Class: XII

SESSION : 2022-2023

SUBJECT: Chemistry (043)

SAMPLE QUESTION PAPER - 4

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. Which of the following set of compounds constitute only disaccharides? **[1]**

a) Starch, cellulose, glucose

b) Maltose, lactose, sucrose

c) Maltose, sucrose, galactose

d) Starch, maltose, lactose

2. What will occur if a block of copper metal is dropped into a beaker containing a solution of 1M $ZnSO_4$? **[1]**

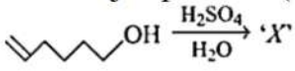
a) The copper metal will dissolve and zinc metal will be deposited.

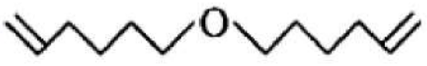
b) No reaction will occur.

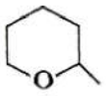
c) The copper metal will dissolve with evolution of hydrogen gas.

d) The copper metal will dissolve with evolution of oxygen gas.

3. The major product (X) of the reaction: **[1]**



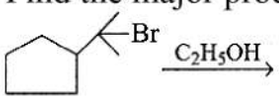
a) 

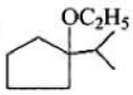
b) 

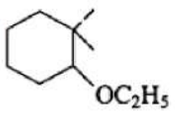
c)

d)

4. Find the major product of the following reaction- **[1]**



a) 

b) 

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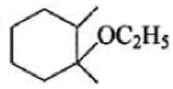
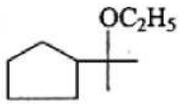
c) 

d) 

5. Benzaldehyde and acetone can be best distinguished by using: **[1]**

a) Hydrazine

b) Tollen's reagent

c) 2, 4 – DNP reagent

d) Sodium hydroxide solution

6. Consider the change in oxidation state of bromine corresponding to different emf values as shown in the diagram below : **[1]**

$BrO_4^- \xrightarrow{1.82\ V} BrO_3^- \xrightarrow{1.5\ V} HBrO \xrightarrow{1.595\ V} Br_2 \xrightarrow{1.0652\ V} Br^-$

Then the species undergoing disproportionation is :

a) Br_2

b) BrO_3^-

c) BrO_4^-

d) HBrO

7. Gadolinium belongs to 4f series, Its atomic number is 64. Which of the following is the correct electronic configuration of gadolinium? **[1]**

a) $[Xe]\ 4f^8\ 6d^2$

b) $[Xe]\ 4f^7 5d^1 6s^2$

c) $[Xe] 4f^6 5d^2 6s^2$

d) $[Xe] 4f^9\ 5s^1$

8. Normality of 0.3 M phosphoric acid is **[1]**

a) 0.9

b) 0.1

c) 0.6

d) 0.5

9. Which among the following shows a negative deviation from Raoult's law? **[1]**

a) Acetone and chloroform

b) Acetone and benzene

c) Methyl alcohol and water

d) Carbon tetrachloride and chloroform

10. Pyranose ring consist of a Skelton of: **[1]**

a) 5 carbon atoms and one oxygen atom

b) 6 carbon atoms and one oxygen atom

c) 6 carbon atoms

d) 4 carbon atoms and one oxygen atom

11. In the presence of a catalyst, the heat evolved or absorbed during the reaction: **[1]**

a) increase

b) remains unchanged

c) decreases

d) may increase or decrease

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12. The best method for the conversion of an alcohol into an alkyl chloride is by treating the alcohol with: **[1]**

a) $SOCl_2$ in presence of pyridine

b) PCl_3

c) Dry HCl in the presence of anhydrous $ZnCl_2$

d) PCl_5

13. The difference between the electrode potentials of two electrodes when no current is drawn through the cell is called _____. **[1]**

a) Cell voltage

b) Cell potential

c) Potential difference

d) Cell emf

14. Select the disproportionation reaction which are expected to be spontaneous in aq. solution. **[1]**

a) Neither $MnO_4^{2-} \xrightarrow{H^+} MnO_4^- + MnO_2$ nor $Cu^+ \longrightarrow Cu^{2+} + Cu$

b) $Cu^+ \longrightarrow Cu^{2+} + Cu$

c) $MnO_4^{2-} \xrightarrow{H^+} MnO_4^- + MnO_2$

d) Both $MnO_4^{2-} \xrightarrow{H^+} MnO_4^- + MnO_2$ and $Cu^+ \longrightarrow Cu^{2+} + Cu$

15. **Assertion (A):** S_N1 mechanism is facilitated by polar protic solvents like water, alcohol, etc. **[1]**
Reason (R): $C_6H_5CH(C_6H_5)Br$ is less reactive than $C_6H_5CH(CH_3)Br$ in S_N1 reactions.

