



ཤེས་རིག་ལྷན་ཁག།
ལུ་ཏིག་མང་འབྲིང་རིམ་སློབ་གྲྭ་གོང་མ།



**MOTTIHANG HIGHER SECONDARY SCHOOL
THIMPHU THROMDE**

“Every child is **inspired** to learn and **empowered** with **wisdom** to excel in life”
TRIAL EXAMINATION 2020

Class: XII
Chemistry

Writing time: 3 Hours
Total marks: 100

Name:.....Roll no.....Class.....Section.....

Invigilator’s Initial

Read the following directions carefully.

1. Do not write for the first 15 minutes. This time is to be spent reading over the questions. After having read over the questions, the time given at the top of this paper is the time allowed for writing the answers.
2. On the space provided above, write your name, class and roll number.
3. In this paper there are two sections – A and B. Section A is **compulsory** and you are expected to attempt **any six questions** from Section B.
4. The intended marks for questions or parts of the questions are given in the bracket.
5. Read the directions to each questions carefully and write all your answers neatly in the space provided in the question booklet itself.

For Teachers use only													
Question Number	Section A (40)					Section B (60)							Total (100)
	Question 1					Q2	Q3	Q4	Q 5	Q 6	Q7	Q8	
Marks	a	b	c	d	e	10	10	10	10	10	10	10	10
Total Marks Awarded													
Teacher’s Initial													

SECTION A (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 choice circled, NO score will be awarded. [15]

(i) The osmotic pressure of equimolar solution of sodium chloride, glucose and barium chloride will be in the order

- A. glucose > sodium chloride > barium chloride
- B. sodium chloride > barium chloride > glucose
- C. barium chloride > glucose > sodium chloride
- D. barium chloride > sodium chloride > glucose

(ii) When vegetable oil is treated with methanol in the presence of NaOH/KOH as a catalyst, the products formed are

- A. soap and glycerol.
- B. soap and detergent.
- C. detergent and glycerol.
- D. biodiesel and glycerol

(iii) Analytical technique used to determine the presence of cocaine and other drugs in blood and urine is

- A. Mass Spectroscopy
- B. Infrared (IR) Spectroscopy
- C. Nuclear Magnetic Resonance (NMR) Spectroscopy
- D. High Performance Liquid Chromatography (HPLC)

(iv) If the rate of reaction is equal to the rate constant, the unit of rate constant is

- A. $\text{mol L}^{-1} \text{time}^{-1}$
- B. time^{-1}
- C. $\text{mol}^{-1} \text{L time}^{-1}$
- D. $\text{mol}^{-2} \text{L}^2 \text{time}^{-1}$

(v) HCO_3^- is an example of

- A. conjugate acid
- B. conjugate base
- C. amphiprotic ion
- D. amphoteric ion

(vi) Which of the following pairs of organic compound would undergo Cannizzaro reaction?

- B. formaldehyde and benzaldehyde
- B. formaldehyde and acetaldehyde
- C. acetaldehyde and acetone
- D. benzaldehyde and acetaldehyde

(vii) E^0 of M^{3+}/M^{2+} values of Cr, Mn, Fe and Co are -0.41V, +1.57V, +0.77V and +1.97V respectively. The metal that would easily change its oxidation state from +2 to +3 is

- A. Cr B. Mn C. Fe D. Co

(viii) The table below shows the pK_b values of ammonia and its derivatives (amines)

Ammonia and Amines	Ammonia	Trimethylamine	Methylamine	Dimethylamine
pK_b	4.75	4.22	3.38	3.27

The order of basic strength is

- A) dimethylamine > methylamine > trimethylamine > ammonia
B) ammonia > trimethylamine > methylamine > dimethylamine
C) methylamine > dimethylamine > trimethylamine > ammonia
D) methylamine > trimethylamine > ammonia > Dimethylamine

(ix) which of the following structures is a zwitter ion?

- A. H_2N-CH_2-COOH B. $^+H_3N-CH_2-COOH$
B. $^-NH-CH_2-COO^-$ D. $^+H_3N-CH_2-COO^-$

(x): In a nuclear reaction, the product formed is an isobar if there is

- A. 1 α -emission B. 1 β -emission
C. 1 α -emission and 1 β -emission D. 2 α -emission and 2 β -emission

