Class: XII

SESSION : 2022-2023

SUBJECT: Chemistry

SAMPLE QUESTION PAPER - 1

with SOLUTION

MM: 70 **Time: 3 hours**

General Instructions:

Read the following instructions carefully.

a) There are **35** questions in this question paper with internal choice.

b) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.

c) SECTION B consists of 7 very short answer questions carrying 2 marks each.

d) SECTION C consists of 5 short answer questions carrying 3 marks each.

e) SECTION D consists of 2 case- based questions carrying 4 marks each.

f) SECTION E consists of 3 long answer questions carrying 5 marks each.

g) **All questions are compulsory.**

h) **Use of log tables and calculators is not allowed**

Section A

1. A correct electrochemical series can be obtained from K, Ca, Na, Al, Mg, Zn, Fe, Pb, H, Cu, Hg, Ag, Au by interchanging: **[1]**

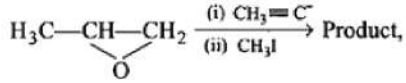
   a) Zn and Fe b) Pb and H

   c) Al and Mg d) Zn and Pb

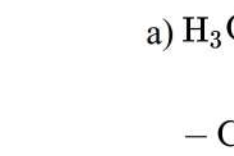
2. α-D-glucopyranose and β-D-glucopyranose are: **[1]**

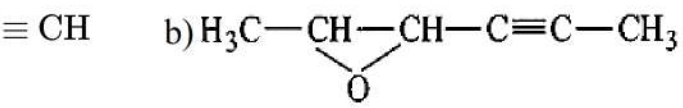
   a) Enantiomers b) Anomers

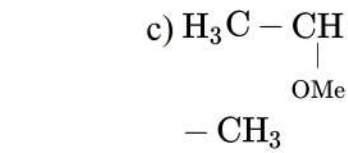
   c) Epimers d) Tatutomers

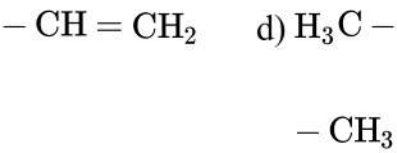
3.  **[1]**

   Product is

   a) 

   b) 

   c) 

   d) 

4. Which of the following is used in photography? **[1]**

   a) Ag_2S b) AgBr

   c) AgCl d) $Ag_2C_2O_4$

5. When alkyl halides are heated, with dry Ag_2O, they give **[1]**

a) Benzene

b) Ketone

c) Diethyl ether

d) Ester

6. Which of the following is formed, when benzaldehyde reacts with alcoholic KCN? **[1]**

a) Benzoin acid

b) Ethyl benzoate

c) Benzoin

d) Benzyl alcohol

7. The amount of energy expanded during the passage of 1 ampere current for 100 sec under a potential of 115 V. **[1]**

a) 11.5 kJ

b) 20 kJ

c) 0.115 kJ

d) 115 kJ

8. Solution of hydrogen in palladium is an example of **[1]**

a) Gas in gas

b) Solid in solid

c) Liquid in gas

d) Gas in solid

9. Arrange the following in decreasing order of S_N2 reaction **[1]**

$\underset{(P)}{CH_3Cl}$ $\underset{(Q)}{CH_3CH_2Cl}$ $\underset{(R)}{CH_3CH_2CH_2Cl}$ $\underset{(S)}{CH_3-\overset{\overset{Cl}{|}}{CH}-CH_3}$

a) P > Q > S > R

b) S > Q > R > P

c) S > R > Q > P

d) P > Q > R > S

10. A substance will be deliquescent if its vapour pressure is: **[1]**

a) lesser than that of water vapour in the air

b) equal to that of water vapour in the air

c) greater than that of water vapour in the air

d) equal to the atmospheric pressure

11. In nucleic acids, the sequence is: **[1]**

a) Base - sugar - phosphate

b) Base - phosphate - sugar

c) Phosphate - sugar - base

d) Sugar - base - phosphate

12. Which of the following statement is not correct for the catalyst? **[1]**

a) It is a substance that does not change the equilibrium constant of a reaction.

b) It provides an alternate mechanism by reducing activation energy between reactants and products.

c) It catalyses the forward and

d) It alters ΔG of the reaction.

backward reaction to the same extent.

