to Zn (Z = 30). (ii) Name the element which shows only + 3 oxidation states. (b) What is lanthanoid contraction? Name an important alloy which contains some of the lanthanoid metals

CHAPTER - COORDINATION COMPOUNS
(ONE MARK MCQ TYPE QUESTIONS)

1. Vitamin B_{12} is a complex of
   (a)   cobalt   (b) zinc   (c) vandium   (d) nickel

2. The complex ion $[Ni(CN)_4]^{2-}$ is
   (a)   square planer and diamagnetic   (c) square planer and paramagnetic
   (b)   tetrahedral and paramagnetic   (d) tetrahedral and diamagnetic

3. What kind of isomerism exist between $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_5Cl]Cl_2 . H_2O$:
   (a)   Linkage isomerism   (c) Ionisation isomerism
   (b)   Solvate isomerism   (d) Coordination isomerism

4. IUPAC Name of $[Pt(NH_3)_2 Cl(NO_2)]$ is
   (a)   platinum diaminechloronitrite   (c) diamminechloridonitrito-N- platinum(II)
   (b)   chloronitrito-N-ammineplatinuim(II) (d) diamminechloronitrito-N- platinate(II)

5. Which has maximum number of unpaired electrons.
   (a) Zn^{2+} (b) Fe^{2+} (c) Ni^{2+} (d) Cu

6. The oxidation state of iron in $K_4[Fe(CN)_6]$ is
   (a) 1   (b) 2   (c) 3   (d) 4
7. Primary and secondary valency of Pt in $[Pt(en)_2Cl_2]$ are
   (a) 4,4   (b) 4,6   (c) 6,4   (d) 2,6
8. Which of the following has square planar structure?
   (a) $[NiCl_4]^2$ (b) $[Ni(CO)_4]$ (c) $[Ni(CN)_4]^{2-}$ (d) None of these
9. The correct IUPAC name of $[Pt(NH_3)_2Cl_2]$ is
   (a) Diamminedichloridoplatinum(II)   (c) Diamminedichloridoplatinum(0)
   (b) Diamminedichloridoplatinum(IV)   (d) Dichloridodiammineplatinum(IV)
10. Which of the following is a strong field ligand?
    (a) CO   (b) H_2O (c) NH_3 (d) Ox^{-2}
11. An example of ambidentate ligand is
    (a) Ammine   (b) Aqua   (c) Oxalato   (d) Thiocyanato
12. How many donor atoms can $EDTA^{4-}$ ligand bind through?
    (a) 2   (b) 4   (c) 6   (d) 8
13. What is the shape of the coordination polyhedron of $[PtCl_4]^{2-}$?
    (a) Linear   (b) Square planar   (c) Tetrahedral   (d) Octahedral
14. The oxidation state of nickel in $[Ni(CO)_4]$ is
    (a) 4   (b) 0   (c) 2   (d) 3
15. The oxidation number of chromium in $K[Cr(CO)_4]$:
    (a) +1   (b) +3   (c) -1   (d) -3
16. Which of the following compounds is not a linkage isomer?
    (a) $Hg[Co(SCN)_4]$ (b) $[Cr(H_2O)_5(NO_2)]Cl_2$ (c) $[CoCl_2(en)_2]Cl$ (d) $K[Cr(NH_3)_2(ONO)_4]$
17. The compounds $[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5(SO_4)]Cl$ are __ isomers.
    (a) Linkage   (b) Coordination   (c) Ionisation   (d) Solvate
18. Haemoglobin is a complex compound of which metal ion?
    (a) Fe^{2+} (b) Fe^{3+} (c) Co^{2+} (d) Co^{3+}
19. The oxidation number of Cobalt in $K[Co(CO)_4]$ is
    (a) +1   (b) +3   (c) -1   (d) -3
20. Ethylenediamine is an example of
    (a) monodentate ligand   (c) tridentate ligand
    (b) bidentate ligand   (d) polydentate ligand

Answers

1. (a)	2. (a)	3. (b)	4. (c)	5.(b)
6. (b)	7. (d)	8. (c)	9. (a)	10. (a)
11. (d)	12. (c)	13 (b)	14 (b)	15.(c)
16. (c)	17. (c)	18. (a)	19.(c)	20. (b)

(2 MARK QUESTIONS)

1. Define Ambident ligands ?
2. Write the factors affecting the stability of Complex Ion.
3. Explain difference between Weak field ligand and Strong field ligand.