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):** Boiling points of alcohols and ethers are high. **[1]**
Reason (R): They can form intermolecular hydrogen bonding.

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):** Ethers behave as bases in the presence of mineral acids. **[1]**
Reason (R): It is due to the presence of a lone pair of electrons on the oxygen.

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.

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18. **Assertion:** 0.1 M NH_4OH at $25^\circ C$ has more conductance than at $50^\circ C$. **[1]**

Reason: Conductance of a weak electrolyte decreases with increase in temperature.

a) Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

b) Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

c) Assertion is CORRECT but, reason is INCORRECT.

d) Both assertion and reason are INCORRECT.

Section B

19. Write the reagents required in the following reactions : **[2]**

i. CH_2=CH-$CH_2OH \xrightarrow{?} CH_2$=CH-CHO

ii. CH_3-$COOH \xrightarrow{?} CH_3$-$CONH_2$.

OR

Complete the following reactions:

1. $CH_3COCH_3 + CH_3MgBr \xrightarrow{H_2O}$

2. $CH_3COCH_2CH_3 \xrightarrow[H_2O]{NaBH_4}$

3. $R - COCl \xrightarrow[Pd-BaSO_4]{H_2}$

20. Distinguish between homoleptic and hetroleptic ligands. **[2]**

OR

Write the formula of the following complexes:

i. Hexaammine platinum (IV) chloride.

ii. Dichloro tetrammine cobalt (III) ion.

21. Using the valence bond approach, predict the shape and magnetic character of $[Fe(CN)_6]^{3-}$ ion. **[2]**

22. Describe briefly the nature of bonding in metal carbonyl. **[2]**

23. Glucose or sucrose are soluble in water but cyclohexane or benzene (simple six membered ring compounds) are insoluble in water. Explain. **[2]**

24. For the reaction : $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ express the rate of reaction in terms of formation of ammonia. **[2]**

25. Write IUPAC names of the following: **[2]**

i. $HOOC - CH_2 - \underset{\underset{CH_3}{|}}{C} = CHCOOH$

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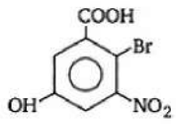
ii. 

Section C

26. All energetically effective collisions do not result in a chemical change. Explain with the help of an example. **[3]**

27. Predict the major product formed when HCl is added to isobutylene. Explain the mechanism involved. **[3]**

28. An aromatic compound A (Molecular formula C_8H_8O) gives positive 2, 4-DNP test. It gives a yellow precipitate of compound B on treatment with iodine and sodium hydroxide solution. Compound A does not give Tollen's or Fehling's test. On drastic oxidation with potassium permanganate it forms a carboxylic acid C (Molecular formula $C_7H_6O_2$), which is also formed along with the yellow compound in the above reaction. Identify A, B and C and write all the reactions involved. **[3]**

29. Write the chemical reaction equations for the reaction of glucose with: **[3]**

i. acetic anhydride

ii. NH_2OH

Also draw Fisher projections of D-glucose and L-glucose.

OR

Name the main disease caused due to lack of the vitamin and its sources in each of the following: A, B_6 and E.

30. Why is the reactivity of all the three classes of alcohols with conc. HCl and $ZnCl_2$ (Lucas reagent) different? **[3]**

Section D

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

Many chemical and biological processes depend on osmosis, the selective passage of solvent molecules through the porous membrane from a dilute solution to a more concentrated one. The osmotic pressure π depends on molar concentration of the solution ($\pi = CRT$). If two solutions are of equal solute concentration and, hence, have the same osmotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic.
Osmosis is the major mechanism, for transporting water upward in the plants. Transpiration is the leaves supports the transport mechanism of water. The osmotic pressure of seawater is about 30 atm; this is the pressure that must be applied to the seawater (separated from pure water using a semi-permeable membrane) to get drinking water.

