Sample Paper 2 Solutions

Class XII 2023-24

Chemistry

Time: 3 Hours **Max. Marks: 70**

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

SECTION-A

Directions (Q. Nos. 1-16) : The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Acetic acid reacts with hydrazoic acid at 0° in the presence of conc. H_2SO_4 to give:

(a) methyl amine (b) methyl cyanide

(c) ethylamine (d) methane

Ans : (a) Methyl amine

On treating acetic acid with hydrazoic acid and conc. H_2SO_4 at $0^\circ C$, the product obtained is methylamine.

The reaction is known as schmidt reaction.

$$\underset{\text{acetic acid}}{CH_3-COOH} + \underset{\text{hydrazoic acid}}{HN_3} \xrightarrow[0^\circ C]{\text{conc } H_2SO_4} \underset{\text{methylamine}}{CH_3-NH_2} + CO_2 + N_2$$

2. Osmotic pressure of a solution is 0.0821 atm at a temperature of 300 K. The Concentration in moles/ lit. will be:

(a) 0.3×10^{-2} (b) 3

(c) 0.33 (d) 0.666

Ans : (a) 0.3×10^{-2}

We Know that,

$$\begin{aligned}\pi &= CRT\\ 0.0821 &= C\times 0.0821\times 300\\ C &= \frac{1}{300}\text{mol/L}\\ C &= 0.3\times10^{-2}\,\text{mol/L}\end{aligned}$$

3. When nitrobenzene is reduced in neutral medium, the product is:

(a) C_6H_5NHOH (b) C_6H_5NH2

(c) *p*-aminophenol (d) azobenzene

Ans : (a) C_6H_5NHOH

When nitrobenzene is reduced in neutral medium, the product is C_6H_5NHOH.

4. The rate constant for the reaction, $A+2B\longrightarrow$ product is expressed by $R=[A][B]^2$ The order of reaction will be:

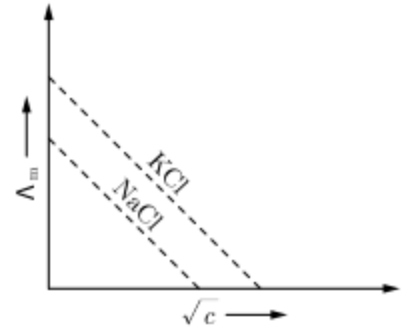
(a) 6 (b) 5

(c) 2 (d) 3

Ans : (d) 3

The order of the reaction is 3. Therefore, option (b) is correct.

5. Consider the following graph between molar conductivity (Λ_m) and $\sqrt{c}$



What do you infer about NaCl and KCl from the graph?

(a) NaCI and KCl are strong electrolytes

(b) Na^+ (aq.) has less conductance than $K^+(aq)$ due to less hydration

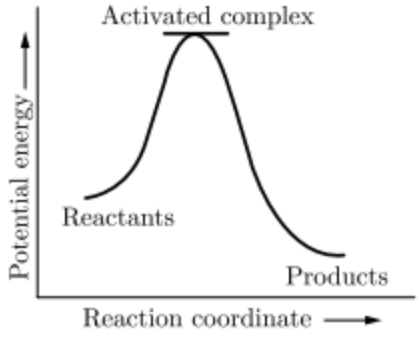
(c) NaCl and KCl are weak electrolytes

(d) Na^+ (aq.) has more conductance than $K^+(aq)$

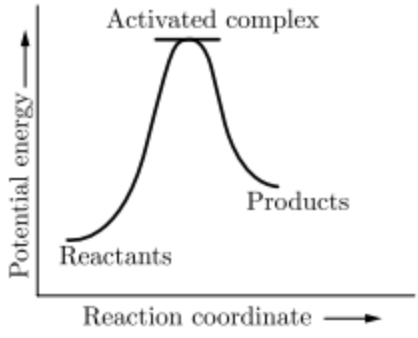
Ans : (a) NaCl and KCl are strong electrolytes.

Both NaCl and KCl are strong electrolytes and $Na^+(aq)$ has Less conductance than K^+(aq) due to more hydration.

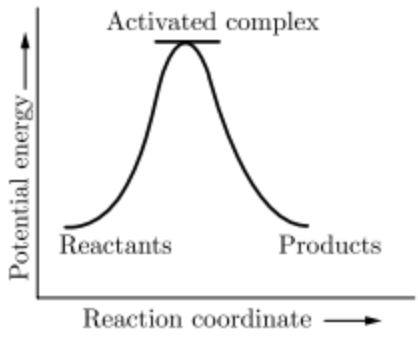
6. Which of the following graphs represents exothermic reaction?



(i)



(ii)



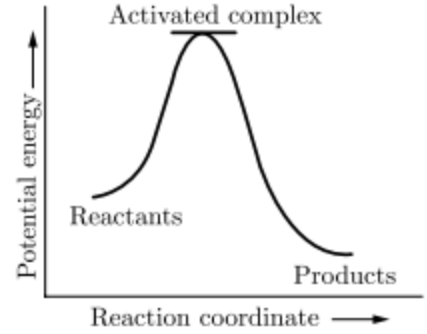
(iii)

(a) (ii) only (b) (i) only

(c) (iii) only (d) (i) and (ii)

Ans : (b) (i) only

The graph of potential energy versus reaction coordinate showing the effect of a catalyst on activation energy is as shown. A catalyst provides an alternate pathway having lower activation energy.