13. Which of the following is not an actinoid? **[1]**

a) Curium (Z = 96)

b) Terbium (Z = 65)

c) Californium (Z = 98)

d) Uranium (Z= 92)

14. Standard electrode potentials are **[1]**
Fe^{2+}/Fe; E^o = -0.44 and Fe^{3+}/Fe^{2+}; E^o = 0.77 Fe^{2+}, Fe^{3+} and Fe blocks are kept together, then:

a) Fe^{2+} decreases

b) Fe^{2+} / Fe^{3+} remains unchanged

c) Fe^{3+} increases

d) Fe^{3+} decreases

15. **Assertion (A):** Boiling point of alkyl halides increases with an increase in molecular weight. **[1]**
Reason (R): Boiling point of alkyl halides is in the order RI > RB > RCl > RF.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

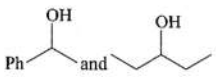
16. **Assertion (A):** Water boils at 373 K as the vapour pressure at this temperature becomes equal to atmospheric pressure. **[1]**
Reason (R): Vapour pressure of water is less than 1.013 bar at 373 K.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

17. **Assertion (A):** 

can be differentiated by iodoform reaction. **[1]**

Reason (R): Alcohols having $-\overset{OH}{\overset{|}{C}}H-CH_3$ group give haloform reaction.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

18. **Assertion (A):** Zinc displaces copper from copper sulphate solution. **[1]**
Reason (R): The E^0_{298} of Zn is -0.76 volts and that of Cu is +0.34 volts.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

19. Write the equation involved in the Etard reaction. **[2]**

OR

Define carbonyl group.

20. Write the formula of the following complexes: (i) Pentaamminechlorocobalt (III) ion (ii) Lithium tetrahydro aluminate (III) **[2]**

21. Out of $[CoF_6]^{3-}$ and $[Co(en)_3]^{3+}$, which one complex is **[2]**

i. paramagnetic

ii. more stable

iii. inner orbital complex and

iv. high spin complex
(Atomic no. of Co = 27)

OR

Using IUPAC norms, write the formulae for the following complexes:

a. Hexa aqua chromium (III) chloride

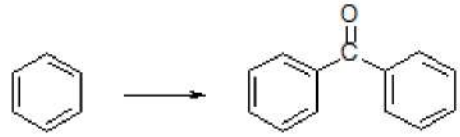
b. Sodium tri oxalato ferrate

22. Mention the various factors that effect the rate of a chemical reaction. **[2]**

23. Give some example showing importance of complexes in biological system? **[2]**

24. When is a protein said to be denatured? **[2]**

25. Complete the synthesis by giving missing starting material, reagent and products **[2]**



Section C

26. Write a test to detect the presence of a double bond in a molecule. **[3]**

27. i. Determine the units of rate constant for first and zero order reaction. **[3]**

ii. Show that time required for the completion of 99% of the first order reaction is twice the 90% of completion of the reaction.

28. Write the structures of the major products expected from the following reactions: **[3]**

a. Mononitration of 3-methylphenoI

b. Dinitration of 3-methylphenol

c. Mononitration of phenyl methanoate

29. An organic compound A, which has a characteristic odour, on treatment with con.NaOH forms two compounds B and C. Compound B has molecular formula C_7H_8O which on oxidation gives back A. Compound C is the sodium salt of an **[3]**

acid. C, when heated with soda lime yields an aromatic hydrocarbon D. Deduce the structures of A, B, C and D.

30. Monosaccharides contain carbonyl group hence are classified, as aldose or ketose. The number of carbon atoms present in the monosaccharide molecule is also considered for classification. In which class of monosaccharide will you place fructose? **[3]**

OR

Differentiate between following:

i. Amylose and Amylopectin

ii. Globular protein and Fibrous protein

iii. Nucleotide and Nucleoside

Section D

31. **Read the text carefully and answer the questions:** **[4]**

The boiling point elevation and the freezing point depression of solutions have a number of practical applications. Ethylene glycol ($CH_2OH{\cdot}CH_2OH$) is used in automobile radiators as an antifreeze because it lowers the freezing point of the coolant. The same substance also helps to prevent the radiator coolant from boiling away by elevating the boiling point. Ethylene glycol has a low vapour pressure. We can also use glycerol as an antifreeze. In order for boiling point elevation to occur, the solute must be non-volatile, but no such restriction applies to freezing point depression. For example, methanol (CH_3OH), a fairly volatile liquid that boils only at 65^oC is sometimes used as antifreeze in automobile radiators.

(i) Out of the CH_3OH and $C_6H_{12}O_6$, which is a better reagent for depression in freezing point but not for elevation in boiling point?

(ii) Will the depression in freezing point be same or different, if 0.1 moles of sugar or 0.1 moles of glucose is dissolved in 1 L of water?

(iii) 124 g each of the two reagents glycerol and glycol are added in 5 kg water of the radiators in the two cars. Which one is better for a car? Justify your answer.

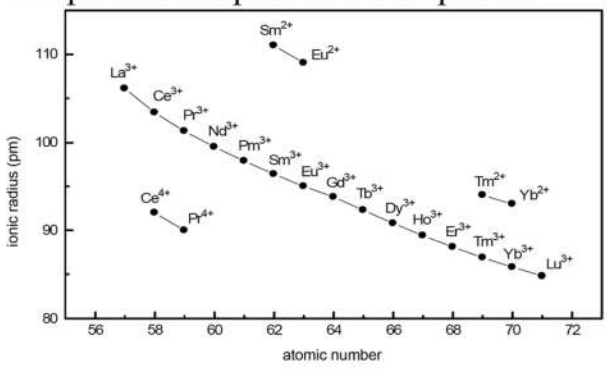
OR

If the cost of glycerol, glycol and methanol are the same, then what would be the sequence of the economy to use these compounds as antifreeze?