4. Give the IUPAC names of the following:
   a) $[Co(NH_3)_4(H_2O)_2]Cl_3$ b) $[Cr(en)_3]Cl_3$ c) $[PtCl_2(en)_2](NO_3)_2$
   d) $K_2[PdCl_4]$ e) $Fe_4[Fe(CN)_6]_3$
5. Using IUPAC norms write the formulas for the following:
   a) Pentaamminenitrito-N-cobalt(III)
   b) Tetrahydroxidozincate(II)
   c) Tetracarbonylnickel(0)
   d) Potassiumtri(oxalate)chromate(III)
   e) Hexaamminecobalt(III)sulphate
6. Define Denticity of the ligand ?
7. Define Homoleptic complexes ?
8. Name central metal atom present in haemoglobin and Vitamin B_{12}
9. What is the difference between co-ordination compounds and Double salt ?
10. Name the following complexes :
    (*i*) $K[Ag(CN)_2]$ (*ii*) $[Ni(H_2O)_2(NH_3)_4]SO_4$
11. Write difference between low spin ligand and high spin ligand

(True / False Type Questions)

1. The oxidation state of Ni in $[Ni(CO)_4]$ is zero.   (True)
2. $[Fe(CO)_5]$ is most stable because CO is weak field ligand.   (False)
3. The energy difference between the two sets of *d*-orbitals is called crystal field splitting energy denoted by Δ_0.
   (True)
4. $Fe(CN)_6]^{3-}$ ion shows magnetic moment corresponding to two unpaired electrons (False)
5. Chelate complexes tend to be more stable.   (True)
6. $[Ni(CN)_4]^{2-}$ is square planar.   (True)
7. Two N and four O are donor atoms in ethylenediamine tetraacetate ion.   (True)
8. The primary and secondary valency of copper in the complex $[Cu(NH_3)_4]SO_4$ are 2 and 4

                                                 (True)

CHAPTER HALOALKANE AND HALOARENES

(ONE MARK MCQ TYPE QUESTIONS)

1. Name the reaction : - R-OH + HCl $\rightarrow$ R-Cl + H_2O
   (a) Swartz Reaction   (*b*) Darzen's Method
   (*c*) Groove's Process   (*d*) Peroxide effect
2. Find the correct order of melting/boiling point of these aryl halides:-
   (a) aryl iodide > aryl bromide > aryl chloride
   (b) aryl bromide > aryl iodide > aryl chloride
   (c) aryl chloride > aryl bromide > aryl iodide
   (d) aryl iodide > aryl chloride > aryl bromide
3. Haloarenes are insoluble in water but are soluble in benzene because:
   (a) they cannot form hydrogen bond with water

