CHEMISTRY PAPER–1
(THEORY)

Maximum Marks: 70

Time allowed: 3 hours

Candidates are allowed an additional 15 minutes for only reading the paper. They must NOT start writing during this time.

This paper is divided into four sections - A, B, C and D.

All questions are compulsory

Section -A consists of one question having subparts of one mark each.

Section-B consists of ten questions of two marks each.

Section -C consists of seven questions of three marks each and Section-D consists of three questions of five marks each.

Internal choices have been provided in one questions each in section B, section -C and section-D.

All working, including rough work, should be done on the same sheet as, and adjacent to the rest of the answer.

The intended marks for questions or parts of questions are given in brackets. [ ]

Balanced equations must be given wherever possible and diagrams where they are helpful.

When solving numerical problems, all essential working must be shown.

In working out problems, use the following data:

Gas constant $R = 1.987$ Cal deg^{-1} mol^{-1} = 8.314 JK^{-1} mol^{-1} = 0.0821 dm^3 atm K^{-1}mol^{-1}

1 L atm = 1 dm^3 atm = 101·3 J. 1 Faraday = 96500 coulombs.

Avogadro's number = 6.023×10^{23}

SECTION-A [14 Marks]

Question 1

(A) Fill in the blanks by choosing appropriate word (s) from those given in the brackets : [1×4=4]

[Aniline, two, violet, $3°$, tetrahedral, Luca's reagent, zero, dia, tri, $1°$, phenol, buff]

i) When the concentration of a reactant of first order is doubled, the rate becomes _____ times but for _____ order reaction, the rate remains same.

(ii) The complex $[Ni(CO)_4]$ is _____ in shape and is _____ magnetic.

(iii) A mixture of conc. HCl and anhydrous $ZnCl_2$ is called _____ which shows maximum reactivity with _____ alcohol.

(iv) Benzenediazonium chloride on warming with water gives _____ which gives _____ colour with neutral $FeCl_3$ solution.
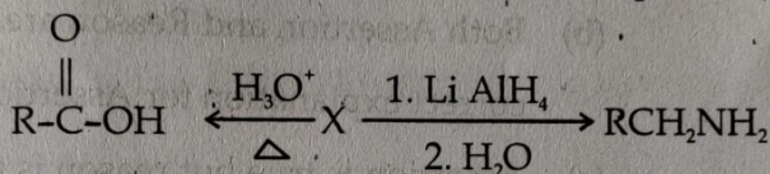
(B) Select and write the correct alternative from the choices given below : [1×4=4]

(i) The quantity of electricity required to deposit 1.15 g of sodium from molten $NaCl$ ($Na=23$, $Cl=35.5$) is :

(a) 1 F

(b) 0.5 F

(c) 0.05 F

(d) 1.5 F

(ii) The half-life period of a first order reaction is 20 minutes. The time required for the concentration of reactant to change from 0.16 M to 0.02 M is :

(a) 80 min

(b) 60 min

(c) 40 min

(d) 20 min

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(iii) Which of the following statement is not correct ?

(a) $La(OH)_3$ is less basic than $Lu(OH)_3$

(b) In lanthanide series, ionic radius decreases from La^{3+} to Lu^{3+} ion.

(c) La is actually an element of transition series rather than lanthanides.

(d) Atomic radius of Zr and Hf are same because of lanthanide contraction.

(iv) Consider the following rection of the compound (X)

$$R-\overset{\overset{\displaystyle O}{\|}}{C}-OH \underset{\Delta}{\overset{H_3O^+}{\longleftarrow}} X \xrightarrow[2.\ H_2O]{1.\ Li\ AlH_4} RCH_2NH_2$$

The compound X is expected to be :

(a) an oxime

(b) an isonitrile

(c) a nitrile

(d) a nitrite

(C) Match the following :   [1×4=4]

(i)   EDTA   (a)   chloroform

(ii) isotonic solution   (b)   peptide bond

(iii) Protein   (c)   Same molar concentration

(iv) Dow's process   (d)   Co-ordination No. 6

(D) (i) **Assertion :** E_{cell} should have a positive value for the cell to function.   [1×4=2]

Reason : $E_{cathode} < E_{anode}$

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

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(b) Both Assertion and Reason are true but reason is not the correct explanation for Assertion.

(c) Assertion is true but reason is false.

(d) Assertion is false but reason is true.

(ii) **Assertion :** Aryl halides undergo electrophilic substitution reactions more readily than benzene.

Reason : Aryl halide gives a mixture of o-and p-products.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both Assertion and Reason are true but reason is not the correct explanation for Assertion.

(c) Assertion is true but reason is false.

(d) Assertion is false but reason is true.

SECTION–B [20 Marks]

Question 2 [2]

A 0.01 m aqueus solution of $AlCl_3$ freezes at -0.068 C°. Calculate the percentage of dissociation. K_f is 1.86 k kg mol^{-1}.

