

PART I (40 marks)

Answer all questions.

Question 1.

(a) For each question, there are four alternatives A, B, C and D. Choose the correct alternative and circle it. Do not circle more than ONE alternative. If there are more than one circled, NO score will be awarded.

[10]

(i) The hybridization of carbon in ethyne, graphite and diamond is

- A sp, sp², sp³.
- B sp², sp, sp³.
- C sp³, sp, sp².
- D sp³, sp², sp.

(ii) After the emission of one α -particle and two β -particles from the atom ${}_{92}X^{238}$, the number of protons in the atom will be

- A 93.
- B 92.
- C 91.
- D 90.

(iii) Which of the following statements is correct for an ideal solution?

- I. The change in volume of mixing is equal to zero.
- II. The change in enthalpy is zero but change in volume is not equal to zero.
- III. The change in enthalpy of mixing is equal to zero.

- A I and II
- B I and III
- C II and III
- D II only

(iv) The movement of colloidal particles under an applied electric potential is known as

- A Brownian movement.
- B electro-dialysis.
- C electrophoresis.
- D peptization.

(v) The coordination compound formed when potassium ferrocyanide solution is added to an aqueous solution of copper sulphate is

A $\text{Cu}_2[\text{Fe}(\text{CN})_6]$.
B $\text{Cu}_2[\text{Fe}(\text{CN})_5]$.
C $\text{Cu}_2[\text{Fe}(\text{CN})_4]$.
D $\text{Cu}_2[\text{Fe}(\text{CN})_3]$.

(vi) Solder is an alloy composed of

A lead and tin.
B lead and copper.
C tin and cadmium.
D tin and antimony.

(vii) Which of the following is the correct order of +I-effect?

A $-\text{CH}_3 > -\text{CH}_2\text{R} > -\text{CHR}_2 > -\text{CR}_3$
B $-\text{CH}_2\text{R} > -\text{CHR}_2 > -\text{CR}_3 > -\text{CH}_3$
C $-\text{CHR}_2 > -\text{CH}_2\text{R} > -\text{CH}_3 > -\text{CR}_3$
D $-\text{CR}_3 > -\text{CHR}_2 > -\text{CH}_2\text{R} > -\text{CH}_3$

(viii) The following reactions are given by all the amines **EXCEPT**

A $\text{RNH}_2 + \text{HCl} \longrightarrow [\text{RNH}_3]^+\text{Cl}^-$
B $\text{RNH}_2 + \text{H}_2\text{O} \xrightarrow{\hspace{1cm}} \text{RNH}_3\text{OH}$
C $\text{R}_2\text{NH} + \text{H}_2\text{SO}_4 \xrightarrow{\hspace{1cm}} [\text{R}_2\text{NH}_2]\text{HSO}_4$
D $\text{RNH}_2 + \text{CHCl}_3 + 3\text{KOH} \longrightarrow \text{RNC} + 3\text{KCl} + 3\text{H}_2\text{O}$

(ix) Williamson's synthesis is used for the preparation of

A ether.
B alcohol.
C ketones.
D aldehydes.

(x) The test which can differentiate benzaldehyde from acetone is

A iodoform test.
B carbylamine test.
C ferric chloride test.
D sodium bicarbonate test.

(b) *Correct the following statements by changing only the underlined words.*

Rewrite ONLY the correct answer. DO NOT copy the whole sentences.

[5]

(i) Some of the polar crystals on heating produce a small electric current called piezoelectricity.

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(ii) Effective collisions are those in which colliding molecules must have energy equal or greater than the activation energy.

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(iii) In a cyclic process the net change of internal energy is maximum.

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(iv) In fibers, the chains are held together by covalent bonds.

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(v) Fructose is a carbohydrate containing carboxyl group.

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(c) *Match the items in Column A with the items in Column B. Rewrite the correct pairs by writing the number and the corresponding alphabet in the spaces provided. For example: (vi) – (h)*

[5]

Column A	Column B
(i) Adiabatic process	(a) $dT = 0$
(ii) Isobaric process	(b) $dV = 0$
(iii) Isochoric process	(c) $dq = 0$
(iv) Electrophilic addition	(d) $dp = 0$
(v) Nucleophilic addition	(e) C_2H_6
	(f) C_2H_4
	(g) CH_3COCH_3

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(d) **Fill in the blanks choosing appropriate word/s given in the brackets.**

Write the correct answers in the space provided.