(b) they can form hydrogen bond with water

(c) intermolecular forces of haloarenes and benzene are of different nature

(d) all options are incorrect

4. Hybridization of carbon atom carrying halogen atom in haloarenes is

(a) sp (b) sp^3 (c) sp^2 (d) dsp^2

5. Haloarenes are less reactive than haloalkanes due to

(a) Resonance Effect

(b) Difference in hybridisation state of carbon atoms

(c) both a and b (d) None of these

6.
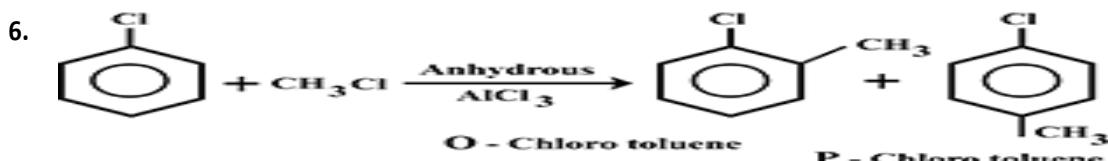
The above reaction is

(a) Friedel Craft's Alkylation

(b) Friedel Craft's Acylation

(c) Fries Rearrangement

(d) Gattermann Reaction

7. Chlorobenzene can be prepared from Benzene diazoniumchloride by

(a) Kolbe's Schmitt Reaction

(b) Hunsdiecker Reaction

(c) Hell -Vohlard Reaction

(d) Gattermann Reaction

8. The reaction of Iodobenzene with copper powder in a sealed tube to give diphenyl iscalled:

(a) Ullmann reaction

(b) Hunsdiecker reaction

(c) Gattermann reaction

(d) Fittig reaction

9. The IUPAC name of the following is
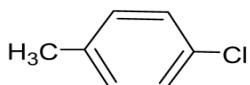
(a) 1-Chloro-4-methylbenzene

(b) 1-Chlorotoluene

(c) 1-Methyl-4-chlorobenzene

(d) 4-Methylchlorobenzene

10.
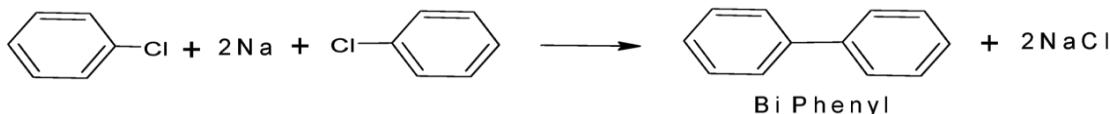
This reaction is

(a) Wurtz Reaction

(b) Fittig Reaction

(c) Wurtz Fittig Reaction

(d) Ullmann Reaction

11. The isomers which can be interconverted through rotation around a single bond are:

(a) Diastereomers (c) Enantiomers

(b) Conformers (d) Position isomers

12. The carbon which is bonded to four different atoms or group of atoms is:

(a) Chiral (c) Both a and b

(b) benzene (d)None of the above

13. The process of separation of a racemic mixture into d- or l- forms is called:

(a) Evaporation (c) Resolution

(b) Chromatography   (d) Distillation

14. Wurtz reaction involves
    (a) Two molecules of arylhalide
    (b) Two molecules of alkylhalide
    (c) One molecule each of alkyl and arylhalides
    (d) One molecule each of alkyl halide and aromatic hydrocarbon

15. The C-X bond is strongest in
    (a)CH_3Cl (c) CH_3F
    (b) CH_3Br (d)CH_3I

16. Alkyl halides react with KCN to give_____as the major   product
    (a) isocyanide   (c)Amines
    (b) cyanides   (d) Nitro compounds

Answers

1. (*c*)	2. (*a*)	3. (*a*)	4. (*c*)	5. (*c*)
6. (*a*)	7. (*d*)	8. (*a*)	9. (*a*)	10. (*b*)
11. (b)	12. (a)	13. (c)	14. (b)	15. (c)
16. (b)				

(FIVE MARK QUESTIONS)

1. Define the following terms : (i) Enantiomers (ii) Racemic mixture (b) Why is chlorobenzene resistant to nucleophilic substitution reaction?

2. Explain
    (*i*)   Swarts reaction   (*iii*) Friedel Craft Acylation
    (*ii*) Huns dicker reaction   (*iv*) Friedel Craft Alkylation
    (v)   Wurtz Fittig reaction.

3. (i)   Difference between Haloalkane and Haloarenes.
    (ii)   What is Iodoform Test ?

4. (a) Define
          (i) Specific rotation (ii) Racemic Mixture (iii) Optical Activity:
    (b) Give two uses of chloroform.

5. (i) Why treatment of alkyl halide with $\mathbf{AgNO_2}$ form Nitro alkane and with $\mathbf{KNO_2}$ alkyl Nitrate ?
    (ii) Reaction of an alkyl halide with KCN and AgCN in different ways giving different products ? Explain.

6. The treatment of alkyl chlorides with aqueous KOH leads to the formation of alcohols but in presence of alocholic KOH, alkenes are major products. Explain.

7. (i) Difference between SN^1 and SN^2 reaction ?
    (ii)   Difference between Haloalkane and Haloarenes ? (iii) Give the use of Iodoform.

8. (i)Explain S_N^2 mechanism ?
    (ii)Explain S_N^1 mechanism ?(iii) Write the use of Freons.

9. Explain the following reaction :(i) Fittig reaction   (ii)   Sulphonation of haloarene

(iii)Hunsdicker reaction (iv)Nitration of haloarene (v)Wurtz reaction

10. Explain the following reaction :
(i)   Balz Schiemann reaction (ii)   Sulphonation of Haloarenes
(iii)   Sandmeyer's reaction   (iv)   Finckelstein reaction.   (v)Ullman reaction
11. Why aryl halide(haloarenes) are less reactive than alkyl halide(haloalkanes).

CHAPTER - ALCOHOL,PHENOL AND ETHERS
(ONE MARK TRUE/FALSE TYPE QUESTIONS)

1. Phenol have higher boiling than toluene.   True
2. Victor meyer test used to distinguish between alcohols.   True
3. Ether posses a dipole moment.   True
4. The boiling point of ether are higher than that of corresponding isomeric alcohols .   False
5. Alcohols are more soluble in water than hydrocarbon.   True
6. Phenol are acidic in nature.   True

(TWO   MARKS QUESTIONS)

1.   Why do alcohols has higher boiling point than haloalkanes of similar molecular mass ?
2.   Alcohols are comparatively more soluble in water than hydrocarbons of comparable molecular masses. Explain this fact.
3.   Write two uses of Methanol ?
4.   Write two uses of Ethanol ?
5.   How does phenol react with (*i*) Sodium (II) WATER
6.   Why are ether relatively inert compound ?
7.   The boiling point of ether are lower than their corresponding isomeric alcohols. Explain.
8.   What is the catalyst dehydrogenation of alcohol
9.   How alcohol react with

    (*i*) Carboxylic acid   (*ii*) Acid anhydride
10.   Explain why alcohols are weaker acid than water.
11.   Solubility of alcohols in water decreases with increase in molecular mass. Discuss
12.   Why primary alcohols are more acidic than secondary alcohols ?
13.   Write short note on coupling reaction
14.   Write the uses of ether
15.   Why are ether relatively inert compound ?
16.   Ethers possess a dipole moment even if the alkyl radicals in the molecule are identical. Explain

(THREE   MARKS QUESTIONS)

