

Ex/SC/CHEM/UG/MAJOR/TH/21/205/2025

B. SC. CHEMISTRY EXAMINATION, 2025

(2nd Year, 1st Semester)

PAPER : V

Time : Two Hours

Full Marks : 40

Use a separate Answer Script for each CO

UNIT—305-Ia

[CO1]

1. (a) The E° value of the $\text{Cu}^{2+}/\text{Cu}^0$ half-cell is 0.34 V and that of the $\text{Cu}^{2+}/\text{Cu}^+$ half-cell is 0.15 V. Find out the E° of the $\text{Cu}^{2+}/\text{Cu}^0$ half-cell. 2

- (b) Describe, with a suitable example, the effect of H^+ concentration on the redox potential. 2

- (c) $\text{MnO}_4^{2-} + 4\text{H}^+ + 2e^- \rightleftharpoons \text{MnO}_2 + 2\text{H}_2\text{O}$
($E_1^\circ = 2.26 \text{ V}$)



Based on the above two half-cell reactions, write down the net redox reaction and comment on its type and spontaneity. 2

(2)

(d) What is cyclic voltammetry? Draw a reversible cyclic voltammogram and state the meaning of the following symbols associated with it.

(i) E_{pa}

(ii) E_{pc}

(iii) $E_{1/2}$

(iv) ΔE_p

(v) i_{pa}

(vi) i_{pc}

1+3=4

UNIT—305-O-a

[CO2]

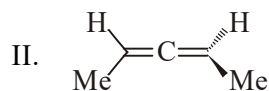
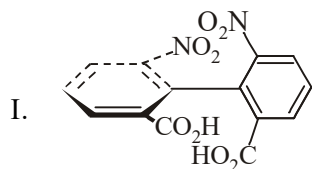
1. Attempt **all** the questions.

2×5

(i) Optically pure 2-iodooctane loses its optical activity when treated with sodium iodide (NaI). Explain the observation.

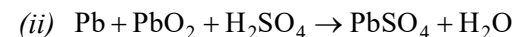
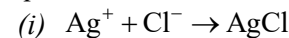
(ii) Define specific rotation. Calculate the specific rotation of cholesterol, when the observed rotation of a 0.3 g sample of cholesterol in 15 ml of chloroform solution contained in a 10 cm polarimeter tube is -0.78° .

(iii) Assign R/S descriptor for the following dissymmetric molecules :



(7)

(c) What will be the expression of the Nernst potential for the following electrochemical process under chemical equilibrium? 2



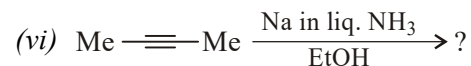
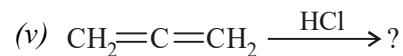
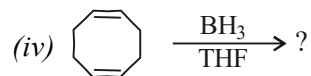
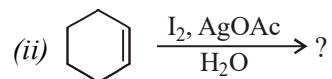
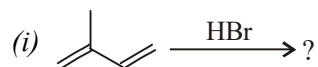
(d) Explain briefly the working principle of pH detection using a Glass electrode. 2

(e) The EMF of the cell obtained by coupling through salt bridge with quinhydrone electrode ($E^0 = 0.6994 \text{ V}$) dipping into a buffer solution and saturated calomel electrode ($E^0 = 0.2415 \text{ V}$) is 0.0042 V . What is the pH of the buffer solution? 2

★ ★ ★

(6)

- (b) Give the major product of following reactions (*any five*)
(mechanism not required): $\frac{1}{2} \times 5$



UNIT—305-P-a

[CO4]

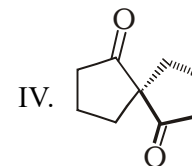
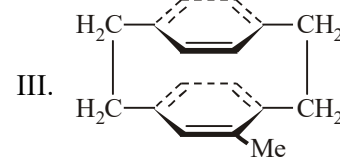
1. Answer **all** questions.

- (a) Does the potential energy change can observe to bring a charged particle from vacuum to inside of electrolytic solution? 2
- (b) Construct an electrochemical cell and its operating principle to determine the dissociation constant of a weak acid. 2

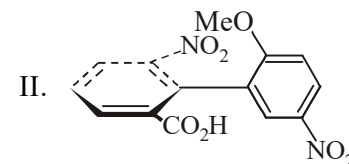
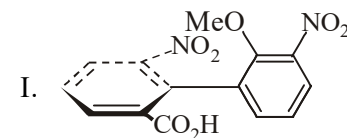
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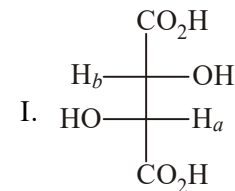
(3)



- (iv) Which one between I and II have higher rate of racemization when heated and why?



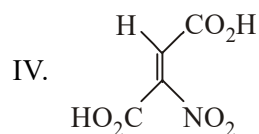
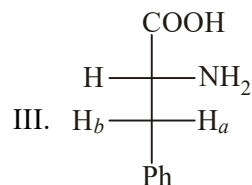
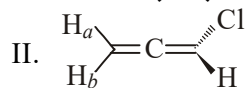
- (v) Assign topicity and appropriate descriptor, wherever applicable, for each homomorphous group (marked as *a* and *b*) of the compounds I, II and III. Also, assign topicity and appropriate descriptors for the faces of the double bond of compound IV.



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[Turn Over]

(4)



UNIT—305-O-b

[CO3]

2. (a) Attempt any **three** questions : $2\frac{1}{2} \times 3$

(i) The rate of epoxidation of alkene with *m*CPBA increases with the increase of substitution of alkene in the following manner. Explain this observation in light of FMO-approach.



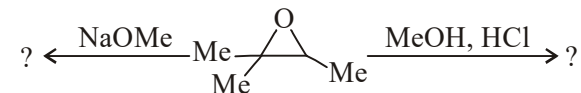
Substance:	$H_2C=CH_2$	$Me-CH=CH_2$	$Me-CH=CH-Me$	$\begin{array}{c} Me \quad Me \\ \diagdown \quad / \\ C=C \\ / \quad \diagdown \\ Me \quad Me \end{array}$	$\begin{array}{c} Me \quad Me \\ \diagdown \quad / \\ C=C \\ / \quad \diagdown \\ Me \quad Me \end{array}$
Substance:	1	24	500	6500	>6500

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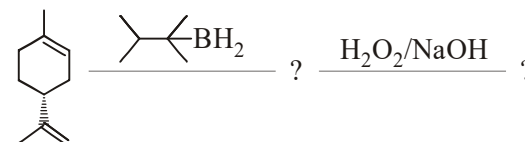
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(5)

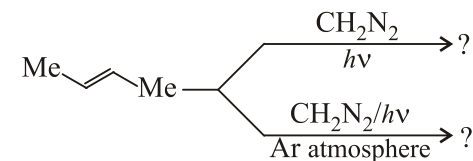
(ii) Give the product(s) of the following reaction with a mechanism and proper explanation



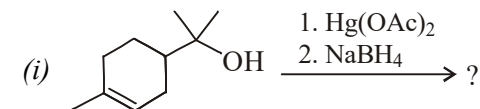
(iii) Give the product(s) of the following reaction with a mechanism.



(iv) Discuss the stereospecificity of the following reaction with proper reason.



(v) Give the product(s) of the following reactions with a probable mechanism`:



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[Turn Over]