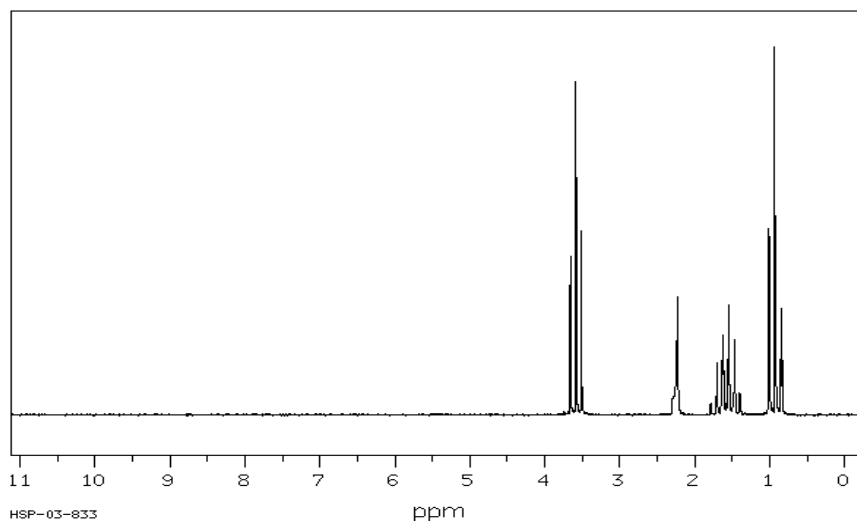
(xi) Which of the following aqueous solution will be coloured?

- A. $Zn(NO_3)_2$ B) $LiNO_3$ C) $Co(NO_3)_2$ D) $TiCl_4$

(xii) The four important derivatives of carboxylic acids are acyl halides, acid amides, esters and acid anhydrides. Acyl halides are the most reactive of all the derivatives. This is attributed to strong

- A. +R effect of halogen B. +I effect of halogen
C. -R effect of halogen D. -I effect of halogen

(xiii) The alcohol that gives following NMR spectrum is



- A. Methanol B. Ethanol C. Propanol D. Butanol

(xiv) The density of 3 M NaOH solution is 2 g/cm^3 . The molality of the solution is

- A. 0.67 m B. 1.50 m C. 1.60 m D. 3.20 m

(xv) The following equilibrium exists in aqueous solution: $\text{CH}_3\text{COOH} \rightleftharpoons \text{H}^+ + \text{CH}_3\text{COO}^-$. When dilute HNO_3 is added

- A. the equilibrium constant will increase B. the equilibrium constant will decrease
C. acetate ion concentration will increase D. acetate ion concentration will decrease

(b) Fill in the blanks with appropriate word/s. [5]

- i) When a small quantity of HCl is added to equimolar mixture of acetic acid and sodium acetate, the pH of the mixture will.....
- ii) "*The sickness the baby gets when the new baby comes*" or "*the disease of the deposed child*" is due to lack
- iii) The total number of ions furnished by $\text{K}_4[\text{Fe}(\text{CN})_6]$ in solution is
- iv) The IUPAC name of carboxylic acid present in rancid butter is
- v) For second order reaction when the concentration of the reactant is halved the rate of reaction becomes.....

(c) Match each item of Column A with the most appropriate item of Column B. Rewrite the correct pairs by writing the number against the alphabet in the spaces provided. [5]

Column A	Column B
i) Used in preserving biological specimens	A) Acetic Acids
ii) Used as ingredients in nail polishes	B) Esters
iii) Used as vinegar in <i>chutneys</i>	C) Formaldehyde
iv) Used as urinary antiseptics	D) Oxalic Acid
v) Used in preparation of artificial flavours in foods	E) Acetone
	F) Acetamide
	G) Benzoic Acid

Column A	Column B
i) Used in preserving biological specimens	
ii) Used as ingredients in nail polishes	
iii) Used as vinegar in <i>chutneys</i>	
iv) Used as urinary antiseptics	
v) Used in preparation of artificial flavours in foods	

(d) Correct the following statement by changing the word given in **BOLD**. Rewrite the correct word/s only. **DO NOT** copy the whole sentence. [5]

- i) The freezing point of a solution containing 342g /L of sugar is **lower than** the solution containing 60 g/L of urea.
- ii) In galvanic cell **electrons** flow in the internal circuit.
- iii) The oxidation state of Cr in CrO₅ is **+5**.
- iv) During “Hoffmann’s ammonolysis of alkyl halide” when excess of alkylhalide is used the product obtained is **primary amine**.....
- v) $\text{RCOOR}' + \text{R}''\text{OH} \xrightarrow[\text{R}_1\text{ONa}]{\text{H}^+}$ $\text{RCOOR}'' + \text{R}'\text{OH}$. The reaction represented is **esterification**.

(e) Answer the following questions.