1.   Why is the Boiling point of ether lower than the isomeric alcohols ?
2.   Why is $C - O - C$ bond angle in ether is more than $H - O - H$ bond angle in water though oxygen atom is sp^3 hybridised in both the cases ?
3.   Write short note on coupling reaction.
4.   Discuss the oxidation of alcohols

5. Discuss the reaction and mechanisms of Acidic Dehydration of ethyl alcohol to prepare ether.

6. How can you distinguish primary, secondary and tertiary alcohols by Lucas test ?

7. What happens when 1°, 2° and 3° alcohols are passed over red hot copper ?

8. Discuss the acidic dehydration of alcohol at different temperature.

9. Write Victor Meyer's test to distinguish between 1°, 2° and 3° alcohols

10. Discuss the reaction and mechanisms of Acidic Dehydration of ethyl alcohol to prepare ethene

11. Phenol are more acidic than alcohols. Why ?

12. Phenol has higher boiling point the toluene. Why ?

13. Dimethyl ether is completely soluble in water but diethyl ether is soluble in water to a smaller extent. Explain.

CHAPTER - ALDEHYDE KETONE AND CARBOXYLIC ACID
(ONE MARK MCQ TYPE QUESTIONS)

1. Which of the following reactions will not result in the formation of C-C bond?
   (a) Cannizzaro Reaction (c) Reimer-Tiemann Reaction
   (b) Wurtz Reaction (d) Friedal Crafts Reaction

2. The strongest acid among the following compound is.
   (a) HCOOH (b) CH_3COOH (c) $(CH_3)_3$ CHCOOH (d) $(CH_3)_3CCOOH$

3. Which of the following do not give aldol condensation reactions?
   (a) Formaldehyde (b) Acetaldehyde (c) Dimethylketone (d) Propionaldehyde

4. The catalyst used in Rosenmund's reduction is
   (a) $HgSO_4$ (b) $Pd/BaSO_4$ (c) Anhydrous $AlCl_3$ (d) Ni/H_2

5. Carboxylic acids are more acidic then phenol and alcohol because of :
   (a) Intermolecular hydrogen bonding (c) Highly acidic hydrogen
   (b) Formation of dimers (d) Resonance stabilization of conjugate base

6. Correct order of decreasing reactivity of nucleophillic addition in case of HCHO, CH_3 CHO and CH_3 $COCH_3$ is
   (a) CH_3 $COCH_3$ > CH_3 CHO > HCHO (b) HCHO > CH_3 CHO > CH_3 $COCH_3$
   (c) CH_3 $COCH_3$ > HCHO > CH_3 CHO (d) CH_3 CHO > HCHO > CH_3COCH_3

7. The reagent with which both acetaldehyde and acetone react easily is
   (a) Fehling's reagent (c) Schiff's reagent
   (b) Grignard's reagent (d) Etard's reaction.

8. The chemical reaction 2HCHO $\xrightarrow{Conc. NaOH}$ CH_3OH + HCOONa represents
   (a) Rosenmund's reaction. (c) Kolbe's reaction
   (b) Cannizaro's reaction (d) Etard's reaction

9. For distinction between pentan-2-one and pentan-3-one, which reagent can be employed?
   (a) $K_2Cr_2O_7$ /H (b) ZnHg/HCl
   (c) $NaOH/I_2$ (d) $AgNO_3$ /NH_4 OH

10. Which of the following will undergo aldol condensation?
    (a) CH_2 = CHCHO (b) CH = CCHO

(c) C_6H_5CHO (d) CH_3CH_2CHO

11. Compound 'A' $C_5H_{10}O$ forms a phenyl hydrazone and gives a negative Tollen's reagent test and iodoform test. On reduction with Zn+Hg/HCl, compound A gives n-pentane. Thecompound OA' is

    (a) Primary alcohol   (b) Aldehyde   (c) Secondary alcohol (d) Ketone

12.   Tert Butyl alcohol can be obtained by treating with CH_3MgBr followed by hydrolysis

    (a) HCHO   (b) CH_3CHO (c) CH_3COCH_3(d) CH_3CH_2CHO

13. $C_6H_3N_3O_7$ is called as :

    (a) 3-Nitrosalicylic acid   (b) 3, 5-Dinitrosalicylic acid
    (c)   m-Nitrobenzoic acid   (d) Picric acid

14. The end product in ethyl alcohol on heating at 443K

    (a) $CH_3 — CH_2COONa$ (b) $CH_2= CH_2$ (c) $CH_3 — CH_3$ (d) $CH_2 = CH\text{-}COOH$

15. Benzoic acid is weaker than .... but stronger than ....

    (a) p-toluic acid, o-toluic acid   (b) p-nitrobenzoic acid, p-toluic acid
    (c) acetic acid, formic acid   (d) fomic acid, acetic acid