Question 3 [2]
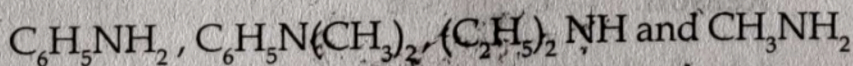
Give reason for the following :

(i) In a given transition series, there is no significant change in the atomic radii of elements with increase in atomic number.

(ii) Iron has higher enthalpy of atomisation than copper.
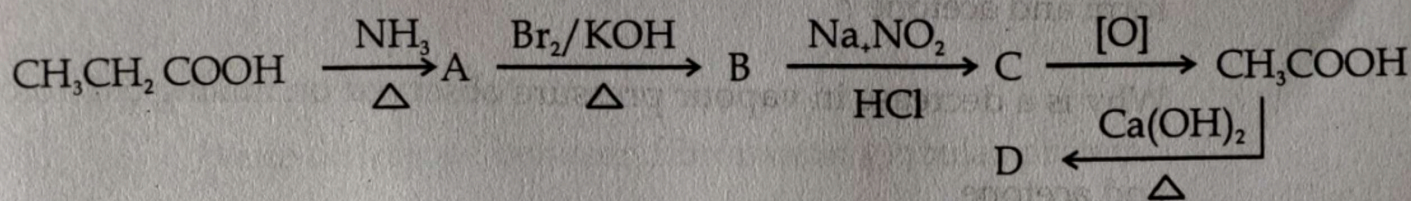
Question 4 [2]

(i) Write balanced chemical reaction of aniline with Acetyl chloride.

(ii) Arrange the following in decreasing order of basic strength.

$C_6H_5NH_2$, $C_6H_5N(CH_3)_2$, $(C_2H_5)_2NH$ and CH_3NH_2

Question 5 [2]

Identify A to D

$$CH_3CH_2COOH \xrightarrow[\Delta]{NH_3} A \xrightarrow[\Delta]{Br_2/KOH} B \xrightarrow[HCl]{Na_*NO_2} C \xrightarrow[]{[O]} CH_3COOH$$
$$D \xleftarrow[\Delta]{Ca(OH)_2}$$

Question 6 [2]

Calculate emf of the following cell at 25°C Fe/Fe²⁺ (0.001 M)||H⁺(0.01M)/

$H_2(g)$ (1 bar)/Pt(s)

$E°(Fe^{2+}/Fe) = -0.44V$ $E°(H/H_2) = 0.00V$

Question 7 [2]

Complete and balance the following chemical equations :

(i) $K_2Cr_2O_7 + H_2SO_4 + H_2S \rightarrow$

(ii) $KMnO_4 + H_2SO_4 + HI \rightarrow$
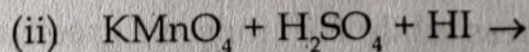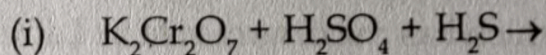
Question 8 [2]

(i) Write balanced chemcial equation for :

    (a) Swart's reaction

    (b) Fittig reaction

OR

(ii) Do following conversion :

    (a) Chlrobenzene → DDT

    (b) Propene → propan-1-ol

Question 9 [2]

What type of deviation from Raoult's Law is observed by mixing chloroform and acetone?

Why is a decrease in vapour pressure observed on mixing chloroform and acetone.

Question 10 [2]

Give one chemical test for each to distinguish between the following pair of compounds:

(i) Acetaldehyde and Benzaldehyde

(ii) Aniline and Phenol

Question 11 [2]

(i) Name the trivalent ion which has maximum size in Lanthanoid series.

(ii) Why Zn^{2+} ions are colourless while Ni^{2+} ions are green and Cu^{2+} ions are blue in colour?

SECTION-C [21 Marks]

Question 12 [3]

A first order reaction is 50% complete in 30 minutes at 27°C and in 10 minutes at 47°C. Calculate the reaction rate constant at 27°C and the energy of activation of the reaction in KJ/Mol.

Question 13 [3]

An organic compound A with molecular formula C_2H_7N on reaction with nitrous acid gives a compound B.

B On controlled oxidation gives compound C. C reduces Tollen's reagent to give silver mirror and D.

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B reacts with D in the presence of concentrated sulphuric acid to give a sweet smelling compound E. Identify A to E. Give reaction of C with HCN and name the product.

Question 14   [3]

  (i)   Write difference between fibrous and globular protein.

  (ii) Dificiency of which vitamin causes following :

     (a) delay in blood clotting

     (b) rickets

Question 15   [3]

   An aqueous solution freezes at 272.4 K, while pure water freezes at 273.0 K. Determine :

   (a) the molality of solution

   (b) boiling point of solution

   (c) lowering of vapour pressure of water at 298 K.

        $K_f = 1.86$ K kg mol^{-1}, $K_b = 0.512$ K kg mol^{-1} and vapour pressure of water at 298 k is 23.756 mm Hg.

Question 16   [3]

   Write balance equation and also name the reaction when :

   (a) Benzaldehyde is heated with alc KCN solution

   (b) Acetone is heated with a mixture of hydrazine and potassium hydroxide in ethylene glycol as solvent at a temperature of 453–473 K.