(i) What will happen if a plant cell kept in a hypertonic solution?

(ii) Blood cells are isotonic with 0.9% sodium chloride solution. What happens if we

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place blood cells in a solution containing in 1.2% sodium chloride solution?

(iii) What happens when the external pressure applied becomes more than the osmotic pressure of solution?

OR

Which mechanisms helps in the transportation of water in a plant?

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

The actinoids include the fourteen elements from Th to Lr. The actinoids are radioactive elements and the earlier members have relatively long half-lives, the latter ones have half-life values ranging from a day to 3 minutes for lawrencium. The latter members could be prepared only in nanogram quantities. Actinoids show a greater range of oxidation states. The elements, in the first half of the series frequently exhibit higher oxidation states. The actinoids resemble the lanthanoids in having more compounds in +3 state than in the +4 state. All the actinoids are believed to have the electronic configuration of $7s^2$ and variable occupancy of the 5f and 6d subshells. The magnetic properties of the actinoids are more complex than those of the lanthanoids. The variation in the magnetic susceptibility of the actinoids with the number of unpaired 5f electrons is roughly parallel to the corresponding results for the lanthanoid.

(i) Actinoid contraction is greater from element to element than lanthanoid contraction. Why?

(ii) Actinoids show irregularities in their electronic configuration. Justify?

(iii) The actinoid metals are all silvery in appearance but display a variety of structures than lanthanoid give reason.

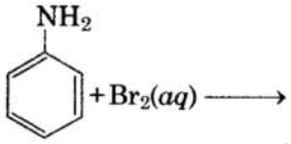
OR

The magnetic properties of the actinoids are more complex than those of the lanthanoids. Why?

Section E

33. Write the main products of the following reactions: **[5]**

i. $C_6H_5N_2^+Cl^- \xrightarrow{H_3PO_2 + H_2O}$

ii. 

iii. $CH_3 - \underset{\underset{O}{\|}}{C} - NH_2 \xrightarrow{Br_2 + NaOH}$

OR

I. Show how p-aminoazobenzene can be obtained from aniline.

II. Write structures for the following compounds:

a. Benzene diazonium chloride

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b. p-Nitrotoluene

c. SuIphanilic acid

34. Two students use same stock solution of $ZnSO_4$ and a solution of $CuSO_4$. The e.m.f. of one cell is 0.03 V higher than the other. The concetration of $CuSO_4$ in the cells with higher e.m.f. value is 0.5 M. Find out the concentration of $CuSO_4$ in the other cell. (2.303 RT/F = 0.06) **[5]**

OR

What do you understand by sacrificial, cathodic and barrier protection of corrosion?

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

(i) For a reaction R $\rightarrow$ P, half-life ($t_{1/2}$) is observed to be independent of the initial concentration of reactants. What is the order of reaction?

(ii) How many geometrical isomers are possible in the following coordination entities?

a. $[Cr(C_2O_4)_3]^{3-}$

b. $[Co(NH_3)_3Cl_3]$

(iii) Draw the structure of hex-1-en-3-ol compound.

(iv) Write IUPAC name of a secondary amine having lowest molecular mass.

(v) Out of Al, Zn, Mg and Fe which is the maximum density element?

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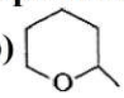
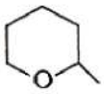
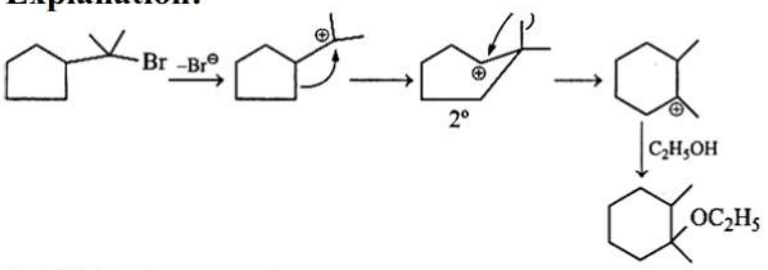
SOLUTION

Section A

1. **(b)** Maltose, lactose, sucrose
   Explanation: Maltose, lactose, sucrose
2. **(b)** No reaction will occur.
   Explanation: No reaction will occur.
3. **(b)** 
   Explanation: 
4. **(c)**

   Explanation:
   

5. **(b)** Tollen's reagent
   Explanation: Tollen's Test is used to distinguish between aldehyde and ketone. It uses the fact that aldehydes are easily oxidised to their corresponding acids while ketones are not. Tollen's reagent is aqueous ammonical silver nitrate solution which reacts with aldehydes as shown.

