PART I (40 marks)

Answer **all** *questions.*

Question 1.

(a) Read the following questions carefully. For each question there are four alternatives A, B, C and D. Choose the correct alternative and write it in the space provided. **[10]**

(i) Which of the following reactions proceed by an increase in entropy?

A $CaCO_{3(s)} \longrightarrow CaO_{(s)} + CO_{2(g)}$

B $NH_{3(g)} + HCl_{(g)} \longrightarrow NH_4Cl_{(s)}$

C $N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$

D $H_{2(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(l)}$

Answer: ……

(ii) Which of the following pairs of solution is isotonic at the same temperature?

A 0.1 M NaCl and 0.1 M Glucose

B 0.1 M NaCl and 0.1 M Na_2SO_4

C 0.1 M NaCl and 0.1 M HCl

D 0.1 M NaCl and 0.1 M $CaCl_2$

Answer: ……

(iii) The hybridization of SO_4^{-2} is

A sp^3d.

B sp^3.

C sp^2.

D sp.

Answer: ……

(iv) The electric current produced when a crystal is subjected to heat is called

A antiferroelectricity.

B piezoelectricity.

C ferroelectricity.

D pyroelectricity.

Answer: ……

(v) The correct order of the +I effect of the substituents is

A t-butyl > isopropyl > ethyl > methyl.

B t-butyl > isopropyl > methyl > ethyl.

C isopropyl > t-butyl > ethyl > methyl.

D t-butyl > ethyl > isopropyl > methyl.

Answer: ……

(vi) The polymer which possesses the strongest intermolecular forces is

A thermosetting plastics.

B fibrous polymers.

C thermoplastics.

D elastomers.

Answer: ……

(vii) The denticity of ethylene diamine is

A ambidentate.

B unidentate.

C tridentate.

D bidentate.

Answer: ……

(viii) On adding a base to a buffer solution of NH_4OH and NH_4Cl, the concentration of

A OH^- ions remain constant.

B OH^- ions decrease.

C OH^- ions increase.

D Cl^- ions increase.

Answer: ……

(ix) Which of the following compounds is achiral?

A 2-butanol

B lactic acid

C propanoic acid

D 2-chlorobutane

Answer: ……

(x) When $_{86}Rn^{222}$ emits two α-particles followed by one β-particle the product formed will have a mass number and an atomic number of

A 214, 82.
B 214, 83.
C 218, 84.
D 218, 85.

Answer: ……

(b) Correct the following statements by changing only the underlined words. Rewrite ONLY the correct answer. DO NOT copy the whole sentence. **[5]**

(i) The movement of colloidal particles under an applied electric potential is called <u>electro-osmosis</u> .

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(ii) Both benzoic acid and benzaldehyde have <u>activating</u> substituents.

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(iii) The solvent-solute interactions are accompanied with release of energy called <u>lattice energy</u>.

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(iv) The molecules or ions that can lose as well as accept protons are called <u>amphoteric</u> substances.

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(v) <u>Acetone</u> is sold in bottles containing iron wire in order to prevent the formation of peroxide.

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(c) Fill in the blanks choosing appropriate word/s given in the brackets. **[5]**

[*electrochemical equivalent, threshold energy, sodium stearate, silver, gluconic acid, sodium lauryl sulphate, chemical equivalent, copper, glycolic acid, activation energy*]

(i) The minimum amount of energy which reacting molecules must possess to produce effective collision is ……

(ii) …… can be used in acidic solutions as well as in hard water.

(iii) When glycine reacts with nitrous acid …… is formed.

(iv) …… is the metal used as a non-irritating disinfectant for eye diseases.

(v) The amount of substance deposited by one coulomb of electricity is ……

(d) Match each item of Column A with the most appropriate item of Column B. Rewrite the correct pairs by writing the number and the corresponding alphabet in the spaces provided. For example, (ix) – (k **[5]**

Column A	**Column B**
(i) Sandmeyer rection	a. C_6H_5CHO
(ii) Dow's process	b. C_2H_5NC
(iii) Etard reaction	c. $C_2H_5NH_2$
(iv) Hoffman's reaction	d. C_6H_5OH
(v) Carbylamine reaction	e. C_6H_5Cl
	f. $C_6H_5NO_2$

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(e) Answer the following questions.