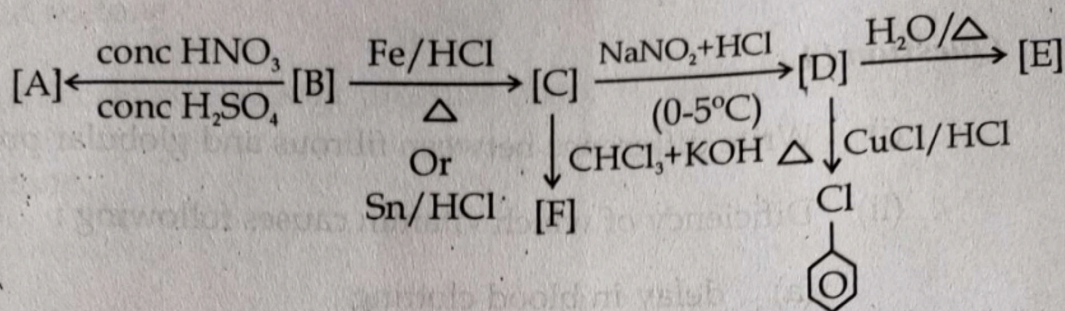**Question 17**   [3]

  (i)   How will the following be converted (Give chemical equation)

     (a) Aniline to Benzene

     (b) Benzoic acid to benzaldehyde

(c) Ethylamine to Methylanine

OR

(ii) Identify A to F in the following :

$$[A] \xleftarrow{\dfrac{conc\ HNO_3}{conc\ H_2SO_4}} [B] \xrightarrow[\Delta]{Fe/HCl} [C] \xrightarrow[(0\text{-}5°C)]{NaNO_2+HCl} [D] \xrightarrow{H_2O/\Delta} [E]$$

Or
Sn/HCl

$[C] \downarrow CHCl_3+KOH \quad [D] \downarrow \Delta \ CuCl/HCl$

[F]

Cl

[3]

Question 18

Observe the table given showing volume of CO_2 obtained by reaction of $CaCO_3$ and dil HCℓ after every minute.

Answer the questions that follow :

Table showing volume of CO_2 at one minute interval by reaction of $CaCO_3$ with dil HCℓ.

Time (min.)	Volume of CO_2/cm^3
0	0
1	$24\ cm^3$
2	$34\ cm^3$
3	$38\ cm^3$
4	$40\ cm^3$
5	$40\ cm^3$
6	$40\ cm^3$

(i) What happen to rate of reaction with time ?

(ii) Why does $CaCO_3$ powder react faster than marble chips ?

(iii) What happens to the rate of reaction if concentrated HCℓ is used ?

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SECTION-D [15 Marks]

Question 19 [5]

    (i)   Explain the following :

        (a)   Acetaldehyde undergoes aldol condensation but formalde hyde does not.

        (b)   Acetic acid is weaker acid than formic acid.

    (ii)   Write chemical equations to illustrate the following name reactions ?

        (a)   HVZ reaction

        (b)   Perkin's reaction

        (c)   Cannizaro's reaction

Question 20 [5]

    (i)   (a)   Write formula for :

                Pentaamminenitrito-o-cobalt (III) chloride

        (b)   Why CO is stronger complexing reagent than NH_3.

        (c)   Write co-ordination isomer of $[Co(NO_3)_6]\ [Cr(C_2O_4)_3]$

    (ii)   Write formula for the co-ordination entity in which Co^{3+} ion is bound to one Cl^-, one NH_3 molecule and two bidentate ethylenediamine (en) moleculaes. Write the name and magnetic behaviour also.

Question 21 [5]

    (i)   (a)   The reduction potential of a metal X is 20.76 volts while that of Y is –2.38 volts. Which of the two metals is a stronger reducing agent ? Give reason for your answer.

(b) The specific conductance of 0.01 M solution of acetic acid at 298 K is 1.65×10^{-4} ohm^{-1} cm^{-1}. The molar conductance at infinite dilution for H$^+$ ion and CH$_3$COO$^-$ ion are 349.1 ohm^{-1} cm^2 mol^{-1} and 40.9 ohm^{-1} cm^2 mol^{-1} respetively calculate :

(1) Molar conductance of the solution

(2) Degree of dissociation of CH$_3$COOH

(3) Dissociation constant for CH$_3$COOH.

OR

(ii) (a) How can you increase reduction potential of an electrode ?

(b) Which will allow greater conduction of electricity and why ?
0.1 M acetic acid and 0.01 M acetic acid solution

(c) Consider the reaction $2Ag^+ + Cd \rightarrow 2Ag + Cd^{2+}$. The standard reduction potential of Ag$^+$/Ag and Cd^{2+}/Cd are 0.80 volts and -0.40 volt respectively.

(i) Give the cell repesentation

(ii) What will be the emf of the cell if concentration of Cd^{2+} is 0.1 M and Ag$^+$ is 0.2 M.

(iii) Will the cell work spontaneously for the condition given in (ii) above ?

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