   $RCHO + 2Ag^{+} + 2OH^{-} \rightarrow RCOO^{-} + Ag + H_2O.$

   $RCOR + 2Ag^{+} + 2OH \rightarrow$ No reaction
   If this test is carried in a glass tube, the Ag formed forms a mirror on the sides of the test tube so the test is also known as the silver mirror test.
   Aldehydes show Tollen's test while acetone which is a ketone does not give Tollen's test.
6. **(d)** HBrO
   Explanation: $\overset{+1}{H}\overset{+1}{Br}O \rightarrow \overset{0}{Br_2}, E^{o}_{HBrO/Br_2} = 1.595$ V
   $\overset{+1}{H}\overset{+1}{Br}O \rightarrow \overset{+5}{Br}O_3^{-}$, $E^{o}_{HBrO/BrO_3^{-}} = -1.5$ V
   $2HBrO \rightarrow Br_2 + BrO_3^{-}$
   E°_{Cell} for disproportionation of HBrO is
   $E^{o}_{Cell} = E^{o}_{OP_{HBRO/BrO_3^{-}}} + E^{o}_{RP_{HBrO/Br2}}$
   $= -1.5 + 1.595$
   $= 0.095$ V = +ve
   (Thus spontaneous reaction)
7. **(b)** $[Xe]\ 4f^{7}5d^{1}6s^{2}$
   Explanation: $[Xe]\ 4f^{7}5d^{1}6s^{2}$

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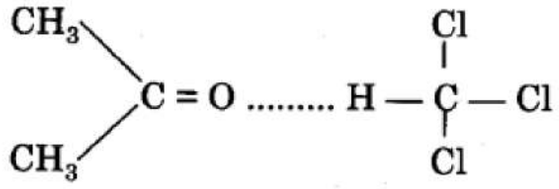
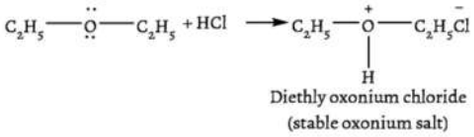
8. **(c)** 0.6
   Explanation: For acids, Normality = molarity × basicity
   $N = M \times n_f$
   $N = 0.3 \times 2 = 0.6$
9. **(a)** Acetone and chloroform
   Explanation: Acetone and chloroform will show a negative deviation due to their association after mixing.



10. **(a)** 5 carbon atoms and one oxygen atom
    Explanation: Pyranose
11. **(b)** remains unchanged
    Explanation: Catalyst does not change heat of reaction.
12. **(a)** $SOCl_2$ in presence of pyridine
    Explanation: The hydroxyl group of an alcohol is replaced by halogen on reaction with concentrated halogen acids, phosphorus halides, or thionyl chloride. Thionyl chloride ($SOCl_2$) is preferred because the other two products SO_2 and HCl are escapable gases. Hence, the reaction gives pure alkyl halides.
    $ROH + SOCl_2 \rightarrow RCl + SO_2\,(g) + HCl\,(g)$
13. **(d)** Cell emf
    Explanation: EMF is the difference between the electrode potentials of two electrodes cathode and anode when no current is drawn through the cell.
14. **(d)** Both $MnO_4^{2-} \xrightarrow{H^+} MnO_4^- + MnO_2$ and $Cu^+ \longrightarrow Cu^{2+} + Cu$
    Explanation: Both $MnO_4^{2-} \xrightarrow{H^+} MnO_4^- + MnO_2$ and $Cu^+ \longrightarrow Cu^{2+} + Cu$
15. **(c)** A is true but R is false.
    Explanation: The carbocation intermediate obtained from $C_6H_5CH(C_6H_5)Br$ is more stable than that obtained from $C_6H_5CH(CH_3)Br$ because it is stabilized by two phenyl groups due to resonance. Therefore, the former bromide is reactive than the latter in S_N1 reactions.
16. **(b)** Both A and R are true but R is not the correct explanation of A.
    Explanation: Both A and R are true but R is not the correct explanation of A.
17. **(a)** Both A and R are true and R is the correct explanation of A.
    Explanation: Because of the presence of lone pairs of electrons, the ether can act as a base in the presence of mineral acid.