32. **Read the text carefully and answer the questions:** **[4]**

The f-block consists of the two series, lanthanoids (the fourteen elements following lanthanum) and actinoids (the fourteen elements following actinium). Because lanthanum closely resembles the lanthanoids. The chemistry of the actinoids is much more complicated. The complication arises partly owing to the occurrence of a wide range of oxidation states in these elements and partly because their radioactivity creates special problems in their study. The overall decrease in atomic and ionic radii from lanthanum to lutetium (the lanthanoid contraction) is a unique feature in the chemistry of the lanthanoids. In the lanthanoids, La(II) and Ln(III)

compounds are predominant species.



(i) Which metal in the first transition series (3d series) exhibits +1 oxidation state most frequently and why?

(ii) The transition metals (with the exception of Zn, Cd and Hg) are hard and have high melting and boiling points. Give reason.

(iii) Both O_2 and F_2 stabilize high oxidation states of transition metals but the ability of oxygen to do so exceeds that of fluorine. Give reason.

OR

The atomic radii of the metals of the third (5d) series of transition elements are virtually the same as those of the corresponding members of the second (4d) series. Give reason.

Section E

33. Conductivity of 0.00241 M acetic acid is 7.896×10^{-5} S cm^{-1}. Calculate its molar conductivity and if for acetic acid is 390.5 S cm^2 mol^{-1}, what is its dissociation constant? **[5]**

OR

Predict the products of electrolysis in each of the following:

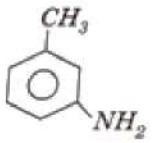
i. An aqueous solution of $AgNO_3$ with silver electrodes.

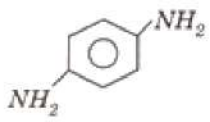
ii. An aqueous solution of $AgNO_3$ with platinum electrodes.

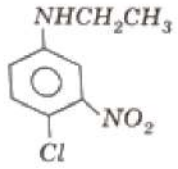
iii. A dilute solution of H_2SO_4 with platinum electrodes.

iv. An aqueous solution of $CuCl_2$ with platinum electrodes.

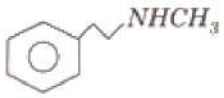
34. Give the IUPAC names of the following compounds **[5]**

a. 

b. 

c. 

d. 

e. 

OR

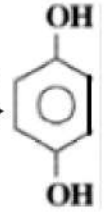
i. How will you convert:

a. Nitrobenzene to phenol,

b. Aniline to chlorobenzene

ii. Identify the compounds A, B and C in the following reactions:

a. $A \xrightarrow[NaOH]{Br_2} B \xrightarrow{HNO_2} C \xrightarrow[I_2]{\text{Red } P} CH_3$

b. $A \xrightarrow{dil.\ HNO_3} B \xrightarrow{Sn/HCl} C \xrightarrow[Boil]{NaNO_2+HCl}$ 

c. $A \xrightarrow{\Delta} B \xrightarrow[KOH]{Br_2} C \xrightarrow{HNO_2} C_2H_5OH$

35. Answer the following questions: **[5]**

(i) $t_{1/2}$ of the reaction increases with increase in initial concentration. What is the order of reaction?

(ii) Name one ion whose central atom has the sp^3d^3 type of hybrid orbitals.

(iii) Write the structure of the compound whose IUPAC name is:
Cyclopent-3-en-1-ol

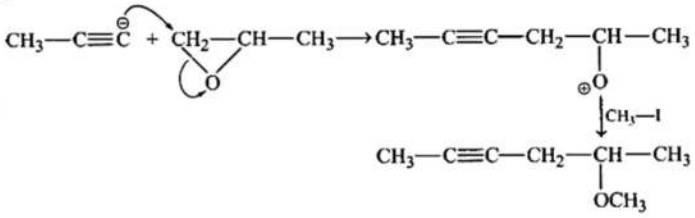
(iv) Write the IUPAC name of the compound:
$CH_3 - \underset{\displaystyle NH_2}{\underset{|}{CH}} - CH_2 - CHO$

(v) The second and third rows of transition elements resemble each other much more than they resemble the first row. Explain why?