16.   Which of the following reactions will give benzolphenone?
    (i)   Benzoyl chloride + Benzene + $AlCl_3$
    (ii) Benzoyl chloride + Phenylmagnesium bromide
    (iii) Benzoyl chloride + Diphenyl cadmium
    (a) (i) and(ii)   (b) (ii) and (iii)   (c) (i) and (iii)   (d) (i), (ii) and (iii)

17.   Propanone can be prepared from ethyne by
    (a) passing a mixture of ethyne and steam over a catalyst, magnesium at 420°C
    (b) passing a mixture of ethyne and ethanol over a catalyst zinc chromite
    (c) boiling ethyne with water in the presence of $HgSO_4$ and H_2SO_4
    (d) treating ethyne with iodine and NaOH

18.   The oxidation of toluene to benzaldehyde by chromyl, chloride is called
    (a) Etard reaction   (b) Riemer-Tiemann reaction
    (c) Wurtz reaction   (d) Cannizzaro's reaction

19.   There is a large difference in the boiling points of butanal and butanal-1-ol due to
    (a) intermolecular hydrogen bonding in butan-1-ol
    (b) intermolecular hydrogen bonding in butanal
    (c) higher molecular mass of butan-1-ol
    (d) resonance shown by butanal

20.   Which of the following compounds will undergo Cannizzaro reaction?
    (i) CH_3CHO (b) CH_3COCH_3 (c) C_6H_5CHO (d) $C_6H_5CH_2CHO$

Answers

1. (a)   2. (a)   3. (a)   4. (b)   7. (d)

6. (b)   7. (b)   8. (b)   9. (c)   10. (d)

11 (b)   12. (c)   13. (d)   14. (b)   17. (d)
.

16 (c)   17. (c)   18. (a)   19. (a)
.

20.   (c)

True / False

1. Aldehydes and ketones react with electrophiles but not with nucleophiles   (False)

2. Wolff Kishner reduction of acetophenone gives toluene (False)
3. Acetaldehyde can be reduced to ethane in the presence of LiAlH$_4$ (False)
4. Acetaldehyde can be prepared by the distillation of calcium acetate (False)
5. Benzaldehyde cannot undergo Cannizzaro Reaction. (True)
6. Aldehydes are less easily oxidized than ketones (False)
7. Benzaldehyde reduces Fehling Solution (False)
8. Ketones give nucleophilic addition reactions more readily. (False)
9. Acetaldehyde cyanohydrin on hydrolysis give Lactic Acid (True)
10. Benzaldehyde forms addition product with sodium bisulphite but but acetophenone does not. (True)
11. Calcium formate on heating gives acetaldehyde (False)
12. The pK$_a$ Value of formic acid is smaller than that of acetic acid (True)
13. The carbon-oxygen bond lengths in formic acid are equal. (False)
14. During the reaction of carboxylic acid with NaHCO$_3$ (True)
15. When benzoic acid is heated with soda lime, benzene is formed. (True)
16. Acetate ion is a stronger acid than methoxide ion. (Acetate ion is a weaker base than methoxide ion because a stronger acid has a weaker conjugate base) (False)
17. Me$_3$CCH$_2$ -COOH is more acidic than Me$_3$SiCH$_2$COOH. (True)
18. Formic acid gives Silver mirror test Tollens Reagent. (True)

(TWO MARKS QUESTIONS)

1. Most aromatic acids are solids while acetic acid and other acids of this series are liquids. Explain.
2. Why do aldehyde and ketones have high dipole a moment ?
3. Aldehydes lower boiling points than corresponding alcohols and acids. Explain
4. Distinguish test between aldehyde and Ketone
5. What is formalin solution give its one use ?
6. How does   > C = C<   differ from   >C = O group in Chemical reactions.
7. Why carboxylic acid exists as dimer ?
8. Why are boiling points of carboxylic acids higher than the corresponding alcohols?
9. Why chloroacetic acid is stronger acid than acetic acid ?
10. Write the IUPAC name of salicylic acid.
11. How benzoic acid is prepared from toluene ?
12. Why are bond length of C = O in carboxylic acid is slightly larger than that in aldehyde and Ketone ?
13. Discuss Hell-volhard-Zelinsky reaction of carboxylic acid
14. Why do aldehyde and ketones have high dipole a moment ?
15. Explain Clemmeson's reaction.
16. Aldehydes lower boiling points than corresponding alcohols and acids. Explain.
17. How will you distinguish between Acetaldehyde and benzaldehyde ?
18. Explain, why benzoic acid is stronger acid than acetic acid.
19. Fluoroacetic acid is stronger acid than chloroacetic acid. Explain.
20. How will you account for the acidic nature of carboxylic acid ?