7. In which of the following ions, number of unpaired electron is zero?

(a) $Fe^{++}(Z = 26)$ (b) $Cr^{++}(Z = 24)$

(c) $Zn^{++}(Z = 30)$ (d) $Cu^{++}(Z = 29)$

Ans : (c) $Zn^{++}(Z = 30)$

Ion	Unpaired Electron (S)
Cr^{2+}	4
Fe^{2+}	4
Cu^{2+}	1
Zn^{2+}	0

Important MCQ Question For Class 12 Chemistry

8. Phenol does not undergo nucleophilic substitution reaction easily due to:

(a) instability of phenoxide ion

(b) acidic nature of phenol

(c) partial double bond character of C—OH bond

(d) partial double bond character of C—C bond

Ans : (c) partial double bond character of C-OH bond

Phenol does not undergo nucleophilic substitution reaction easily due to partial double bond character of C − OH bond. Due to resonance effect the oxygen gets attached to the C on the benzene ring and acquires a partial double bond character, making it tough to break.

9. The time required for the half-completion ($t_{1/2}$) of a first order reaction is:

(a) independent of its initial concentration
(b) dependent on square root of its initial concentration
(c) dependent on its initial concentration
(d) inversely proportional to its initial concentration

Ans : (a) independent of its initial concentration

The time required for the half-completion of a first order reaction is independent of its initial concentration.

10. Which of the following isomer has the highest melting point?

(a) 1, 4-dichlorobenzene
(b) 1, 2-dichlorobenzene
(c) 1, 3-dichlorobenzene
(d) All isomers have same melting points

Ans : (a) 1, 4-dichlorobenzene.

1, 4-dichlorobenzene is a para isomer and para isomers are more symmetric than ortho and meta isomers. Hence, it has highest melting point

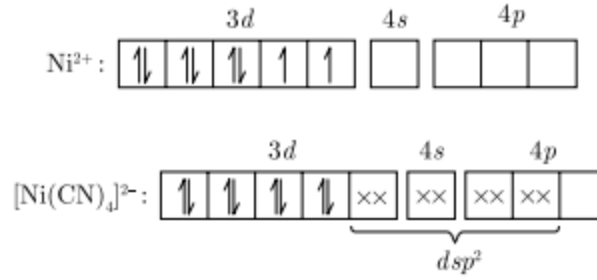
Important MCQ Question For Class 12 Chemistry

11. Why is $[Ni(CN)_4]^{2-}$ diamagnetic while $[NiCl_4]^{2-}$ is paramagnetic in nature:

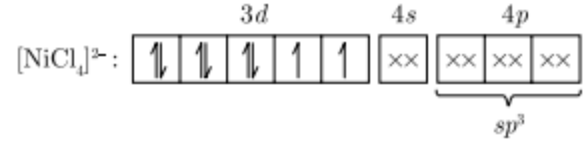
(a) In $[Ni(CN)_4]^{2-}$, no unpaired electrons are present while in $[NiCl_4]^{2-}$ two unpaired electrons are present.
(b) $[NiCl_4]^{2-}$ shows sp^2 hybridisation, hence it is paramagnetic.
(c) $[Ni(CN_4)]^{2-}$ shows sp^3 hybridisation, hence it is diamagnetic.
(d) In $[NiCl_4]^{2-}$, no unpaired electrons are present while in $[Ni(CN)_4]^2$ two unpaired electrons are present.

Ans : (a) In $[Ni(CN)_4]^{-2}$, no unpaired electrons are present white in $[Ni(CN)_4]^2$, two unpaired electrons are present.

In $[Ni(CN)_4]^{-2}$ there is no unpaired electrons because CN^- is a strong field ligand thus it pair up the electrons



In $[Ni(Cl)_4]^{2-}$

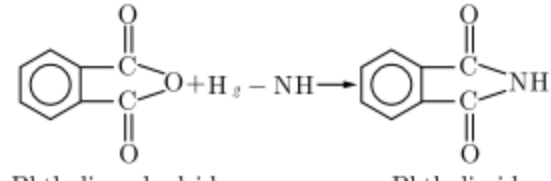


12. Which one of the following is formed by Gabriel phthalimide reaction?

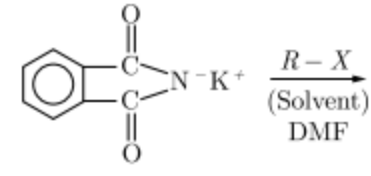
(a) Tertiary amine
(b) Primary aromatic amine
(c) Primary aliphatic amine
(d) Secondary amine

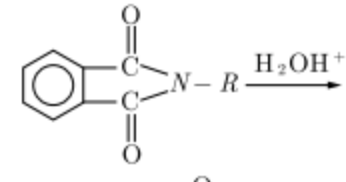
Ans : (c) Primary aliphatic amine

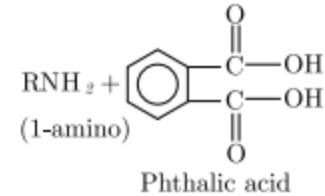
Among the given options, benzylamine can be prepared by Garbriel phthalimide systhesis. It gives primary aliphatic amines. Therefore, product is



Phthalic anhydride Phthalimide







Phthalic acid

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Separation of Zr and Hf is difficult.
Reason : Because Zr and Hf lie in the same group of the periodic table.
(a) Both Assertion and Reason are true but Reason not the correct explanation of Assertion.
(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(c) Assertion is false but Reason is true.
(d) Assertion is true but Reason is false.