SOLUTION

Section A

1. **(c)** Al and Mg
   Explanation: E°_{OP} of Mg > E°_{OP} of Al
2. **(b)** Anomers
   Explanation: Cyclic compound which differ in configuration across that carbon, where they contain functional group.
3. **(d)** $H_3C - \underset{\underset{OMe}{|}}{CH} - CH_2 - CH \equiv CH - CH_3$
   Explanation:



4. **(b)** AgBr
   Explanation: As AgBr is sensitive to light, it is used for making photographic films. The solution of sodium thiosulphate is used as a fixer. It forms a soluble complex with silver halides.
   $AgBr + 2Na_2S_2O_3 \rightarrow Na_3\left[Ag(S_2O_3)_2\right] + NaBr$
5. **(c)** Diethyl ether
   Explanation: $R - X \xrightarrow[\Delta]{\text{Dry } Ag_2O} R - O - R$
6. **(c)** Benzoin
   Explanation: The reaction is known as benzoin condensation.
   $\underset{\text{Benzaldehyde}}{2C_6H_5CHO} \xrightarrow{al.\ KCN} \underset{\text{Benzoin}}{C_6H_5CH(OH)COC_6H_5}$
7. **(a)** 11.5 kJ
   Explanation: Energy = Charge $\times$ Potential = 1 $\times$ 100 $\times$ 115 J = 11.5 kJ
8. **(d)** Gas in solid
   Explanation: Hydrogen (solute, gas) and solvent is palladium (solid).
9. **(d)** P > Q > R > S
   Explanation: Rate of S_N2 reaction depends on the following factors:
   i. As the size of the substrate increases the rate of reaction decreases
   ii. As the stability of the transition state increases the rate of reaction increases
   iii. Rate of reaction increases with better-leaving groups
   iv. Electron withdrawing groups increases the rate of reaction.
10. **(a)** lesser than that of water vapour in the air
    Explanation: Higher vapor pressure of H_2O in the atmosphere will derive H_2O vapours to solute particles.
11. **(c)** Phosphate - sugar - base
    Explanation: A unit formed by the attachment of a base to 1′ position of sugar is known as nucleoside. When nucleoside is linked to phosphoric acid at 5′-position of sugar moiety, we get a nucleotide. Nucleotides are joined together by phosphodiester linkage between 5′ and 3′ carbon atoms of the pentose sugar. So Phosphate - sugar - base is the sequence in nucleic acids.
12. **(d)** It alters ΔG of the reaction.
    Explanation: A catalyst increases the rate of reaction by decreasing the activation energy of the reaction. it catalyzes the spontaneous reaction.

It does not affect the Gibbs free energy ΔG of the reaction. Thus, the statement given in option B is incorrect.

13. **(b)** Terbium (Z = 65)
Explanation: Terbium (Z = 65) is a lanthanoid and all others are actinoids. Lanthanoids have atomic numbers from 58 to 71. Actinoids have atomic numbers from 90 to 103.

14. **(d)** Fe^{3+} decreases
Explanation: The three cells formed are:
(1) $Fe|Fe^{2+}||Fe^{3+}|Fe$
(2) $Fe|Fe^{2+}||Fe^{3+}|Fe$
(3) $Fe|Fe^{3+}||Fe^{3+}, Fe^{2+}|Pr$
In (1) and (2)
$Fe^{3+} + 3e \longrightarrow Fe$
In (3) $Fe^{3+} + e \longrightarrow Fe^{2+}$
thus $[Fe^{3+}]$ decreases.

15. **(b)** Both A and R are true but R is not the correct explanation of A.
Explanation: The greater the molecular mass, the stronger the van der Waals' forces of attraction and hence higher is the melting point/boiling point.

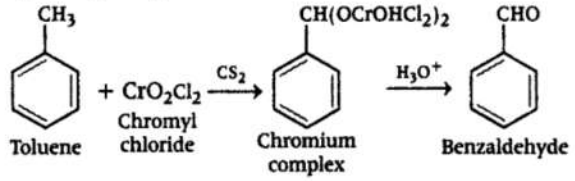
16. **(c)** A is true but R is false.
Explanation: At 373 K ($100^{o}C$) the vapour pressure of water is equal to 1 atmospheric pressure which is 1.013 bar.

17. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: Both A and R are true and R is the correct explanation of A.

18. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: A metal having smaller reduction potential can displace metals having larger reduction potentials from the solution of their salt.
Zinc lies above copper in the electrochemical series. So zinc will displace copper from copper sulphate solution.
Both assertion and reason are correct and the reason is the correct explanation for the assertion.

Section B

19. **Etard Reaction:** Toluene reacts with chromyl chloride in presence of CS_2 followed by hydrolysis produces benzaldehyde.