21. Why chloroacetic acid is stronger acid than acetic acid ?
22. Why formic acid is a stronger acid than acetic acid

CHAPTER - ORGANIC COMPOUNDS CONTAINING NITROGEN COMPOUNDS
(TWO OR THREE MARKS QUESTIONS)

1. Which is more basic, aliphatic amines or ammonia and why?
2. Why do primary amines have higher boiling point than tertiary amines?
3. Out of ammonia (NH_3) and $C_2H_5NH_2$ which is more basic and why?
4. What is carbylamine reaction ?
5. Write a short note on diazotisation.
6. Write short note on Gabriel Phthalimide synthesis.
7. Why do primary amines have higher boiling point than tertiary amines
8. Aniline dissolves in aqueous HCl. Why?
9. Arrange the following in increasing order of base strength in gas phase: $(C_2H_5)_3N$, $C_2H_5NH_2$, $(C_2H_5)_2NH$
10. Out of CH_3NH_2 and CH_3OH, which has higher boiling point ?
11. Why secondary amines are more basic than primary amines
12. Why methylamine has less boiling point than methanol ?
13. How will you convert Aniline to benzene diazonium chloride ?
14. How will you convert benzene diazonium chloride to bromobenzene ?
15. Give one example of Gattermann reaction.

(THREE MARKS QUESTIONS)

1. Write a Hinsberg's test to distinguish between 1°, 2° and 3° amines.
2. Write the reaction of benzene diazonium chloride with.(i) water (ii)KI(iii)CuCN
3. Write the reaction of benzene diazonium chloride with.(i)CuBr/HBr (ii)CuCl/HCl (iii)Aniline
4. Write the reaction of benzene diazonium chloride with.(i) HNO_2 (ii)Fluoro boric acid (iii)Phenol
5. Write short note on coupling reactions.
6. Give reasons : (i) Aniline does not undergo Friedal-Crafts reaction. (ii) Aromatic primary amines cannot be prepared by Gabriel's phthalimide synthesis. (iii) Aliphatic amines are stronger bases than ammonia
7. Arrange the following in increasing order of boiling points : $(CH_3)_3N$, C_2H_5OH, $C_2H_5NH_2$
8. Write the reaction involved in the Hoffmann bromamide degradation reaction.
9. Write the reactions involved in the following : (i) Hofmann bromamide degradation reaction (ii) Diazotisation (iii) Gabriel phthalimide synthesis
10. Give reasons : (i) $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution. (ii) Aromatic diazonium salts are more stable than aliphatic diazonium salts.
11. Give reasons for the following: (i) Aniline does not undergo Friedal-Crafts reactions. (ii) $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution. (iii) Primary amines have higher boiling point than tertiary amines
12. Arrange the following in increasing order of boiling points : $(CH_3)_3N$, C_2H_5OH, $C_2H_5NH_2$
13. Write the reaction involved in the Hoffmann bromamide degradation reaction.
14. Write the reactions involved in the following : (i) Hofmann bromamide degradation

15.   (a) Write the reactions involved in the following : (i) Hofmann bromamide degradation reaction (ii) Diazotisation (iii) Gabriel phthalimide synthesis

CHAPTER - BIOMOLECULES
(COMPEHENSION TYPE QUESTIONS)

1.Comprehension:

Structure and shape of proteins can be studied at four different levels, i.e., primary, secondary, tertiary and quaternary, each level being more complex than the previous one. (i) Primary structure of proteins: Proteins may have one or more polypeptide chains. Each polypeptide in a protein has amino acids linked with each other in a specific sequence and it is this sequence of amino acids that is said to be the primary structure of that protein. (ii) Secondary structure of proteins: The secondary structure of protein refers to the shape in which a long polypeptide chain can exist. They are found to exist in two different types of structures viz. a- helix and b-pleated sheet structure. These structures arise due to the regular folding of the backbone of the polypeptide chain due to hydrogen bonding between and −NH− groups of the peptide bond. (iii) Tertiary structure of proteins: The tertiary structure of proteins represents overall folding of the polypeptide chains i.e., further folding of the secondary structure. It gives rise to two major molecular shapes viz. fibrous and globular. The main forces which stabilise the 2° and 3° structures of proteins are hydrogen bonds, disulphide linkages, van der Waals and electrostatic forces of attraction. (iv) Quaternary structure of proteins: Some of the proteins are composed of two or more polypeptide chains referred to as sub-units. The spatial arrangement of these subunits with respect to each other is known as quaternary structure.

   (i) Write the classification of the proteins?.
   (ii)How many types of the secondary structure of the proteins?
   (iii) Name the forces present in the proteins.
   (iv) Define the Quaternary structure of proteins?
   (v) Define Peptide bond?

2.Comprehension:

Proteins are the most abundant biomolecules of the living system. Chief sources of proteins are milk, cheese, pulses, peanuts, fish, meat, etc. They occur in every part of the body and form the fundamental basis of structure and functions of life. They are also required for growth and maintenance of body. The word protein is derived from Greek word, "proteios" which means primary or of prime importance. All proteins are polymers of a-amino acids.