[10]

- i) The given redox reaction $\text{Cu(s)} + 2\text{HCl(aq)} \rightarrow \text{CuCl}_2 + \text{H}_2(\text{g})$ is found to be impractical. Explain. ($E^0 \text{Cu/Cu}^{+2} = -0.34 \text{ V}$) [1]

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- ii) Of the three radioactive rays which is the most harmful to human beings. Why? [1]

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- iii) Why is aniline less basic than aliphatic amines? [1]

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- iv) *When a solute is dissolved in a solvent the boiling point of the solution increases.* Explain the statement with reference to vapour pressure. [1]

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- v) Bending vibration occur at lower wave number than stretching vibration? Justify [1]

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vi) For the chemical reaction $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$ at 25°C , the equilibrium constant is 1.8×10^{-7} . Calculate standard free energy change for the forward reaction if $R = 8.31 \text{ JK}^{-1} \text{ mol}^{-1}$ [1]

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vii) Among isomeric aldehydes and ketones, ketones have slightly higher boiling points. Explain the observation taking propanal ($\text{CH}_3\text{CH}_2\text{CHO}$) and propanone (CH_3COCH_3) with boiling points 322 K and 329 K respectively as examples. [1]

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viii) The pH of solution A is 2 while the pH of solution B is 4. Prove that solution A is 100 times more acidic than solution B. [1]

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ix) For the reaction $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$, write the rate expression in terms of disappearance of NH_3 and appearance of NO . How are they related? [1]

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x) In NMR spectroscopy the signal of Tetra Methyl Silane (TMS) whose chemical shift (δ) value is assigned "ZERO" is taken as standard reference. Justify [1]

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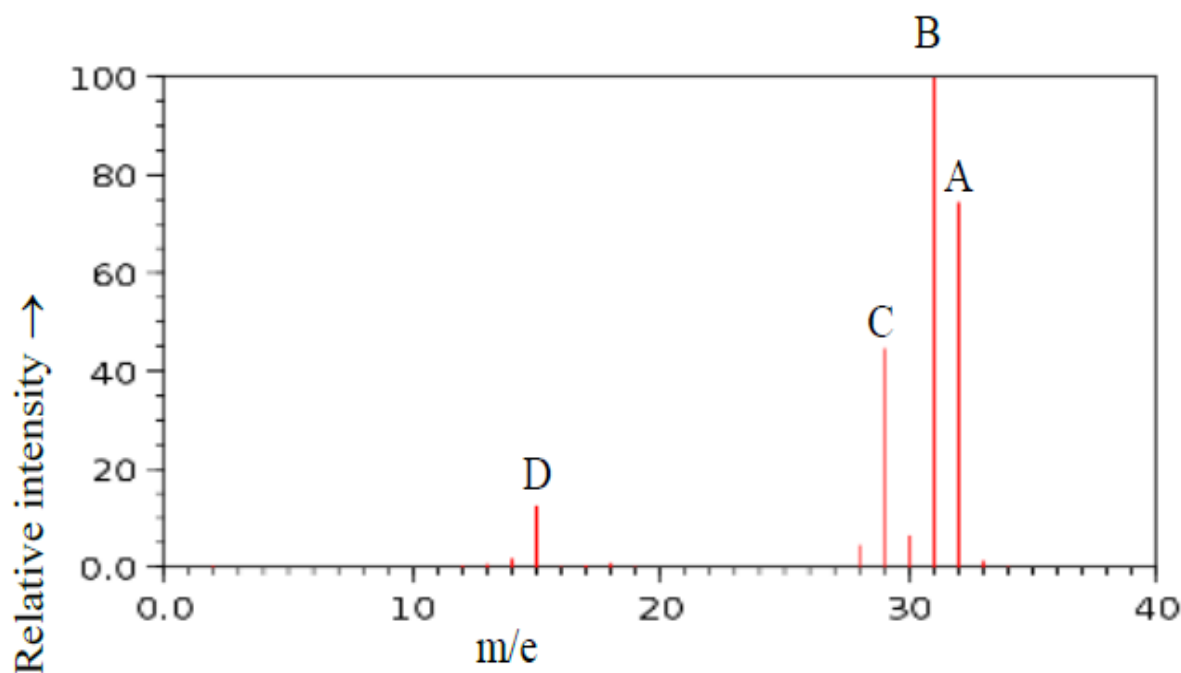
SECTION B (60 MARKS)
ATTEMPT ANY SIX QUESTIONS

Question 2

- a) "The rate of reaction cannot be determined by dividing the total change in concentration by total time". Explain the statement. [1]

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- b) Given below is a mass spectrum of an alcohol. Study the spectrum and answer following questions. [$\frac{1}{2} \times 4 = 2$]