OR

A carbonyl group is an organic functional group composed of a carbon atom double-bonded to an oxygen atom. It is represented as > C = O. The simplest carbonyl groups are aldehydes and ketones. The carbonyl carbon is prone to additions and nucleophilic attack because or carbon's positive charge and oxygen's negative charge, as shown in its resonating structures:

20. i. $[Co(NH_3)_5Cl]^{2+}$
ii. Li $[AlH_4]$

21. i. **Paramagnetic:** $[CoF_6]^{3-}$
ii. **More stable:** $[Co(en)_3]^{3+}$

iii. **Inner orbital complex:** $[Co(en)_3]^{3+}$

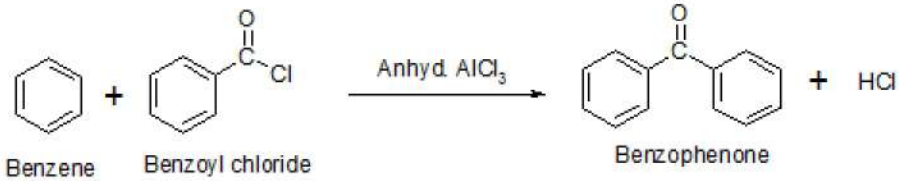
iv. **High spin complex:** $[CoF_6]^{3-}$

OR

i. Formula of Hexa aqua chromium (III) chloride is $[Cr(H_2O)_6]Cl_3$

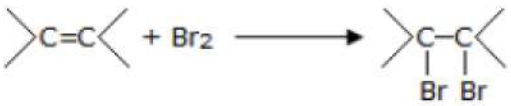
ii. Formula of Sodium tri oxalato ferrate is $Na_3[Fe(ox)_3]$

22. The factors that effect the rate of chemical reactions are:
    i. Nature of reactants
    ii. Physical state of reactants
    iii. Concentration
    iv. Temperature
    v. Catalyst
    vi. Surface area
23. Examples of complexes in biological system.-
    1. Chlorophyll is a complex of Mg.
    2. Haemoglobin is a complex of iron.
    3. Cyanocobalamine , Vitamin B_{12},is a complex of cobalt.
24. When 2° and 3° structure of protein is destroyed by changing pH or in temperature protein is said to be denatured.
25. It is an example of Friedel Craft's acylation where benzene is converted into benzophenone using benzoyl chloride in presence of anhydrous $AlCl_3$.

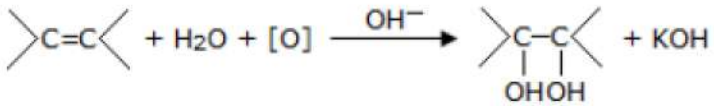


Section C

26. There are two tests to detect the presence of an unsaturated double bond in an organic molecule that are as follows:
    i. **Bromine water test:**
    In the Bromine water test, when the molecule is added to bromine water, bromine is added to the carbon atoms across the double bond. The orange-brown colour of bromine water changes and becomes colourless at the end of the reaction.



    ii. **Bayer's test:**
    In Bayer's test, alkaline $KMnO_4$ is used to detect unsaturated carbon with a double bond.
    Bayer's test uses dilute potassium permanganate to oxidize the carbon-carbon double bond. The chemical gives rise to [O], which hydrolyses the carbons across the double bond, and the solution containing the two compounds goes from a purple colour to colourless.
    $2KMnO_4 + H_2O \rightarrow 2KOH + 2MnO_2 + 3[O]$



27. i. $K = (mol)^{1-n} L^{n-1} s^{-1}$
    For zero order, n = 0
    So, $K = (mol)^{1-0} L^{0-1} s^{-1} = s^{-1}$ mol L^{-1}
    For first order, n = 1

$K = (mol)^{1-n} L^{n-1} s^{-1}$

So, $K = (mol)^{1-1} L^{1-1} s^{-1}$

$= s^{-1}$

ii. For a first order reaction,

$t = \frac{2.303}{K} \log \frac{[A]_0}{[A]}$

$[A]_0 = a, [A] = a - \frac{a \times 99}{100} = 0.01a$

$t(99\%) = \frac{2.303}{K} \log \frac{a}{0.01a}$

$= \frac{2.303}{K} \log 100$

$= \frac{2.303}{K} \times 2$ ...(i)

For 90% completion of reaction,

$[A] = a - \frac{a \times 99}{100} = 0.1a$

$t(90\%) = \frac{2.303}{K} \log \frac{a}{0.1a}$

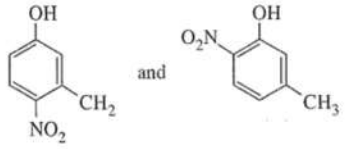
$= \frac{2.303}{K} \times 1$ ....(i)

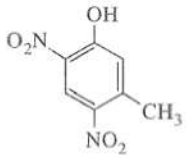
Dividing equation (i) by equation (ii), we get

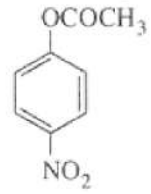
$t(99\%) = 2 \times t(90\%)$

Hence, the time taken to complete 9% of the first order reaction is twice the time required for the completion of 90% of the reaction.