Ans : (a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

Separation of Zr and Hf is difficult because of lanthanoid contraction which causes almost similar radii of both of them.

14. **Assertion :** All naturally occurring α-amino acids except glycine are optically active.
Reason : Most naturally occurring amino acids have L-configuration.
(a) Both Assertion and Reason are true but Reason not the correct explanation of Assertion.
(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(c) Assertion is false but Reason is true.
(d) Assertion is true but Reason is false.

Ans : (a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

Except glycine, all other naturally occurring α -amino acids are optically active since the α-carbon atom is asymmetric. These exist both in O and L forms.

15. **Assertion :** N, N-Diethylbenzene sulphonamide is insoluble in alkali.
Reason: Sulphonyl group attached to nitrogen atom is strong electron withdrawing group.
(a) Both Assertion and Reason are true but Reason not the correct explanation of Assertion.
(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(c) Assertion is false but Reason is true.
(d) Assertion is true but Reason is false.

Ans : (a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

N, N-diethylbenzene sulphonamide is insoluble on alkali because it has no acidic hydrogen and sulphonyl group that is attached to nitrogen atom in electron withdrawing group.

16. **Assertion :** Alcohols have higher boiling Points than ethers of comparable molecular masses
Reason: Alcohols and ethers are isomeric in nature
(a) Both Assertion and Reason are true but Reason not the correct explanation of Assertion.
(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(c) Assertion is false but Reason is true.
(d) Assertion is true but Reason is false.

Ans : (a) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion.

Alcohols have higher boiling points than ethers because intermolecular H-bonding is present in alcohols and not in ethers.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Define molar conductivity for the solution of an electrolyte. How does it vary with concentration?

Ans :

Molar conductivity of a solution at a given concentration is defined as the conductance of the electrolytic solution kept between the electrodes of a conductivity cell at unit distance but having area of cross section large enough to accommodate sufficient volume of solution that contains one mole of the electrolyte.
Molar conductivity increases with decrease in concentration because total volume V of solution containing one mole of electrolyte also increases

18. Consider the decomposition of hydrogen peroxide in alkaline medium which is catalysed by iodide ions.

$$2H_2O_2 \xrightarrow{OH^-} 2H_2O + O_2$$

This reaction takes place in two steps as given below :

Step-I : $H_2O_2 + I^- \longrightarrow H_2O + IO^-$ (Show)

Step-II : $H_2O_2 + IO^- \longrightarrow H_2O + I^- + O_2$ (fast)

(i) Write the rate law expression and determine the order of reaction w.r.t. H_2O_2

(ii) What is the molecularity of each individual step?

Ans :

(i) For a complex reaction, the rate of overall reaction depends upon the rate of reaction slowest step. Hence. Rate law expression: Rate $k(H_2O_2)(I^-)$. Order of reaction w.r.t. $H_2O_2 = 1$.

(ii) Molecularity of both Step-I and Step-II is two.

19. Glucose and sucrose are soluble in water but cyclohexane and benzene (simple six membered ring compounds) are insoluble in water. Explain.

Ans :

Both glucose ($C_6H_{12}6$) and sucrose ($C_{12}H_{22}O_{11}$) are organic compounds and are expected to be insoluble in water. But quite surprisingly, they readily dissolve in water. This is due to the presence of a number of OH group (five in case of glucose and eight in sucrose) which are of polar nature. These are involved in the intermolecular with the molecules of H_2O (water). As a result, both of them readily dissolve in water.

Benzene (C_6H_6) and cyclohexane (C_6H_{12}) are hydrocarbons which do not have any polar group. They therefore do not dissolve in water since there is hardly any scope of hydrogen bonding in their molecule with those of H_2O (water).

or

What type of bonding helps in stabilising the α -helix structure of proteins? Explain

Ans :

α-helix structure of proteins is a structure in which a polypeptide chain forms all possible hydrogen bonds. In it polypeptide chain is twisted into a right handed screw (helix). Consequently, –NH group of each amino acid residue form hydrogen bonds with $C = 0$ group present at next (adjacent) turn of the helix. Thus, α-helix structure of proteins get stabilised by these hydrogen bonds.

20. CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN. Why?

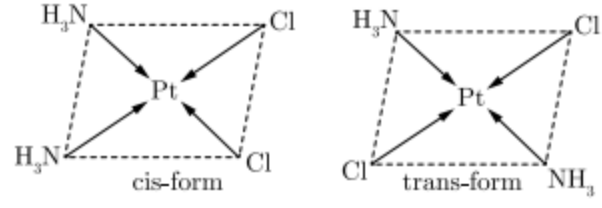
Ans :

CH_3COCH_3 is sterically hindered than CH_3CHO due to the presence of alkyl group on both sides of the carbonyl carbon, making them less reactive towards nucleophilic attack because both methyl groups have electron releasing tendency due to *I*-effect. These alkyl groups make ketone less reactive by donating an electron to a carbonyl group. Therefore, CH_3CHO is more reactive towards reaction with HCN.

21. Write the IUPAC name and geometrical isomer of $[Pt(NH_3)_2Cl_2]$.

Ans :

IUPAC name of $[Pt(NH_3)_2Cl_2]$ is diamminedichloridoplatinum (II). It shows following two geometrical isomers:



SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. Arrange each set of compounds in order of increasing boiling points:

(i) Bromomethane, bromoform, chloromethane, dibromomethane

(ii) 1-Chloropropane, isopropylchloride, 1-chlorobutane.