(i) In cold places ethylene glycol is added to the water in a car radiator. Why? **[1]**

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(ii) What do you understand by London forces? **[1]**

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(iii) State Faraday's second law of electrolysis. **[1]**

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(iv) What does the term molar heat capacity at constant volume mean?
Write the relation between Cv and internal energy change. **[2]**

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(v) Name a non-metal which is used as a deoxidiser in the manufacture of steel and its compound which is used as an abrasive for cutting and grinding glasses. **[2]**

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(vi) A system loses 10 J of heat to the surrounding. What will be the value of 'q' for the system and its surrounding? **[1]**

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(vii) Classify the following as elimination or addition reactions. **[1]**

A $C_2H_4 + Cl_2 \xrightarrow{hv \text{ or heat}} CH_2ClCH_2Cl$

B $(CH_3)_3CBr \xrightarrow{KOH_{(alc)}} (CH_3)_2C{=}CH_2 + H_2O + KBr$

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(viii) Write the balanced equations for the following reactions: **[2]**

A Oxidation of sucrose with conc. HNO_3

B Reduction of fructose with sodium amalgam

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(ix) Identify the kind of isomerism exhibited by the following pairs of compounds: **[1]**

A $CH_3OCH_2CH_2CH_3$ and $CH_3CH_2OCH_2CH_3$

B HONO and HNO_2

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(x) Differentiate between homopolymer and co-polymer with examples. **[1]**

Homopolymer	**Co-polymer**

(xi) What happens when, **[2]**

A neutral ferric chloride is added to acetic acid?

B acetaldehyde is warmed with iodine and caustic soda solution?

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PART II

*Answer **nine** questions choosing **four** from Section A, **three** from Section B and **two** from Section C*

SECTION A (28 marks)

Answer any **four** *questions.*

Question 2.

(a) The elevation of boiling point of water in 0.01 molal urea is 1.86 K.

What would be the elevation of boiling point of water in 0.01 molal solution of potassium chloride? **[2]**

(b) Distinguish between the following pairs: **[3]**

(i) Stoichiometric defects and non-stoichiometric defects

Stoichiometric defects	**Non-stoichiometric defects**

(i) Hydrogen bomb and atom bomb

Hydrogen bomb	**Atom bomb**

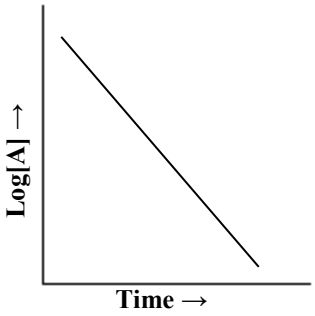
(ii) Homogeneous catalysis and heterogeneous catalysis

Homogeneous catalysis	**Heterogeneous catalysis**

(c) Write the moleculer orbital configuration of N_2^{2-}. Calculate its bond order and predict its magnetic property. **[2]**

Question 3.

(a) A plot of log [A] against time for a reaction is shown below:



(i) What is the order of reaction? **[1]**

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(ii) The slope of the plot of log K versus $\frac{I}{T}$ for a reaction is -750 K.

Find the activation energy of the reaction. **[1]**

(b) Benzene-ethanol, carbontetrachloride-cyclohexane, water-formic acid, acetone-chloroform, benzene-toluene, chloroform-ethanol are examples of solutions of two completely miscible liquids. Classify them into Type I, Type II and Type III solutions. **[3]**

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(c) Predict whether the following reaction will occur or not. $Zn + 2Ag^{+} \longrightarrow Zn^{2+} + 2Ag$ **[2]**

Given that: $E^{0}_{Zn^{+2}/Zn} = -0.76V$, $E^{0}_{Ag^{+}/Ag} = 0.80V$

Question 4.

(a) A solution is prepared by dissolving 4 g of KOH in 500 ml of water. Calculate the pH of the solution. (Atomic weights: K=39, O=16, H=1) **[3]**

(b) Explain how radiocarbon enters the food chain and write the principle of radiocarbon dating. **[2]**

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(c) What do you understand by doping? Explain how germanium doped with phosphorus conducts electricity. **[2]**

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Question 5.

(a) (i) What are the ***two*** main methods of preparing hydrophobic sols? **[1]**

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(ii) How is gold sol prepared? Explain **[1]**

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(b) 30 g of urea is dissolved in 800 g of water and the vapour pressure of pure water is 23.8 mm Hg at 25°C. Calculate the vapour pressure of the solution. **[2]**

(c) (i) Arrange the following molecules in the increasing order of their boiling points. **[1]**

NH_3, H_2S, HF, PH_3

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(ii) Write ***two*** differences between sigma and pi bonds. **[1]**

Sigma bond	**Pi bond**

(iii) Why is alum added to impure water? **[1]**

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Question 6.

(a) A patient with thyroid disorder is injected with a radioisotope iodine having an activity of 10^3 disintegrations per minute. What would be the activity after 5 hours? [Half life of radioisotope iodine is 25 minutes.] **[2]**

(b) The solubility of CaF_2 is 2.5×10^{-5} mol L^{-1} at 25°C.