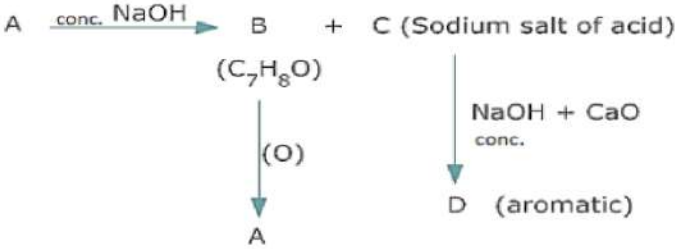
28. The combined influence of -OH and $-CH_3$ groups determine the position of the incoming group. Keeping in view that both -OH and $-CH_3$ are o- and p-directing groups, the following products are obtained:

a. 

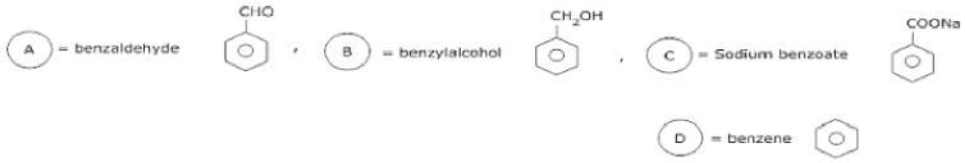
b. 

c. 

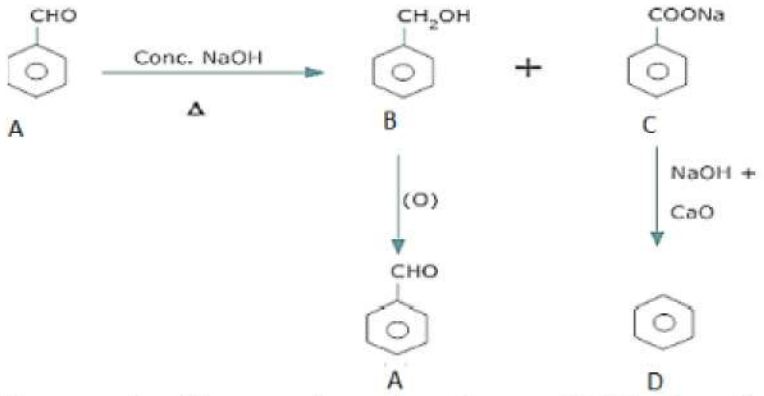
29. This is Cannizzaro Reaction



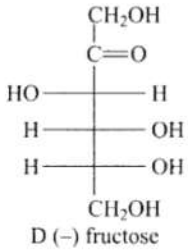
The molecular formula of (B) and characteristic odour of (A) suggests that (A) is an aromatic aldehyde, C_6H_5CHO and (B) is alcohol, $C_6H_5CH_2OH$. As (C) is a sodium salt of an acid & gives hydrocarbon (D) on heating with soda lime, (C) is sodium benzoate and (D) is benzene. In this reaction, Benzaldehyde undergoes self oxidation and reduction(disproportionation). Therefore:-



Reaction are:-



30. Monosaccharides contain carbonyl group(aldehyde or ketone). Hence, are classified as aldose or ketose.
When the aldehyde group is present, the monosaccharides are known as aldose. When ketone group is present, the monosaccharides are known as ketose. Fructose has molecular formula $C_6H_{12}O_6$ containing six carbon and ketonic functional group at carbon 2 and is classified as ketohexose.



D (–) fructose

OR

i. Amylose and Amylopectin:

Amylose	Amylopectin
1. Amylose is a straight chain polymer of D-glucose	1. Amylopectin is a branched-chain polymer of D-glucose.
2. They are linked by 1,4 - glycosidic linkage	2. They are linked by α-1,4 glycosidic and α-1,6-$ glycosidic linkage.
3. Amylose is water-soluble component.	3. Amylopectin is insoluble in water.

ii. Globular and Fibrous protein:

Globular	Fibrous
1. Polypeptide chains are arranged as coils.	1. Polypeptide chains are run parallel to each other.
2. They have a spherical shape.	2. They have thread-like structure.
3. Example- Insulin.	3. Example- keratin.

iii. Nucleotide and Nucleoside:

Nucleoside	Nucleotides
1. A nucleoside consists of a nitrogenous base covalently attached to a sugar (ribose or deoxyribose) but without the phosphate group.	1. A nucleotide consists of a nitrogenous base, a sugar (ribose or deoxyribose) and one to three phosphate groups.

2. Several nucleoside analogs are used as antiviral or anticancer agents.	2. Malfunctioning nucleotides are one of the main causes of all cancers known today.