Ans :

(i) The boiling points of organic compounds are linked with the van der Waals' forces of attraction which depend upon the molecular size. In the present case, all the compounds contain only one carbon atom. The molecular size depends upon size of the halogen atom and also upon the number of halogen atoms present in different molecules. The increasing order of boiling points is

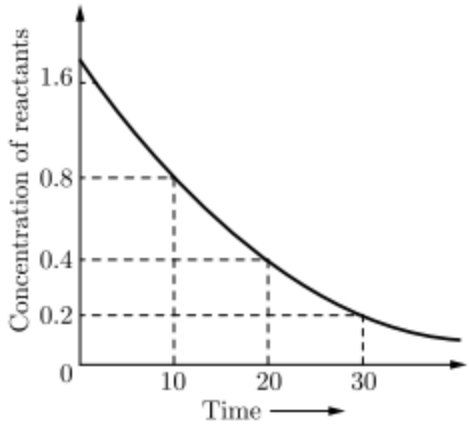
CH_3Cl(chloromethane) < CH_3Br(bromomethane)

CH_2Br_2(dibromomerthane) < $CHBr_3$(bromoform)

(ii) The same criteria is followed in this case. We all know that the branching of the carbon atom chain decreases the size of the isomer and this decreases its boiling point as compared to straight chain isomer. The increasing order of boiling point is:

$(CH_3)_2CHCl$(isopropylchoride or $2-$chloropropane) < $ClCH_2CH_3$($1-$Chloropropane) < $ClCH_2CH_2CH_2CH_3$ ($1-$chlorobutane)

23. Analyse the given graph, drawn between concentration of reactant νs time.



(i) Predict the order of reaction.

(ii) Theoretically, can the concentration of the reactant reduce to zero after infinite time? Explain.

Ans :

(i) It can be seen that, the concentration of the reactant decreases exponentially with time which is a characteristic of the 'first order reaction' and the rate of the reaction here is proportional to the first power of the concentration of the reactants.

(ii) The first order rate equation, $A = A_0 e^{-kt}$ where, A is the concentration of the reactant at time t and A_o is the initial concentration of the reactant.

Putting the value $A = 0$, we get.

$A_0 e^{-kt} = 0$, therefore $e^{-kt} = 0$

Hence, $t = \infty$, since k cannot be zero. So, theoretically, the concentration of the reactant will become zero at infinite time.

24. Answer the following questions: (Any three)

(i) Why is the vapour pressure of an aqueous solution of glucose lower than that of water?

(ii) What is semi-permeable membrane?

(iii) Why do gases always tend to be less soluble in liquids as the temperature is raised?

(iv) How does sprinkling of salt help in clearing the snow covered roads in hilly areas? Explain the phenomenon involved in the process.

Ans :

(i) Evaporation is a surface process. Availability of more surface area is responsible for more vaporisation of water. In pure water, complete liquid surface is covered with water molecules. When a non-volatile solute like glucose is dissolved in water, the fraction occupied by solvent molecules Consequently, the number of solvent molecules leaving the surface reduces and hence, vapour pressure of aqueous solution of glucose decreases

(ii) Semipermeable membranes are natural or synthetic continuous sheets or films which contain a network of submicroscopic holes or pores. Parchment paper, egg shell membrane, copper ferrocyanide are semipermeable membranes.

(iii) Dissolution of gas in liquid is an exothermic three groups of equivalent hydrogen atoms. As a process. Thus, according to Le-Chatelier's principle, the equilibrium shifts in backward direction on increasing the temperature. Therefore, gases always tend to be less soluble on raising the temperature.

(iv) When salt is sprinkled on the snow covered roads, snow from the surface starts melting because sprinkling of a non-volatile substance

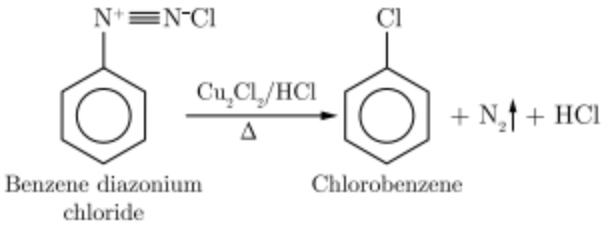
like salt depresses the freezing point of water and hence, it helps in clearing the snow from the roads.

25. (i) What is diazonium salt?
(ii) Write the chemical reaction of preparation of chlorobenzene from benzene diazonium chloride.

Ans :

(i) Diazonium salt is the most reactive derivative of aromatic primary amines. Their general formula is $ArN\overset{+}{\underset{2}{}}X$ (*i.e*, $ArN \equiv NCl^-$). Where Ar is an aryl group and $X^- = Cl^-, I^-, HSO^-_4, BF^-_4$ etc. In these salts $-\overset{+}{N} \equiv N$ group is called diazonium group. If this group is attached with a hydrocarbon, it is attached with a hydrocarbon, it is named by adding suffix diazonium followed by the name of anion present, *e.g*, $C_6H_5N_2Cl$ is named as benzene diazonium chloride.

(ii) Chlorobenzene from benzene diazonium chloride:

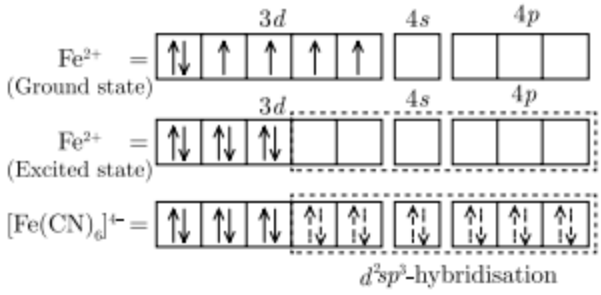


26. Determine the structure and magnetic behaviour of $[Fe(CN)_6]^{4-}$ ion on the basis of valence bond theory.

Ans :

$$_{26}Fe = (Ar)4s^2 3d^6$$
$$Fe^{2+} = 4s^0 3d^6$$

CN^- is a strong field ligand, So pairing of electrons take place.