(i) What is the solubility product? **[1]**

(ii) Find its solubility in 0.02 M solution of $CaCl_2$. **[1]**

(c) (i) How can you determine the standard electrode potential of Cu^{2+}/Cu? **[2]**

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(ii) What is gold number? **[1]**

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Question 7.

(a) Define the following:

(i) Abnormal molecular mass **[1]**

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(ii) Specific conductivity **[1]**

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(b) Draw an energy diagram for uncatalysed and catalysed reactions. **[2]**

(c) NaOH cannot be used in place of NH_4OH to precipitate cations of group III in qualitative analysis. Explain. **[1]**

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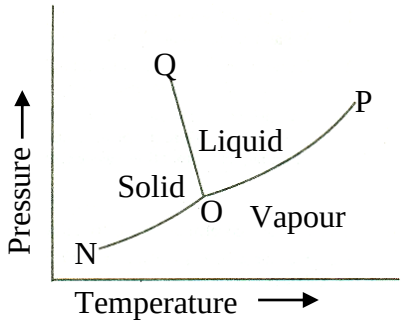
(d) Study the phase diagram given below and answer the questions that follow.



(i) What phases are at equilibrium at point O? **[1]**

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(ii) Calculate the variance along the line QO. **[1]**

SECTION B (18 marks)

Answer any **three** *questions.*

Question 8.

(a) (i) Draw the structure of linkage isomers of $[Co(NH_3)_5 (NO_2)]^{2+}$. **[1]**

(ii) Calculate the oxidation state of Co in $[Co(NH_3)_3 (H_2O)_2Cl]^{+}$. **[1]**

(b) Explain the steps involved in the extraction of pure tin from its ore. **[3]**

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(c) Classify the following compounds into nucleophiles and electrophiles. **[1]**

SO_3, NH_3, $FeCl_3$, H_2O

Nucleophiles	**Electrophiles**

Question 9.

(a) Complete and balance the following equations: **[2]**

(i) $P_4 + NaOH + H_2O \xrightarrow{\Delta}$ …….. + ……..

(ii) $KClO_3 + F_2 + H_2O \longrightarrow$ …….. + ……..

(b) State whether the following process are spontaneous or non-spontaneous and explain. **[2]**

(i) Dissolution of ammonium chloride in water.

(ii) Formation of ice in the refrigerator.

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(c) Explain briefly the laboratory preparation of H_2S gas by using Kipp's apparatus. **[2]**

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Question 10.

(a) 0.125 moles of argon expands isothermally and reversibly at 27°C from 3 L to 6 L. Calculate w and q for the process in calories. **[2]**

(b) Write down ***four*** differences between SN^1 and SN^2 reactions. **[2]**

SN^1 reaction	**SN^2 reaction**

(c) Give ***two*** uses of each of the following: **[2]**

(i) Bromine

(ii) Silicone

Bromine	**Silicone**

Question 11.

(a) Why was there a need for the second law of thermodynamics? Support your answer with ***two*** reasons. **[2]**

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(b) Explain the mechanism for the bromination of methane in presence of UV light. **[2]**

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(c) Name the following: **[2]**

(i) Constituent of cable sheath.

(ii) A heterogeneous catalyst used for the polymerization of alkenes.

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SECTION C (14 marks)

Answer any **two** *questions.*

Question 12.

(a) Define the following: **[2]**

(i) Enantiomers

(ii) Zwitter ion

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(b) Identify A, B and C in the following reaction: **[3]**

$$NH_2CONH_2 \xrightarrow{NaOH} A \xrightarrow{CH_3COCl} B \xrightarrow{P_2O_5} C$$

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(c) (i) Draw the structure of α-D-glucopyranose. **[1]**

(ii) Give ***one*** test to differentiate between starch and cellulose. **[1]**

Starch	**Cellulose**

Question 13.

(a) How would you convert methylamine to ethylamine? **[2]**

(b) What happens when, **[2]**

(i) formic acid is treated with ethyl alcohol in presence of conc. H_2SO_4?

(ii) triolein is treated with caustic soda?

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(c) (i) What do you understand by directive influence of a group? **[1]**

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(ii) Explain the directive influence of $-NO_2$. **[2]**

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Question 14.

(a) (i) What are plasticizers? **[1]**

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(ii) Draw the structure of the main product formed when aniline is treated with aqueous bromine. **[1]**

(b) Explain aldol condensation and support your answer with an example. **[2]**

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(c) Give reasons for the following: **[2]**

(i) Benzaldehyde does not form red precipitate with Fehling's solution.

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(ii) The net rotation of meso-tartaric acid is zero.

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(d) What are the conditions for a molecule to be optically active? **[1]**

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for **ROUGH WORK**

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