        Amino acids contain amino (−NH$_2$) and carboxyl (−COOH) functional groups. Depending upon the relative position of amino group with respect to carboxyl group, the amino acids can be classified as alpha,beta and gamma and so on. Only -amino acids are obtained on hydrolysis of proteins. They may contain other functional groups also. All -amino acids have trivial names, which usually reflect the property of that compound or its source. Glycine is so named since it has sweet taste (in Greek glykos means sweet) and tyrosine was first obtained from cheese (in Greek, tyros means cheese.) Amino acids are generally represented by a three letter symbol, sometimes one letter symbol is also used.

   (i) What are protein?
(ii) What are the sources of the protein?
(iii) How would you classified the amino acids?
(iv)Write the function of protein in body?
(v) What are the amino acids?

3.Comprehension:

      Amino acids are classified as acidic, basic or neutral depending upon the relative number of amino and carboxyl groups in their molecule. Equal number of amino and carboxyl groups makes it

neutral; more number of amino than carboxyl groups makes it basic and more carboxyl groups as compared to amino groups makes it acidic. The amino acids, which can be synthesised in the body, are known as nonessential amino acids. On the other hand, those which cannot be synthesised in the body and must be obtained through diet, are known as essential amino acids Classification of Amino Acids Amino acids are usually colourless, crystalline solids. These are water-soluble, high melting solids and behave like salts rather than simple amines or carboxylic acids. This behaviour is due to the presence of both acidic (carboxyl group) and basic (amino group) groups in the same molecule. In aqueous solution, the carboxyl group can lose a proton and amino group can accept a proton, giving rise to a dipolar ion known as zwitter ion. This is neutral but contains both positive and negative charges. In zwitter ionic form, amino acids show amphoteric behaviour as they react both with acids and bases.

- (i)   What is Amino acid?
- (ii)   Define essential and non essential Amino acid?
- (iii)   Which acidic and basic part is present in the Amino acid?
- (iv)   What is Zwitter ion?
- (v)   Define the amphoteric nature of Amino acid? What is Amino acid?

(TWO MARKS QUESTIONS)

1.   What is the chemical name of Vitamin A and which disease is caused by its deficiency ?
2.   Describe the role or function of Vitamin A.
3.   Describe the role or function of Vitamin C.
4.   Describe the role or functions of Vitamin D.
5.   What is the chemical formula of Vitamin D and which disease is caused by its deficiency?
6.   What is Mutarotation ?
7.   What is peptide bond? Give one e.g. ?
8.   Difference between Enzyme and Catalyst
9.   What is Denatured Protein ? Give example
10.   Difference between DNA and RNA
11.   What is the difference between Nucleotide and Nucleoside
12.   Why can't Vitamin C be stored in our body ?
13.   What is the difference between Essential amino acid and Non-essential amino acid?
14.   What is the difference between Reducing Sugar and Non-reducing sugar.
15.   Explain Primary and Secondary structure of protein.

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Prepared By : State Resource Team Chemistry Punjab

School Education Department

SAMPLE PAPER – 2026 (10+2 CHEMISTRY)

TOTAL MARKS=70   **TIME=3HR**

1. Questions carrying one-mark MCQ

i. The value of Henry's constant K_H is:

(a) greater for gases with higher solubility (b) grater for gases with lower solubility (c) constant for all gases (d) none

ii. Isotonic solution at a particular temperature has the same:

(a) Density (b) Normality (c) Molar concentration(d) Volume

iii. The number of moles of NaCl in 3 litre of 3M solution is.

(a) 1 (b) 3 (c) 9 (d) 27

iv. In electrolysis, oxidation takes place at:

(a) Anode (b) Cathode (c) Anode and cathode (d) the surface of electrolyte solution

v. The number of reacting species which collide simultaneously to bring a chemical reaction is called:

(a) Molecularity (b) Order of reaction (c) Rate of reaction (d) none

vi. Primary and secondary valency of Pt in $[Pt(en)_2Cl_2]$ are:

(a) 4,4 (b) 4,6 (c) 6,4 (d) 2,6

vii. Which of the following has highest dipole moment?

(a) CH_2Cl_2 (b) $CHCl_3$ (c) CCl_4(d) CH_3Cl

viii. Aldehydes and ketones forms hydrocarbons by:

(a) Clemmensen reduction (b) Cannizzaro reaction (c) Rosenmund reduction (d) Aldol condensation

ix. Which of the following is strongest acid?

(a) CH_3COOH (b) $CH_3CHClCOOH$(c) CH_3CH_2COOH (d)CH_2ClCH_2COOH

x. Which of the following gives Iodoform test:

(a) Ethanol(b) Acetic acid (c) Propanol (d) Pantan-3-one

xi. $EDTA^{4-}$is ethylene diaminetetra acetate.   TRUE/FALSE

xii. The oxidation state of Ni in $[Ni(CO)_4]$ is zero.   TRUE/FALSE

xiii. Ether posses a dipole moment.   TRUE/FALSE

xiv. Wolff Kishner reduction of acetophenone gives toluene

xv. Aldehydesandketonesreactwithelectrophilesbutnotwithnucleophiles.