Due to d^2sp^2-hybridisation, its structure is octahedral and because of the absence of unpaired electrons, it is diamagnetic.

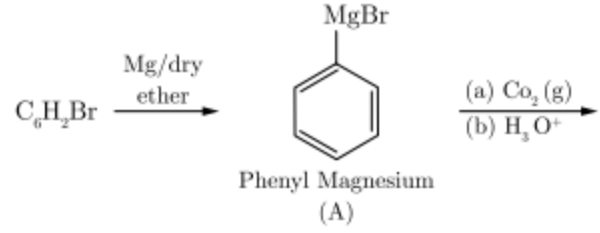
27. Write structure of compounds *A*, *B* and *C* in each of the following reactions:

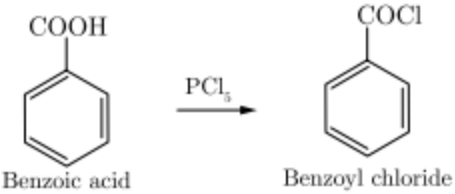
(i) $C_6H_5Br \xrightarrow{Mg/dry\ ether} A \xrightarrow[(b)\,H_3O^+]{(a)\,CO_2(g)} B \xrightarrow{PCl_5} C$

(ii) $CH_3CN \xrightarrow[(b)\,H_3O^+]{(a)\,SnCl_2/HCl} A \xrightarrow{dil.\ NaOH} B \xrightarrow{\Delta} C$

Ans :

(i)





(ii) $CH_3CN \xrightarrow[(b)\,H_3O^+]{(a)\,SnCl_2/HCl} \underset{\text{Acetaldehyide}}{CH_3CHO}\ (A) \xrightarrow{dil\ NaOH}$

$$CH_3 - \underset{\substack{3-\text{hydroxybutana}\\(B)}}{\overset{\overset{HO}{|}}{CH}} - CH_2 - CHO \xrightarrow{\Delta} \underset{\substack{But-2-enal\\(C)}}{CH_3 - CH = CH - CHO}$$

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

Ans :

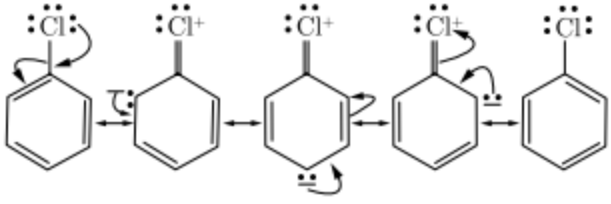
(i)

(a) The stereoisomers retated to each other as non-superimposable mirror images are called enantiomers.

(b) Equimolar mixture of *d* and *I* form is known as racemic mixture.

(ii) Two reasons for the resistivity or less reactivity of chlorobenzene towards a nucleophilic substitution reaction are as follows:

(a) **Resonance Effect :** The electron pair of chlorine atom is involved in conjugation with the n-electrons of the benzene ring and the following resonating structures are obtained.



As a result, electrons of C—Cl bond get delocalised and a partial double bond character develops in the bond and hence, it becomes difficult for the nucleophile to cleave the C—Cl bond.

(b) **Increased Electron Density :** A repulsion is suffered by the nucleophile due to increased electron density on the benzene ring which prohibits the nucleophile to make a close access for the attack on the molecule.

SECTION-D

Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. The four colligative properties of the dilute solutions help in calculating the molecular mass of the solute which is often called observed molecular mass. It may be same as the theoretical molecular mass (calculated from the molecular formula) if the solute behaves normally in solution. In case, it undergoes association or dissociation, the observed molar mass gives different results. The nature of the solute in solution is expressed in terms of van't Hoff factor (i) which may be 1 (if the solute behaves normally), less than 1 (if the solute associates) and more than 1 (if the solute dissociates). The extent of association or dissociation is represented by cc which is:

$$a = \frac{i-1}{(1/n-1)} \quad \text{or } \frac{i-1}{n-1} \text{ (for dissociation)}$$

(for association)

Based on the above passage, answer the following questions :

(i) What is common in all the four colligative properties?

(ii) What is the expected value of van't Hoff factor for $K_4[Fe(CN)_6]$ when it completely dissociates in water?

(iii) What is the value of van't Hoff factor fora dilute solution of K_2SO_4 in water?

or

(iv) In the determination of molar mass of A^+B using colligative property, what will be the van't Hoff factor if the solute is 40% dissociated?

Ans :

(i) All of them depend upon the number of the particles of the solute in the solution as well as its molar concentration.