18. **(d)** Both assertion and reason are INCORRECT.
    Explanation: Both assertion and reason are INCORRECT.

Section B

19.

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i. $CH_2 = CH - CH_2OH \xrightarrow[CH_2Cl_2]{PCC} CH_2 = CH - CHO$

Here, PCC is Pyridinium chlorochromate, a 1 : 2 complex of chromium trioxide pyridine ($CrO_3 \cdot 2C_5H_5N$) which only oxidises OH group and not the = bond.

ii. $CH_3 - COOH \xrightarrow[-H_2O]{NH_3/heat} CH_3 - CONH_2$

OR

1. $CH_3COCH_3 + CH_3MgBr \xrightarrow{H_2O} CH_3 - \underset{CH_3}{\overset{OH}{\underset{|}{\overset{|}{C}}}} - CH_3$

2. $CH_3COCH_2CH_3 \xrightarrow{NaBH_4} CH_3 - \overset{OH}{\underset{|}{C}} - CH_2 - CH_3$

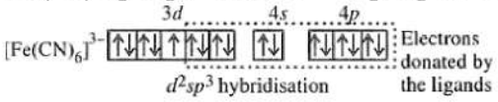
3. $R - COCl \xrightarrow[Pd-BaSO_4]{H_2} R - CHO + HCl \quad (Rosenmund\ Reduction)$

20. Homoleptic complexes are those in which only one type of ligand or donor group is present e.g. $[Pt(NH_3)_6]^{3+}$has only NH_3 as ligand. Whereas hetroleptic complexes are those in which different types of ligands are present eg. $[Pt(NH_3)_4Cl_2]^{+}$ has two type of ligands- NH_3 and Cl^- .

OR

1. $[Pt(NH_3)_6]Cl_4$
2. $[CoCl_2(NH_3)_4]^{+}$

21. Fe(26): $[Ar]4^3d6$, Fe^{3+} : $[Ar]4s^03d^5$



It has octahedral shape and is paramagnetic in nature due to presence of one unpaired electron.

22. The metal carbon bond in metal carbonyls possess both S & P character. The M-C σ bond is formed by the donation of lone pair of electrons on the carbonyl carbon into a vacant orbital of the metal. M-C π bond is formed by the donation of a pair of electrons from a filled d-orbital of metal into the antibonding πorbital of carbon monoxide.
23. A glucose molecule contains five -OH groups while a sucrose molecule contains eight -OH groups. Thus, glucose and sucrose undergo extensive H-bonding with water. Hence, these are soluble in water.
    But cyclohexane and benzene do not contain -OH groups. Hence, they cannot undergo H-bonding with water and as a result, are insoluble in water.
24. Rate = $\frac{1}{2}\frac{d[NH_3]}{dt}$
25. i. 3-Methylpent-2-ene-1, 5-dioic acid
    ii. 6-Bromo-3-hydroxy-5-nitrobenzoic acid

Section C

26. Only effective collision leads to the formation of products. It means that collisions in which molecules collide with sufficient kinetic energy (called threshold energy = activation energy + energy possessed by reacting species). And proper orientation leads to a chemical change (this, forming products)it facilitates the breaking of old bonds between (reactant) molecules and the formation of the new ones, i.e., in products.

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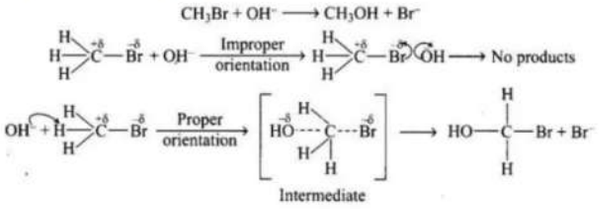
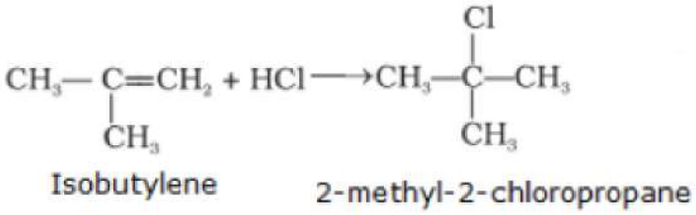
e.g. formation of methanol from bromomethane depends upon the orientation of the reactant molecules.