COMPREHENSION

Proteins are large complex molecules that may play critical roles in our body. They do most of the work in the cell and are required for the structure, function and regulation of the body's tissues and organs. Proteins are made up of hundreds or thousands of smaller units called amino acids, which are attached to one another in long chain. There are 20 different types of amino acids that can be combined to make a protein. The sequence of amino acids determines each protein unique 3-dimentional structure and its specific function. The amino acids which can be synthesized in our body are called non-essential amino acids.

xxvi.   Define the term proteins?   xxvii. What are non-essential amino acids?

xxviii. Why proteins are important for us?   xxix. how function of a protein can be determined?

xx.   How a protein is formed?

SECTION-B   QUESTIONS CARRYING TWO MARKS

2. State and explain Rault's law for liquids containing non-volatile liquids.

3. The boiling point of benzene is 353.23K. When 1.80g of a non-volatile non-ionisation solute was dissolved in 90g of benzene, the boiling point raised to 354.11K. Calculate the molar mass of the solute. [K_b for benzene $=2.53K$ Kg mol^{-1}].Or

Calculate the molar concentration of urea solution if it exerts an osmotic pressure of 2.45 atm at 300K [R=0.082   L atm^{-1} K$_{-}^{1}$].

4. A first order reaction is found to have rate constant, k=5.5 x 10^{-14} s^{-1}. Find half-life period of reaction Or

State the order of reaction and units of rate constant:

$2NOBr(g)$ -------→$2NO(g) + Br_2(g)$ r= $k[NOBr]^2$
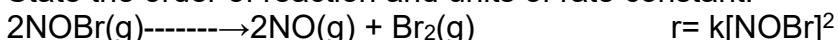
5. Write the difference between the order and molecularity.

6. Write difference between the emf and potential difference of a cell.

7. Name the following complexes: (i) $K[PtCl_3(NH_3)]$ (ii) $[Pt(NH_3)_2Cl_4]$

8. Why are ether relatively inert compound ?Or

Why alcohols have higher boiling points than alkanes?

9. Give one test to distinguish between acetophenone and Benzophenone.

 Or Write Rosenmund reduction reaction.

10. Why do amines act as nucleophiles?

11. Write difference between DNA and RNA.

12.Write short note on Gabriel Phthalimide synthesis

13.Write difference between double salt and coordination compounds.

14.Transition metals have high melting points and boiling points. Why ?

15.What amount of electricity can deposit 1 mole of Al metal at cathode when passed through molten $AlCl_3$?

 SECTION- C QUESTIONS   CARRYING THREE MARKS

16. Write Nernst equation and calculate EMF of cell:
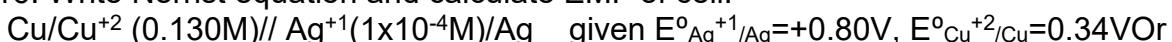
 Cu/Cu^{+2} (0.130M)// Ag^{+1}($1x10^{-4}$M)/Ag   given $E°_{Ag^{+1}/Ag}$=+0.80V, $E°_{Cu^{+2}/Cu}$=0.34VOr

The molar conductance of infinite dilution for sodium acetate (CH_3COONa), Hydrochloric acid (HCl) and sodium chloride (NaCl) are 95.5,426.9 and 120.4 S cm^2mol^{-1} respectively at 298 K. Calculate the molar conductance of Acetic Acid (CH_3COOH) at infinite dilution.

17. A first order reaction is 20% complete in 10 minutes. Calculate the time for 75% completion of reaction..

18. Why boiling points of ethers are lower than corresponding isomeric alcohols? Give two preparations of Phenol.   Or Write the Victor meyer's test to distinguish between   1º, 2º and 3º alcohols

19. Why aliphatic amines are stronger base than ammonia?

 SECTION-D   QUESTIONS CARRYING FIVE MARKS

20. (a)what is lanthanoid contraction? give its cause. Give three consequences of lanthanoid contraction. OR

 (a) Why Zn^{2+} salts are white while Cu^{2+} salts are blue?

 (b) Why is +2 oxidation state of manganese more stable than its +3 oxidation state?

 (c) Why Cu is considered as transition metal?   (2+2+1)

21. Explain the following reactions:

 (a)   Balz-Schiemann reaction   (b) Finkelstein reaction   (c) Ullmann reaction   (d) Swarts reaction

   (e)   Gattermann reaction   (1X5=5)

                 Or

 (a) Give three differences between SN^1 and SN^2 reactions?

 (b) Define (i) Retention (ii) Inversion   (3+2)