(ii) $K_4[Fe(CN)_6]$ dissocoates as: $4K^+ + [Fe(CN)_6]^{3-}$

$$\alpha = \frac{i-1}{(n-1)} \text{ or } 1 = \frac{i-1}{5-1} \text{ or } i = 4+1 = 5$$

(iii) K_2SO_4 dissociates completely in water as:

$$K_2SO_4 \xrightarrow{(aq)} 2K^+(aq) + SO_4^{2-}(aq)$$

$$\alpha = \frac{i-1}{(n-1)} \text{ or } 1 = \frac{i-1}{3-1}$$

$$\text{or } i = 2+1 = 3$$

or

(iv) Dissociation of A^+B^- may be expressed as:

$$A^+B^- \xrightleftharpoons{(aq)} A^+(aq) + B^-(aq) \qquad (n=2)$$

$$\alpha = \frac{i-1}{(n-1)}; 0.4 = \frac{i-1}{2-1}$$

$$i = 1 + 0.4 = 1.4$$

30. Polysaccharides may be very large molecules. Starch, glycogen, cellulose, and chitin are examples of polysaccharides.

Starch is the stored form of sugars in plants and is made up of amylose and amylopectin (both polymers of glucose). Amylose is soluble in water

and can be hydrolyzed into glucose units breaking glycosidic bonds, by the enzymes a-amylase and β-amylase. It is straight chain polymer. β-mylopectin is a branched chain polymer of several D-glucose molecules. 80% of amylopectin is present in starch. Plants are able to synthesize glucose, and the excess glucose is stored as starch in different plant parts, including roots and seeds. The starch that is consumed by animals is broken down into smaller molecules, such as glucose.

The cells can then absorb the glucose. Glycogen is the storage form of glucose in humans and other vertebrates, and is made up of monomers of glucose. It is structurally quite similar to amylopectin. Glycogen is the animal equivalent of starch. It is stored in liver and skeletal muscles.

Cellulose is one of the most abundant natural biopolymers. The cell walls of plants are mostly made of cellulose, which provides structural support to the cell. Wood and paper are mostly cellulosic in nature.

Like amylose, cellulose is a linear polymer of glucose. Cellulose is made up of glucose monomers that are linked by bonds between particular carbon atoms in the glucose molecule. Every other glucose monomer in cellulose is flipped over and packed tightly as extended long chains. This gives cellulose its rigidity and high tensile strength—which is so important to plant cells. Cellulose passing through our digestive system is called dietary fiber.

Based on the above passage, answer the following questions:

(i) Glycogen is a kind of polysaccharide and is the storage form of glucose present in humans and other vertebrates. It is the animal equivalent of starch but can you say where is it stored in animals?

(ii) What can you infer about the characteristic of amylose from the passage?

(iii) Whenever glucose levels drop in our body, a bipolymer breaks down to release glucose. Name this bipolymer and it is structurally similar to which polymer?

or

(iv) Which polymer is important to plant cells? How?

Ans :

(i) Glycogen is stored in animals in liver and skeletal muscles.

(ii) Amylose is a straight chain water soluble component of starch which constitutes 20% of it. It can be hydrolysed into glucose units breaking glycosidic bonds by the enzymes $\alpha-$ amylase and $\beta-$amylase.

(iii) This bipolymer is cellulose and it is structurally similar to amylopectin.

or

(iv) Cellulose is a linear polymer of glucose important to plant cells. It is made up of glucose monomers that are linked by bonds between particular carbon atoms in the glucose molecule. Every other glucose monomer is flipped over and packed tightly as extended long chains providing the cellulose its rigidity and high tensile strength.

Important MCQ Question For Class 12 Chemistry

Section-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. (i) Write down complete equation for the following reactions:

(a) Oxidation of Fee' by 0.203- in acidic medium.

(b) Oxidation of 5203- by KMn04 (aq) neutral.

(c) Decomposition of oxalate in the presence of KMn04 in acidic medium.

(ii) Compare the chemistry of actinoids with that of the lanthanoids with special reference to :

(a) Electronic configuration.

(b) Atomic and ionic sizes.

(c) Oxidation state.

(d) Chemical reactivity.

Ans :

(i)

(a) $Cr_20_{7}^{2-} + 14H^+ + 6Fe^{2+} \rightarrow \underset{\text{Ferric ion}}{2Cr^{3+} + 6Fe^{3+}}\ 7H_2O$

(b) $3S_2O_3^{2-} + 8MnO^{-}_4 + H_2O \longrightarrow 8MnO_2 + 6SO_4^{2-}$

Sulphate ion

(c) $2MnO_4 + 16H^+ + 5C_20_4^{2-} \longrightarrow 2Mn^{2+} + 8H_2O$

Carbon dioxide

$10CO_2\uparrow$

or

$2KMnO_4 + 3H_2SO_4 + 5(COOH)_2 \longrightarrow K_2SO_4 + 2MnSO_4 + 8H_20 + \underset{\text{Carbon dioxide}}{10CO_2}\uparrow$

(ii) (a) **Electronic Configuration :** General etectronic configuration of lanthanoids is $_{54}(Xe)4f^{1-14}5d^{0-1}6s^2$ where for actinoids general electronic configuration is $(Rn)_{86}5f^{1-14}6d^{1-2}7s^2$ Thus lanthanoids are related with $4f$ series and actinoids are related with $5f$ series.

(b) **Atomic and lonic sizes :** Lanthanoids and actinoids both show a decrease in sizes of their atoms or ions in +3 oxidation state. ln case of lanthanoids, this decrease is called Lanthanide contraction and in case of actinoids, it is called actinoid contraction. Although in case of actinoids, the contraction increases gradually due to very less shielding effect of $5f$ electrons.