Section D

31. **Read the text carefully and answer the questions:**

The boiling point elevation and the freezing point depression of solutions have a number of practical applications. Ethylene glycol ($CH_2OH{\cdot}CH_2OH$) is used in automobile radiators as an antifreeze because it lowers the freezing point of the coolant. The same substance also helps to prevent the radiator coolant from boiling away by elevating the boiling point. Ethylene glycol has a low vapour pressure. We can also use glycerol as an antifreeze. In order for boiling point elevation to occur, the solute must be non-volatile, but no such restriction applies to freezing point depression. For example, methanol (CH_3OH), a fairly volatile liquid that boils only at 65^oC is sometimes used as antifreeze in automobile radiators.

(i) CH_3OH is a better reagent for depression in freezing point but not for elevation in boiling point.

(ii) The depression in freezing point will be the same in both the solutions because both are non-electrolytes and gives the same number of solutes.

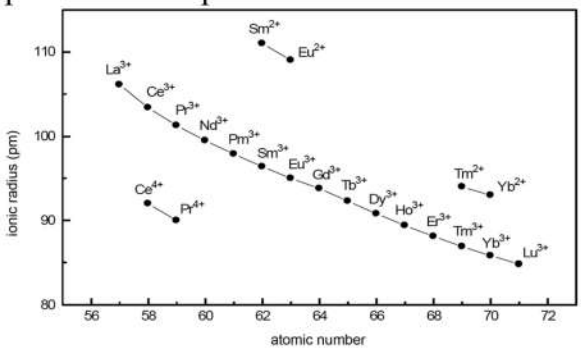
(iii) Glycol will be better than glycerol because it is more volatile than glycerol.

OR

The sequence of the economy to use these compounds as antifreeze is Methanol > Glycol > Glycerol.

32. **Read the text carefully and answer the questions:**

The f-block consists of the two series, lanthanoids (the fourteen elements following lanthanum) and actinoids (the fourteen elements following actinium). Because lanthanum closely resembles the lanthanoids. The chemistry of the actinoids is much more complicated. The complication arises partly owing to the occurrence of a wide range of oxidation states in these elements and partly because their radioactivity creates special problems in their study. The overall decrease in atomic and ionic radii from lanthanum to lutetium (the lanthanoid contraction) is a unique feature in the chemistry of the lanthanoids. In the lanthanoids, La(II) and Ln(III) compounds are predominant species.



(i) Copper exhibits +1 oxidation state more frequently i.e., Cu^{1+} because of its electronic configuration $3d^{10}4s^1$. It can easily lose $4s^1$ electron to give stable $3d^{10}$ configuration.

(ii) Because of stronger metallic bonding and high enthalpies of atomization.

(iii) The ability of O_2 to stabilize higher oxidation states exceeds that of fluorine because oxygen can form multiple bonds with metals.

OR

Due to lanthanoid contraction in second series after lanthanum, the atomic radii of elements of second and third series become almost same and hence show similarities in properties.

Section E

33. Given that, $\kappa = 7.896 \times 10^{-5}$ S m^{-1}

C=M= 0.00241 mol L^{-1}

The formula of molar conductivity,

$\Lambda_m = (k \times 1000)/M$

Plug the value we get

$\Lambda_m = \frac{(7.896 \times 10^{-5} \times 1000)}{0.00241}$

= 32.76S cm^2 mol^{-1}

The formula of degree of dissociation

$\alpha = \Lambda m / \Lambda om$

Plug the value we get

α = 32.76S/390.5

= 0.084

The formula of dissociation constant

$K = C\alpha/(1 - \alpha)$

Plug the values we get

$K = 0.00241 \times 0.084/(1- 0.084)$

= 1.86×10^{-5} mol L^{-1}

OR

i. At cathode: The following reduction reactions compete to take place at the cathode.

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

$H^{+}_{(aq)} + e^{-} \rightarrow \frac{1}{2} H_{2(g)}$; $E^o = 0.00V$

The reaction with a higher value of E^o takes place at the cathode. Therefore, deposition of silver will take place at the cathode.

At anode:

The Ag anode is attacked by NO_3^- ions. Therefore, the silver electrode at the anode dissolves in the solution to form Ag+.

ii. At cathode:

The following reduction reactions compete to take place at the cathode.

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

$H^{+}_{(aq)} + e^{-} \rightarrow \frac{1}{2} H_{2(g)}$; $E^o = 0.00$ V

The reaction with a higher value of E^o takes place at the cathode. Therefore, deposition of silver will take place at the cathode.

At anode:

Since Pt electrodes are inert, the anode is not attacked by NO_3^- ions. Therefore, OH^- or NO_3^- ions can be oxidized at the anode. But OH^- ions having a lower discharge potential and get preference and decompose to liberate O_2.

$OH^- \rightarrow OH + e^-$

$4OH^- \rightarrow 2H_2O + O_2$

iii. At the cathode, the following reduction reaction occurs to produce H_2 gas.

H^+ (aq) + e^- → ½ H_2(g)

At the anode, the following processes are possible.