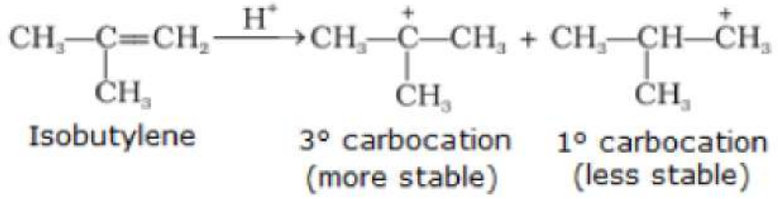
The proper orientation of reactant molecules leads to bond formation whereas improper orientation makes them simply back and no products are formed. To account for effective collisions, another factor P (probability or steric factor) is introduced $K = Ae^{-Ea/RT}$ (Arrhenius equation).

27. The reaction of HCl with isobutylene gives 2-methyl-2-chloropropane:

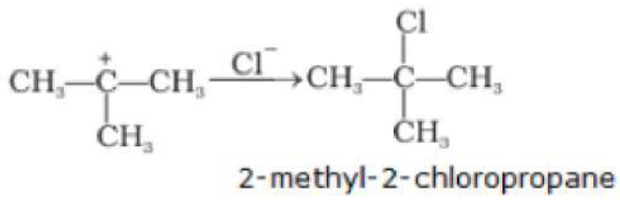


The mechanism of this reaction is given as follows:

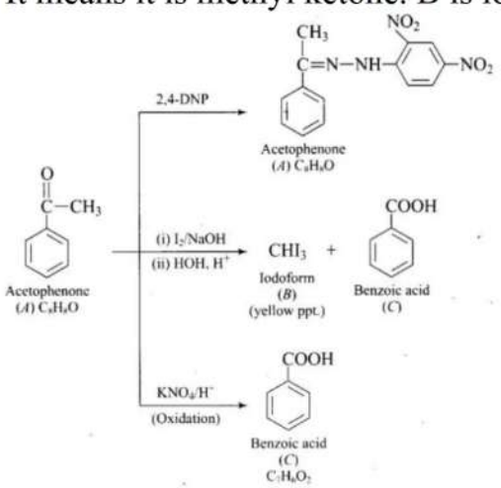
STEP 1



STEP 2



28. The molecular formula of the compound is C_8H_8O. As A does not give Tollens or Fehling's test. It must be a ketone. It gives a positive test with 2, 4-DNP, and iodoform test. It means it is methyl ketone. B is iodoform and C is benzoic acid.



29.

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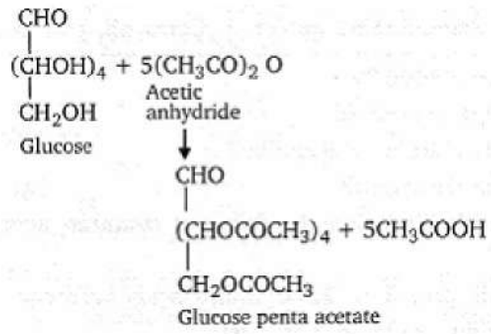
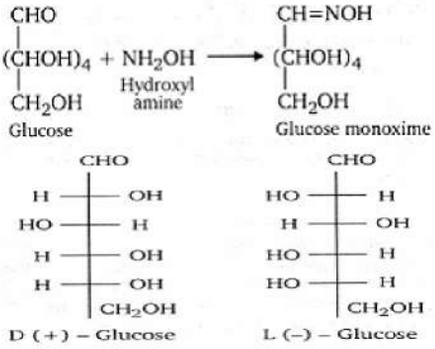
i.



ii.