(c) **Oxidation State :** Lanthanoids exhibit limited oxidation states (+2, +3, +4), out of which +3 oxidation state is most common, This is because of more energy difference between the energies of $4f$ $5d$ and $6s$-subshells.
On the other hand, actinolds exhibit more oxidation states due to less energy difference between the energies of $5f$ $6d$ and $7s$ subshells

(d) **Chemical Reactivity :** Chemical reactivity of lanthanoids and actinoids is described below:
Lanthanoids: ln their chemical behaviour, in general, the earlier members of the series are quite reactive similar to calcium but, with increasing atomic number, they behave more like aluminium.
For the half-reaction $Ln^{3+}(aq) + 3e \longrightarrow Ln(s)$, the value of E° are in the range of –2.2 to –2.4 V except for *Eu* for which the value of E° is –2.0V. Thus, it is obvious that their values show a small variation. On the basis of this standard electrode potential (E°). these show different reactions. When heated slowly in the atmosphere of hydrogen gas, these metals combine with hydrogen. When heated with carbon, these metals form carbides like Ln_3C, Ln_2C_3 and LnC_2. These liberate hydrogen from dilute acids and burn in halogens to form halides. They form oxides M_2O_3 and hydroxides $M(OH)_3$. The hydroxides are definite compounds, not just hydrated oxides. They are basic like alkaline Earth metal oxides and hydroxides.
Actinoids : The actinoids are highly reactive metals, especially when finely divided. The action of boiling water on them gives a mixture of oxide and hydride. These combine with most non-metals at moderate temperatures. Hydrochloric acid attacks all metals, but these are less affected by nitric acid. This is because of the formation of protective layer of oxide on their surface. These remain unaffected by alkalise.

Important MCQ Question For Class 12 Chemistry

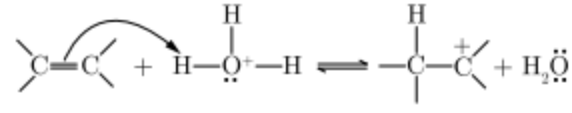
32. (i) Give the mechanism for the formation of ethanol from ethene.
(ii) Predict the reagent for carrying out the following conversions:
(a) Phenol to benzoquinone.
(b) Anisole to p-bromoanisole.
(c) Phenol to 2, 4, 6-tribromophenol.

Ans :

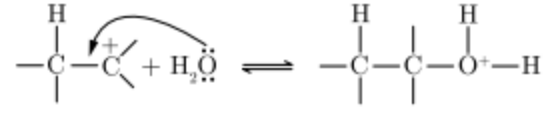
(i) Mechanism for the formation of Ethanol from Ethene.

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

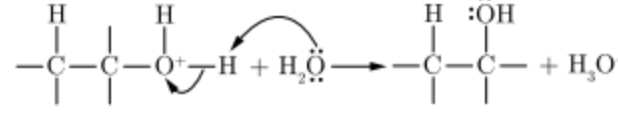
$$H_2O + H^+ \longrightarrow H_3O^+$$



Step 2 : Nucleophilic attack of water on carbocation.



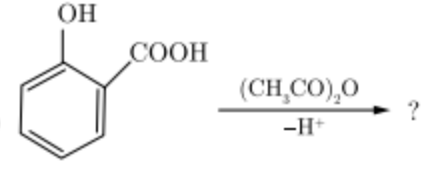
Step 3 : Deprotonation to form an alcohol.



(ii)
(a) $K_2Cr_2O_7 + H_2SO_4/Na_2Cr_2O_7 + H_2SO_4$
(b) $Br_2 in CH_3COOH$
(c) Bromine water ($aa.Br_2$)

or

(i) Write the product(s) in the following reactions:

(a) 

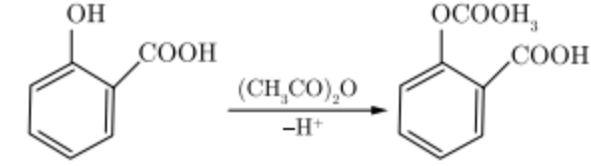
(b) $H_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-O-CH_2-CH_3 \xrightarrow{HI} ? + ?$

(c) $CH_3-CH=CH-CH_2-OH \xrightarrow{PCC} ?$

(ii) Give simple chemical tests to distinguish between the following pairs of compounds:
(a) Ethanol and Phenol.
(b) Propanol and 2-methylpropan-2-ol.

Ans :

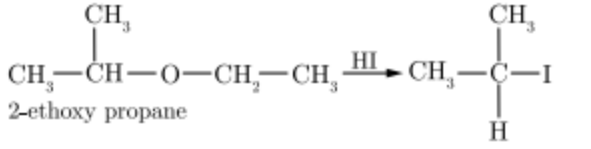
(i) (a)



Salicylic acid Aspirin

$+ CH_3COOH$
Acetic acid

(b)



2-ethoxy propane 2-iodopropane

$+ CH_3CH_2OH$
Ethanol

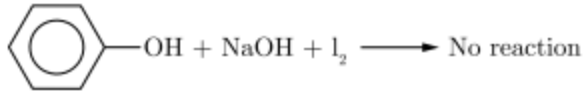
(c)

$CH_3-CH=CH-CH_2-OH$
But-2-en-1-ol

$\xrightarrow{PCC} CH_3-CH=CH-CHO$
But-2-en-1-ol

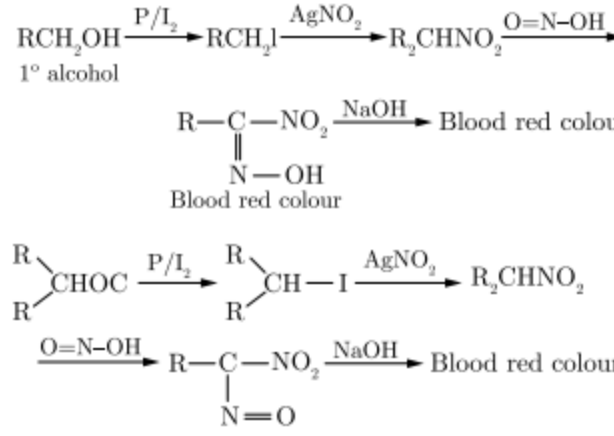
(ii) (a) Ethanol. and Phenol lodoform test is used to distinguish ethanol. Ethanol reacts with NaOH solution containing iodine. 0n heating, it gives a yellow precipitate of iodoform white phenol does not react.