[5]

[anode, greater, cathode, lower, mannitol, one, sorbitol, two]

- (i) Van't Hoff factor, 'i' for KCl is
- (ii) The pH of an aqueous solution of sodium acetate is than seven.
- (iii) Dextrose on reduction with sodium amalgam and water forms
- (iv) Fats have percentage of unsaturated acids than oils.
- (v) When electricity is passed through an acidic medium of glycine it moves towards

(e) **Answer the following questions.**

- (i) Name the type of bond present in ortho-nitrophenol.

[1]

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- (ii) Write down **two** advantages of Thin Layer Chromatography (TLC) over paper chromatography.

[1]

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- (iii) What is the function of HCl in the analysis of group II cations?

[1]

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(iv) On dilution, the equivalent conductance increases and the specific conductance decreases. Why?

[2]

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(v) Why is white phosphorus always kept under water?

[1]

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(vi) Write down the chemical equation for the reaction of H_2O_2 with ethylene.

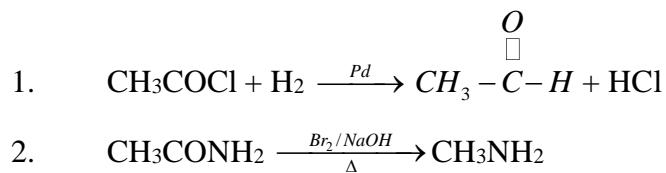
[1]

(vii) Draw the isomers of $C_2H_2Cl_2$ and name the isomers.

[2]

(viii) Name the following chemical reactions.

[2]



(ix) Write down the balanced equation for the preparation of nitroethane from ethane.

[1]

(x) Differentiate between the following pairs of compounds:

[2]

1. phenol and lower aliphatic alcohol
2. aniline and aliphatic amines

Phenol	Lower aliphatic alcohol

Aniline	Aliphatic amines

(xi) Write the structure of monomer unit of polystyrene.

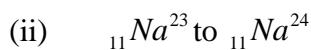
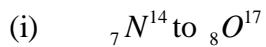
[1]

PART II
SECTION A (28 marks)
Answer any four questions.

Question 2.

(a) 92 g of ethanol is dissolved in 54 g of water. Calculate the mole fraction of each. [2]

(b) Write the nuclear reaction and identify the projectile for the following conversions: [2]



(c) (i) Why is physisorption called physical adsorption and chemisorption as chemical adsorption? [2]

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(ii) Define true equilibrium state of a system under a given set of conditions.

[1]

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Question 3.

(a) If the ionic product of water at 305 K is 2.7×10^{-14} , what is the pH of neutral water?

[2]

(b) Explain why ionic crystals

[2]

(i) are highly brittle?

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(ii) have high density?

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(c) Draw the molecular orbital diagram for N_2^+ and answer the following questions. [3]

(i) Calculate its bond order.

(ii) Predict its magnetic properties.

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Question 4.

(a) On passing 1.34 amperes of current in a solution of copper sulphate for 10 hours, 15.885 g of Cu was deposited on the electrode. The reaction is shown as: $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ [3]

(i) Calculate the amount of electricity passed through the solution.

(ii) How many moles of Cu were deposited?

(iii) If the charge on an electron is 1.6×10^{-19} coulomb, calculate the value of Avogadro's number.

(b) List down and explain briefly ***four*** factors which influence the adsorption of a gas on the surface of a solid. [2]

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(c) Distinguish between the rate of reaction and the rate constant. [2]

Rate of reaction	Rate constant

Question 5.

(a) A solution containing 8 g of a non-volatile solute in 500 g of water freezes at 273.087 K. Calculate the molecular weight of the non-volatile solute.
($k_f = 1.856 \text{ deg mol}^{-1}$)

[2]

(b) (i) What are the roles of cadmium rods and graphite rods in a nuclear reactor? [1]

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(ii) Why is fusion energy superior to fission energy? [1]

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(c) Draw a well labelled phase diagram of the lead-silver system and calculate the degree of freedom at eutectic point. [3]

Question 6.

(a) Write short notes on: [2]

(i) Lewis concept of acids and bases

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(ii) Validity of Ostwald's dilution law

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(b) (i) What is a metallic bond? [1]

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(ii) Conductivity of metal decreases with the increase in temperature. Why? [1]

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(c) (i) When do we get a lower molecular mass of a substance as compared to a normal molecular mass? [1]

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(ii) A voltaic cell consist of a metallic zinc plate immersed in 0.1 M zinc nitrate solution and a lead plate in 0.02 M lead nitrate solution. Calculate the emf of the cell at 25°C. [2]

$$E^0_{Zn^{2+}/Zn} = -0.76 \text{ V} \quad E^0_{Pb^{2+}/Pb} = -0.13 \text{ V}$$

Question 7.