OR

i. Vitamin A deficiency causes night blindness. Its sources are fish oil, carrot etc.
ii. Vitamin B_6 Deficiency causes convulsions. Its sources are cereals, grams, yeast etc.
iii. Vitamin E deficiency causes loss of reproductive power. Its sources are germ oil, cotton seed oil, soyabean oil, etc

30. The alcohol combines with HCl to form protonated alcohol. The positive charge on oxygen weakens the C - O bond leading to its cleavage.

a. $R-\ddot{\underset{\cdot\cdot}{O}}-H + HCl \underset{}{\overset{fast}{\rightleftharpoons}} R-\overset{H}{\overset{|}{\overset{+}{\underset{\cdot\cdot}{O}}}}-H + Cl^-$

b. $R\overset{H}{\overset{|}{\overset{+}{\underset{\cdot\cdot}{O}}}}-H \overset{slow}{\rightleftharpoons} \underset{\text{Carbocation}}{R^+} + H_2O$

c. $R^+ + Cl^- \xrightarrow{fast} RCl$

The rate-determining step in the above mechanism is (b), which is a slow step reaction. The stability of carbocation will determine the reactivity of the reaction. since the order of stability of carbocation is primary. < secondary. < tertiary. Higher the stability of carbonium ion faster the reaction of the alcohol with the nucleophile Cl^-. Hence the order of formation of an alkyl halide in the above reaction is primary < secondary < tertiary.

Section D

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

Many chemical and biological processes depend on osmosis, the selective passage of solvent molecules through the porous membrane from a dilute solution to a more concentrated one. The osmotic pressure π depends on molar concentration of the solution (π = CRT). If two solutions are of equal solute concentration and, hence, have the same osmotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic.

Osmosis is the major mechanism, for transporting water upward in the plants. Transpiration is the leaves supports the transport mechanism of water. The osmotic pressure of seawater

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is about 30 atm; this is the pressure that must be applied to the seawater (separated from pure water using a semi-permeable membrane) to get drinking water.

(i) A plant cell gets shrink when it is kept in a hypertonic solution.
(ii) 1.2% sodium chloride solution is hypertonic with respect to 0.9% sodium chloride solution or blood cells. When blood cells are placed in this solution, water flows out of the cells and they shrink due to loss of water by osmosis.
(iii)When the external pressure applied becomes more than the osmotic pressure of the solution, then the solvent molecules from the solution pass through the semipermeable membrane to the solvent side. This process is called reverse osmosis.

OR

In an upward direction, osmosis helps in the transportation of water in a plant.

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

The actinoids include the fourteen elements from Th to Lr. The actinoids are radioactive elements and the earlier members have relatively long half-lives, the latter ones have half-life values ranging from a day to 3 minutes for lawrencium. The latter members could be prepared only in nanogram quantities. Actinoids show a greater range of oxidation states. The elements, in the first half of the series frequently exhibit higher oxidation states. The actinoids resemble the lanthanoids in having more compounds in +3 state than in the +4 state. All the actinoids are believed to have the electronic configuration of $7s^2$ and variable occupancy of the 5f and 6d subshells. The magnetic properties of the actinoids are more complex than those of the lanthanoids. The variation in the magnetic susceptibility of the actinoids with the number of unpaired 5f electrons is roughly parallel to the corresponding results for the lanthanoid.

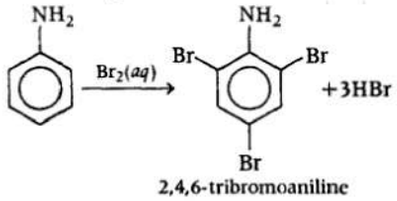
(i) This is because of relatively poor shielding by 5f electrons in actinoids in comparison with shielding of 4f electrons in lanthanoids.
(ii) Actinoids have irregularities in the electronic configuration because of almost equal energy of 5f, 6d and 7s orbitals. Therefore, there are some irregularities in the filling of 5f, 6d, and 7s orbitals. The electron may enter either of these orbitals.
(iii)The structural variability in actinoids is obtained due to irregularities in metallic radii which are far greater than in lanthanoids.

OR

Magnetic properties of actinoid complexes are borne by 5f open shell orbitals. These orbitals have a marked inner shell character, as in lanthanides, but interact more with the chemical environment than the 4f of lanthanides, leading to unique magnetic properties.