$\underset{\text{Ethanol}}{CH_3CH_2OH} + 6NaOH + 3I_2 \longrightarrow \underset{\text{Iodoform}}{CHI_3\downarrow} + HCOONa + 5NaI + 5H_2O$



$\longrightarrow$ No reaction

(b) Propanol and 2-methylpropan-2-ol
PropanoI is 1° alcohoI white 2-methytpropan2-ol is 2° alcohol. Victor-Meyer's test is used to both of them. ln this test, first the given alcohol is treated with P/12 and then with $AgNO_2$ and HNO_2. The final. product obtained gives different colour with NaOH. By identifying the colour produced, the alcohols are identified.



33. (i) For the reaction:
$2AgCl(s) + H_2(g)\,(1\,atm) \longrightarrow 2Ag(s) + 2H^+$
$(0.1M) + 2C1^-(0.1M)$, $\Delta G^\circ = -43600\,J$ at 25°C.
Calculate the emf of the cell. $[Log10^{-n} = -n]$

(ii) Define fuel cell and write its two advantages.

Ans :

(i) Gibbs energy of reaction is.

$$\Delta G^\circ = -nFE^\circ_{cell}$$

Given, $\Delta G^\circ = -43600\,J,\ n = 2,\ E^\circ_{cell} = ?$

$$F = 96500\,C\,mol^{-1}$$

Putting the velues in the formula, We get.

$$-43600\,J = -2\times9 + 96500\times E^\circ_{cell}$$

$$E^\circ_{cell} = \left(\frac{43600}{2\times96500}\right)V$$

$$E^\circ_{cell} = 0.22\,Volt$$

Now using Nernst equation,

$$\underline{E_{cell} = E^\circ_{cell} - \frac{0.0591}{n}\log\left(\frac{\text{Product}}{\text{Reactant}}\right)}$$

$$E_{cell} = E^\circ_{cell} - \frac{0.0591}{n}\log\left(\frac{[H^+]^2[Cl^-]^2}{H_2(g)}\right)$$

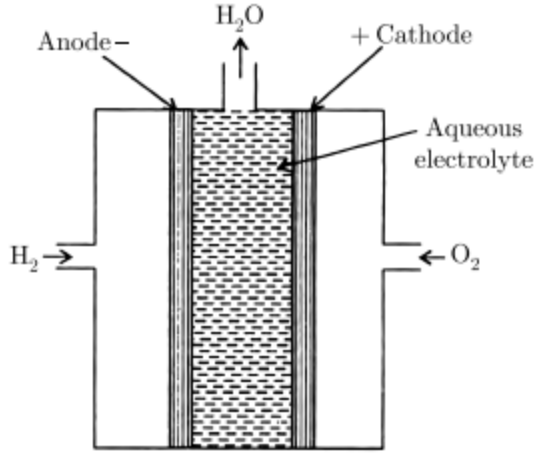
Putting values, we get

$$E_{cell} = 0.22 - \frac{0.0591}{2}\log\left[\frac{(0.1)^2(0.1)^2}{1}\right] \quad (n = 2)$$

$$E_{cell} = 0.22 - \frac{0.0591}{2}\log(10^{-4})$$

$$E_{cell} = 0.22 - \frac{0.0591}{2}(-4) = 3382 \text{ Volt}$$

(ii) Fuel cell is a galvanic cell in which chemical energy from combustion of fuels is converted into electrical energy. In this type of galvanic cell, reactants are continuously feed to the electrodes, which react to produce electricity and products thus formed are continuously removed. Fuel cells that are designed to convert the energy of combustion of fuels like hydrogen, methane, methanol etc. directly into electrical energy are highly efficient (70%) when compared to efficiency of thermal power plants (40%)



Their two advantages are:

(a) Fuel cells are pollution free.

(b) They never become dead due to continuous supply of fuel.

or

(i) Out of the following pairs, predict with reason which pair will allow greater conduction of electricity:

(a) Silver wire at 30°C or silver wire at 60°C.

(b) 0.1 M CH_3COOH solution or 1 M CH_3COOH solution.

(c) KG solution at 20°C or KCl solution at 50°C.

(ii) Give two points of differences between electrochemical and electrolytic cells.

Ans :

(i)

(a) Silver wire at 30°C, because as temperature decreases, resistance decreases so conduction.

(b) 0.1 M CH_3COOH; because on dilution degree of ionisation increases hence conduction increases.

(c) KCl solution at 50°C; because at high temperature mobility of ions increases and hence conduction increases.

(ii)

	Basis of difference	**Electrochemical cell**	**Electrolytic cell**
(a)	Electrode polarity	Anode-negative Cathode-positive	Anode-positive Cathode-nagative
(b)	Energy conservation	it converts chemical energy to electrical energy	it converts electrical energy to chemical energy