- i) Alcohol that gives the mass spectrum is.....
ii) Daughter ion producing base peak is.....
iii) M^+ peak is represented by m/e value.....
iv) Daughter ion at m/e = 15 is produced by removal of O from

- c) A solution of a non-volatile solute in water freezes at -0.30°C . The vapour pressure of pure water at 298 K is 23.51 mm Hg and K_f for water is 1.86 degree/molal. Calculate the vapour pressure of this solution at 298 K. [3]

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- d) Both ${}_{26}\text{Fe}^{55}$ and ${}_{79}\text{Au}^{194}$ lie below stability zone in Serge chart. With the help of equations, explain how they become stable. [2]

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- e) Oils and fats are esters of glycerol and fatty acids. Using tristearin as the fatty acid write a balanced chemical equation for formation of oils and fats. [2]

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Question 3

a) Write the IUPAC name of [½+ ½]

i) Formic Acid.....

ii) Acetic Acid.....

b)

i) Write the IUPAC name of following two coordination compounds [1 x 2 =2]

a) $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2][\text{PtCl}_4]$:

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b) $[\text{Co}(\text{NH}_3)_6][\text{CdCl}_5]$

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ii) With the help of electronic configuration prove that Cd^{2+} ($Z = 48$) salts will be colourless while Fe^{3+} ($Z = 26$) salts will be coloured? [2]

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c) The ionic product of water (K_w) at 373 K (100°C) is $51.3 \times 10^{-14} \text{ mol}^2\text{L}^{-2}$. Based on this information answer the following questions.

i) Calculate the pH of boiling water [1.5]

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ii) What is the nature of boiling water based on its pH calculated in (i)? [½]

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iii) What would happen to the pH of the water if temperature is decreased? Why? [½+½]

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d) An aqueous solution of non-volatile and non-electrolytic substance boils at 100.5°C. Calculate the osmotic pressure of this solution at 27°C if K_b for water per 1000 g is 0.50. [2]

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Question 4

(a) Cooks find it more comfortable to cut cold onions compared to warm onions. Justify the assertion based on scientific thoughts [1]

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(b) When an ester is hydrolysed in presence of mineral acid, corresponding carboxylic acid and alcohol is formed. What is formed when ester is hydrolysed in alkaline medium? Name the process and justify for the name of the process. [2]

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(c) Based on NMR spectrum of Ethylbromide ($\text{CH}_3\text{CH}_2\text{Br}$) answer the following questions. [3]

i) Besides a signal from TMS, how many signals are expected from ethylbromide ?

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ii) Indicate splitting pattern of the peaks identified in (i)

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iii) Identify the peaks identified in (i) at upfield and downfield

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iv) Why do different peaks of ethylbromide appear at different chemical shift?

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(d) When Karma stored blue coloured CuSO_4 solution in Zn vessel, he observed that the solution became colourless. Explain this observation to Karma on the basis of scientific thoughts. [2]

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(e) The experimentally determined rate law for the overall reaction $2\text{NO}_2 + \text{F}_2 \rightarrow 2\text{NO}_2\text{F}$ is given by $r = k[\text{NO}_2][\text{F}_2]$. The presence of F was detected as an intermediate species during the course of the reaction. Propose a suitable mechanism for the reaction. Identify the rate determining step and write the order and molecularity of the reaction. [2]

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Question 5

(a) Calculate the pH of 10^{-10} M NaOH solution [2]

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(b) An organic compound A with molecular formula C_7H_6O on treatment with acidified potassium dichromate produces a carboxylic acid B. B on treatment with soda lime produces a salt of B and soda lime. Write the complete reactions and identify compounds A and B. [2]

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(c) An organic compound 'A' with a molecular formula C_2H_4O undergoes oxidation to form compound 'B'. This compound on reaction with ammonia forms compound 'C', which is an amide compound. [2]

(i) Identify compounds 'A', 'B' and 'C'

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(ii) What will happen when NaHCO_3 is added to compound 'B'?