$2H_2O_{(l)} \rightarrow O_{2(g)} + 4H^+_{(aq)} + 4e^-$; $E^o = +1.23V$ ...(i)

$2SO^{2-}_{4(aq)} \rightarrow S_2O^{2-}_{6(aq)} + 2e^-$; $E^o = +1.96$ V ....(ii)

For dilute sulphuric acid, reaction (i) is preferred to produce O_2 gas. But for concentrated sulphuric acid, reaction (ii) occurs.

iv. At cathode:

The following reduction reactions compete to take place at the cathode.

$Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu_{(s)}$; $E^o = 0.34V$

$H^+_{(aq)} + e^- \rightarrow \frac{1}{2}H_{2(g)}$; $E^o = 0.00$ V

The reaction with a higher value of E^o takes place at the cathode. Therefore, deposition of copper will take place at the cathode.

At anode:

The following oxidation reactions are possible at the anode.

$Cl^-_{(aq)} \rightarrow \frac{1}{2}Cl_{2(g)} + e^{-1}$; $E^o = 1.36V$

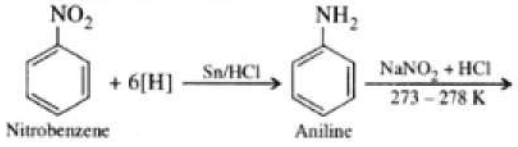
$2H_2O_{(i)} \rightarrow O_{2(g)} + 4H^+_{(aq)} + 4e^-$; $E^o = +1.23V$

At the anode, the reaction with a lower value of E^o is preferred. But due to the over-potential of oxygen, Cl^- gets oxidized at the anode to produce Cl_2 gas.

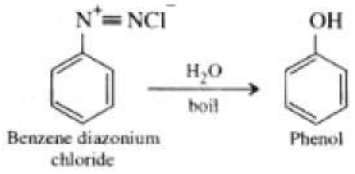
34. a. m-Toluidine or 3-Methylbenzenamine
    b. 1, 4-Benzenediamine
    c. 4-chloro-3-nitro-N-ethyl aniline
    d. 4, 4-Dimethylcyclohexanamine
    e. N-Methyl-2-phenylethanamine

OR

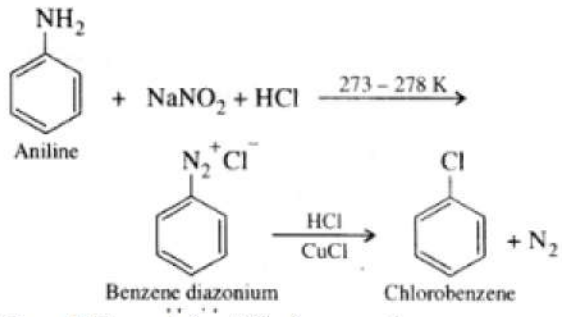
i. Steps involved in the conversions are given below:



a.



b.

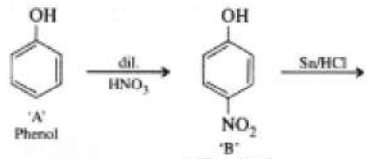


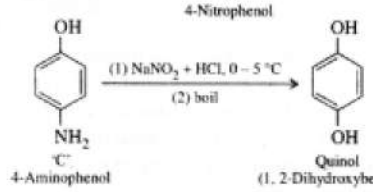
ii. A, B and C are identified as under:

a. $CH_3CONH_2 \xrightarrow[NaOH]{Br_2} CH_3NH_2 \xrightarrow{HNO_2} CH_3OH \xrightarrow{P/I_2} CH_3I$

'A' Ethanamide; 'B' Methanamine; 'C' Methaonol; Iodomethane

b.





c. $\underset{\substack{'A'\\ A\text{min}ophenol}}{CH_3CH_2COONH_4} \xrightarrow{Heat} \underset{\substack{'B'\\ \text{Pr}opana\text{mi}de}}{CH_3CH_2CONH_2} \xrightarrow[KOH]{Br_2} \underset{\substack{'C'\\ \text{Pr}opana\text{min}e}}{CH_3CH_2NH_2} \xrightarrow{HNO_2} \underset{Ethanol}{CH_3CH_2OH}$

35. Answer the following questions:

(i) Zero order reaction.

(ii) The anion $[XeF_7]^-$ possesses sp^3d^3 hybridisation.

(iii) The structure of Cyclopent-3-en-1-ol is 

.

(iv) $\overset{4}{C}H_3 - \overset{3}{C}H(NH_2) - \overset{2}{C}H_2 - \overset{1}{C}HO$

IUPAC name: 3-amino-butan-1-al or 3-aminobutanal.

(v) Due to lanthanide contraction (filling of 4f before 5d orbital) , the atomic radii of the second and third row transition elements are almost same. Therefore, they resemble each other much more as compared to first row elements.