(a) The pH value for $\text{CH}_3\text{COONH}_4$ remains constant even after adding a base or an acid.

Give reasons.

[2]

(b) The rate law for the reaction $\text{H}_2 + \text{I}_2 \rightarrow 2\text{HI}$ is found to be rate = $K[\text{H}_2][\text{I}_2]$.

How will the rate of reaction change when concentration of

[2]

(i) iodine is doubled?

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(ii) hydrogen is halved?

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(c) (i) What do you understand by the term F-centers?

[1]

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(ii) What are the differences between ferromagnetic and antiferromagnetic substances?

[1]

Ferromagnetic	Antiferromagnetic

(iii) State group displacement law.

[1]

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SECTION B (18 marks)

Answer any three questions.

Question 8.

(a) (i) What is Joule-Thomson effect?

[1]

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(ii) ΔH and ΔS for vapourisation of H_2O at 1 atm. pressure are 81260 Jmole^{-1} and $0.2176 \text{ kJmole}^{-1}$ respectively. Calculate the temperature at which the free energy change for transformation is zero.

[2]

(b) Write down the IUPAC name of the following compounds. [2]

(i) $K_3[Al(C_2O_4)_3] = \dots$

(ii) $[Cr(NH_3)_6][Co(CN)_6] = \dots$

(iii) $[Cu(NH_3)_4]SO_4 = \dots$

(iv) $[Fe(H_2O)_6]SO_4 = \dots$

(c) What kind of property is exhibited by copper when copper reacts with ferric sulphate? Write down the reaction. [1]

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Question 9.

(a) Complete the following reactions. [2]

(i) $SiO_2 + Mg \rightarrow \dots$

(ii) $2NaI + MnO_2 + 3H_2SO_4 \rightarrow \dots$

(b) What is ozonolysis? Write the chemical reaction. [2]

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(c) Classify the following reactions as electrophilic, nucleophilic, addition, elimination, substitution or free radical reaction. Write the balanced equations for the reactions. [2]

(i) Chlorination of methane in presence of UV light

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(ii) Reaction of ethylbromide with alcoholic KOH

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Question 10.

(a) Explain the entropy change when [2]

(i) a rubber band is stretched,

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(ii) ice melts to liquid.

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(b) Define linkage isomerism and give *one* example? [1]

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(c) Describe the extraction of lead by carbon reduction process. [3]

Question 11.

(a) State *two* ways in which the internal energy of a system can be changed. [1]

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(b) Write down **two** uses each of [2]

(i) iodine and

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(ii) silver nitrate.

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(c) What are the differences between [3]

(i) homolytic fission and heterolytic fission,
(ii) mesomeric effect and inductive effect,
(iii) SN_1 reaction and SN_2 reaction.

Homolytic fission	Heterolytic fission

Mesomeric effect	Inductive effect

SN_1 reaction	SN_2 reaction

SECTION C (14 marks)

Answer any two questions.

Question 12.

(a) (i) Give **one** characteristic required by an organic compound to exhibit an optical isomerism.

[1]

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(ii) What type of isomerism is exhibited by But-2-ene-1, 4 dioic acid? Draw the structures for all the isomers.

[1]

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(b) Compound A (C_2H_4O) on oxidation gives compound B ($C_2H_4O_2$). Compound A undergoes aldol condensation. [3]

(i) What is aldol condensation?

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(ii) Give the balanced equation of the reaction mentioned above.

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(iii) Write the esterification reaction of compound B.

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(c) How will you distinguish between cyanides and isocyanides? [2]

Cyanides	Isocyanides
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Question 13.

(a) Complete the following reactions and balance them. [3]



(b) What do you observe when [2]

(i) grape sugar is treated with an excess of phenyl hydrazine?

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(ii) sucrose is boiled with mineral acids?

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(c) What do you understand by the following terms? [2]

(i) Racemic mixture

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(ii) Elastomers

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Question 14.

(a) How will you carry out the following conversions? [3]

(i) Urea to biuret

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(ii) Acetyl chloride to acetophenone

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(iii) Ethyle acetate to ethyl alcohol

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(b) Give reasons for the following: [2]

(i) Benzene undergoes electrophilic substitution reaction even though it has a high degree of unsaturation.

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(ii) Aniline is a weak base than aliphatic amines.

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(c) (i) Explain the iso-electric point of glycine. [1]

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(ii) Give *one* difference between soap and detergent.

[1]

Soap	Detergent

for Rough Work