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(d) A complex of nickel has a molecular formula containing five ammonia molecules, a nitrosyl ion and two chloride ions. One mole of the complex on reacting with excess of AgNO_3 produces two moles of precipitate of AgCl . [1 x 4 = 4]

- i) Write the formula of the complex:.....
- ii) Number of secondary valency:.....
- iii) Total number of ions produced in the solution:.....
- iv) The structure of the complex:

Question 6

(a) Define the term "molecularity of a reaction". Why do values of molecularity rarely exceed three [$\frac{1}{2} + \frac{1}{2}$]

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b) Expand the following abbreviated nuclear reaction and identify the product nucleide X and Y. [$\frac{1}{2} \times 4 = 2$]

i) ${}_{13}\text{Al}^{27} (\alpha, n) \text{X} \dots$

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ii) ${}_{4}\text{Be}^9 (p, D) \text{Y}$

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(c) Benzaldehyde gives positive result (silver mirror) with Tollen's reagent. However, it gives negative result with Fehling's solution. Explain this phenomenon with reference to oxidation potential of silver and copper. [2]

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(d) On analysis by IR spectroscopy, two isomers A and B having molecular formula C_3H_6O show peaks at two different regions in the spectrum. Compound A shows peak at 1700cm^{-1} while compound B shows at 1720cm^{-1} . [3]

(i) Based on this information, identify the functional groups of compounds A and B.

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(ii) How can the compounds A and B be differentiated by NMR spectrometry?

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(iii) Write the structural formula of compounds A and B.

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(e) Table below shows boiling points of different classes of aliphatic amines. Based on the information explain the reasons for such observation. [2]

Amines	Class	Mol. Mass	B.P
$(C_2H_5NH_2)$	Primary	45	290 K
$(CH_3)_2NH$	Secondary	45	280 K
$(CH_3)_3N$	Tertiary	59	277 K

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Question 7

(a) Write the “Enantiomers” of Aspartic Acid ($HOOCCH_2CHNH_2COOH$). [1]

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(b) (i) Why are low density lipoproteins (LDL) called “bad” protein and high density lipoproteins (HDL) called “good” protein? [1/2 +1/2]

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(ii) Why is base catalysed transesterification reaction preferred over acid catalysed reaction in preparation of biodiesel?

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(c) The rate law of a reaction is given by $r = K [A] [B]^2$. Which of one the following will react the fastest? Show the detail procedure for reaching to particular answer. [3]

- i) 1 mol of A and 2 mol of B in 1 L vessel
- ii) 2 mol of A and 1 mol of B in 500 ml vessel
- iii) 3 mol of A and 2 mol of B in 2 L vessel

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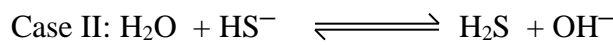
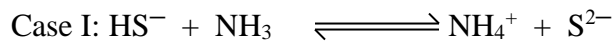
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(d) Study the reactions given below and answer the questions that follow [2]



- i) What is the nature of HS^- in each of the cases? [1/4 + 1/4]

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- ii) Name the term exhibited by HS^- in (i) [1/2]

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iii) What is the relation between HS^- and S^{2-} in case I [½]

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iv) Give another example of such relation from case II [½]

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(e) For the cell; $\text{Cu (s)/Cu}^{+2} (0.13\text{M}) // \text{Ag}^+ (0.01\text{M}) + \text{Ag(s)}$, Calculate [3]

(i) Reduction potential of each electrode if standard reduction potential of Cu and Ag are 0.34 V and 0.80 V respectively and [¼x 4= 1]

(ii) e.m.f of the cell. [½]

(iii) Is the cell reaction spontaneous? Why? [½ + ½]

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Question 8

(a) Write the formula of dichlorobis(ethylenediamine)chromium(IV)sulphate [1]

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(b) Compound 'A' has molecular formula $C_2H_4O_2$. On chlorination with phosphorus pentachloride, a compound 'B' is formed. The compound 'B' on further reaction with ammonia forms 'C'. The product 'C' reacts with bromine water and alkali giving 'D'. Identify A, B, C and D [2]

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(c) An organic compound 'A' with molecular formula C_2H_6O on oxidation with alkaline $KMnO_4$ gives a product 'B' with molecular formula C_2H_4O which gives silver mirror with Tollen's reagent. 'B' on further oxidation with alkaline $KMnO_4$ gives compound 'C' with molecular formula $C_2H_4O_2$ which gives brisk effervescence with $NaHCO_3$.

Write the balanced chemical equations for the conversions of 'A' to 'B' and 'B' to 'C' [2]

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(d) The structure of alanine is $\text{CH}_3\text{CHNH}_2\text{COOH}$. Based on this information answer the following questions. [3]

i) Draw its structure at pI, $\text{pH} = 2$ and $\text{pH} = 10$ (1/2 + 1/2 + 1/2)

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ii) Towards which electrode will alanine move at $\text{pH} = 2$ and $\text{pH} = 10$ when current is passed through it? (1/2 + 1/2)

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iii) Is alanine it be optically active? Why? (1/2)

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(e) After studying the information in the table given below explain the causes of differences in their boiling points. [2]

Compounds	Acetic Acid	Propanol	Butane
Molecular Mass	60	60	58
Boiling Point	391 K	370 K	309 K

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