Section E

33. i. $C_6H_5N_2^+Cl^- \xrightarrow{H_3PO_2 + H_2O} C_6H_6 + N_2 + H_3PO_3 + HCl$

ii. 

2,4,6-tribromoaniline

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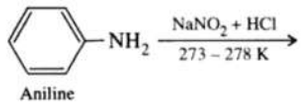
iii. $CH_3 - \underset{\underset{O}{\|}}{C} - NH_2 + Br_2 + 4NaOH \xrightarrow{Hoffmann\ bromamide\ reaction}$

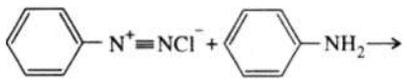
$\underset{\text{Methylamine}}{CH_3NH_2} + Na_2CO_3 + 2NaBr + 2H_2O$

OR

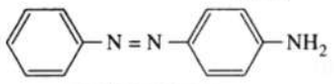
I. Steps involved in the conversion are given below:



Aniline

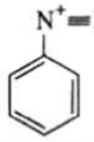


Aniline



p-Aminoazobenzene

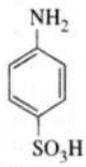
II.

a. 

Benzene diazonium chloride

b.

p-Nitrotoluene

c. 

Sulphanilic acid

34. The two cells may be represented as:

$Zn \mid Zn^{2+}$ (conc = C) || Cu^{2+} (C=?) | Cu EMF = E_1 (say)

$Zn \mid Zn^{2+}$ (conc = C) || Cu^{2+} (C=0.5 M) | Cu EMF = E_2 (say)

$E_2 - E_1 = 0.03$ V (Given)

The cell reaction is

$Zn(s) + Cu^{2+}(aq) \rightleftharpoons Zn^{2+}(aq) + Cu(s)$

For n = 2, Nernst equation is

$$E_{cell} = E^{\ominus}{}_{cell} - \frac{2.303RT}{nF}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$$

$$E_{cell} = E^{\ominus}{}_{cell} - \frac{2.303RT}{2F}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$$

$$= E^{\ominus}{}_{cell} - \frac{0.0591}{2}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$$

$$\therefore E_1 = E^{\ominus}{}_{cell} - \frac{0.0591}{2}\log\frac{C}{[Cu^{2+}]}$$

and $E_2 = E^{\ominus}{}_{cell} - \frac{0.0591}{2}\log\frac{C}{0.5}$

$$\therefore E_2 - E_1 = \frac{0.0591}{2}\left\{\log\left(\frac{C}{Cu^{2+}}\right) - \log\left(\frac{C}{0.5}\right)\right\}$$

$$0.03 = 0.02955\log\frac{0.5}{Cu^{2+}}$$

or $\log\frac{0.5}{Cu^{2+}} = \frac{0.03}{0.02955}$

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or $\log \frac{0.5}{Cu^{2+}} = 1.015$

$\frac{0.5}{Cu^{2+}} = 10^{1.015}$

$\therefore [Cu^{2+}] = \frac{0.5}{10^{1.015}} = 0.0483 mol\ L^{-1}$

OR

Sacrificial protection: Sacrificial protection means covering the iron surface with a layer of metal which is more active (electropositive) iron and thus prevents more active metal is zinc and the process is called galvanization.

Cathodic protection or Electrical protection: A method of metal protection based upon the fact that there is no dissolution of metal ions from the cathode of an electrochemical cell, since the cathode is more negative than the electrode potential of the particular metal. Cathodic protection is used to prevent corrosion of submerged or underground work.

Barrier protection: In barrier protection metal surface is not allowed to come in contact with moisture, oxygen and carbon dioxide. This can be achieved by applying paint, grease, oiling or coated the surface with iron corroding metals such as nickel, chromium, aluminium etc.

35. Answer the following questions:

(i) For a reaction R $\rightarrow$ P, half-life ($t_{1/2}$) is observed to be independent of the initial concentration of reactants. Thus, it follows first order reaction.

(ii) a. (Nil)

b. Two (tac and mer)

(iii) $\overset{6}{C}H_3 - \overset{5}{C}H_2 - \overset{4}{C}H_2 - \underset{OH}{\overset{3}{C}H} - \overset{2}{C}H = \overset{1}{C}H_2$

$Hex-1-en-3-ol$

(iv)N- Methylmethanamine

(v) Fe

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