लक्ष्यं विधमानम्

WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 2nd Semester Examination, 2023

CEMACOR04T-CHEMISTRY (CC4)

ORGANIC CHEMISTRY-II

Full Marks: 40

Time Allotted: 2 Hours

The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

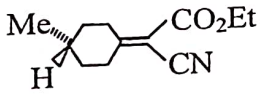
Answer any *three* questions taking *one* from each unit

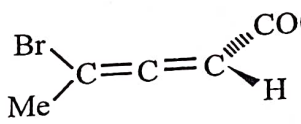
Unit-I

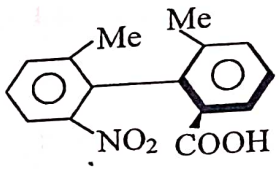
1. (a) All compounds having enantiotopic ligands are achiral, justify. 2

   (b) Write down the structure of the alcohol produced by the attack of hydride (H^-) ion on 2-butanone from its *si*-face and find the absolute configuration. 3

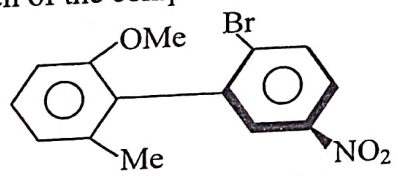
   (c) Designate (*R*/*S*) configuration to the following compounds. 3

   (i) 

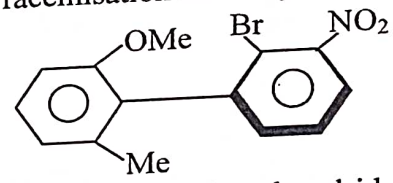
   (ii) 

   (iii) 

   (d) Which of the compound will undergo faster racemisation and why? 2

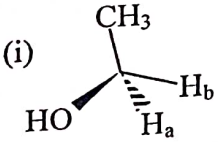
   

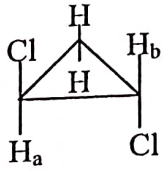
   and

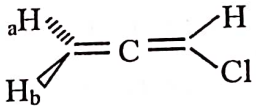
   

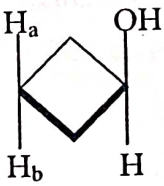
   (e) Draw the qualitative potential energy profile of 2-chloroethanol and identify the most stable conformer with reasoning. 3

2. (a) Identify H_a and H_b as homotopic, enantiotopic or diastereotopic ligands with proper reason. 4

   (i) 

   (ii) 

   (iii) 

   (iv) 

   (b) Draw the *anti*, gauche and eclipsed conformations of 1, 2-dichloroethane. 3

   (c) What is atropisomerism? 1

   (d) Define torsional angle. What is the basic difference between dihedral angle and torsional angle? 1+2

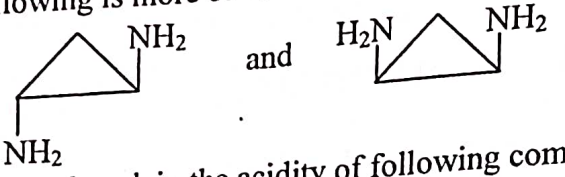
   (e) What is the most stable conformation of 1, 3-butadiene and why? 2

Turn Over

Unit-II

3. (a) Salicylic acid is much stronger than *p*-hydroxy benzoic acid but acidity of *o*-nitrophenol and *p*-nitrophenol is almost same — Explain. 3

(b) Which one of the following is more basic and why? 2



(c) Qualitatively compare and explain the acidity of following compounds: 2

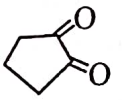
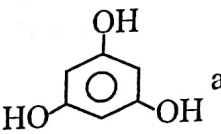
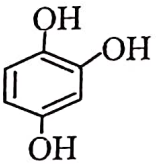
(i) $HC \equiv C-COOH$ (ii) $CH_2=CH-COOH$ (iii) CH_3CH_2COOH

(d) Heat of formation, ΔH of the following two reactions are almost same, but the second reaction is more facile, why? 3

(i) $CH_3COOH + EtOH \underset{\text{Dry HCl}}{\overset{\Delta}{\rightleftharpoons}} CH_3COOEt + H_2O$

(ii) 

(e) Which one of the following pairs has got higher enol content? Explain. 4

(i) $CH_3COCOCH_3$ and  (ii)  and 

4. (a) $CH_3COCH_3 + Br_2 \xrightarrow[k_H]{OH^-} BrCH_2COCH_3$ 3

$CD_3COCD_3 + Br_2 \xrightarrow[k_D]{OH^-} BrCD_2COCD_3$

Given $k_H/k_D \simeq 7.0$. Explain the above reaction indicating the rate determining step.

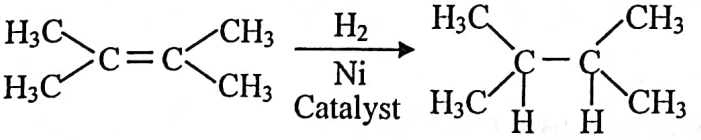
(b) Acetamide is weakly basic but phthalimide is sufficiently acidic, justify your answer with relevant resonating structures. 2

(c) What is nucleophilic catalyst? Give example and application. 1+1

(d) "(*E*)-$HO_2CC = CH\overset{\ominus}{C}O_2\overset{\oplus}{N}a$ is a stronger base than it's (*Z*)-isomer" — Explain. 2

(e) What is secondary kinetic isotopic effect? Give an example. 2

(f) Calculate ΔH (Enthalpy change) for the following reaction: 3



C = C bond energy = 145 kcal / mole

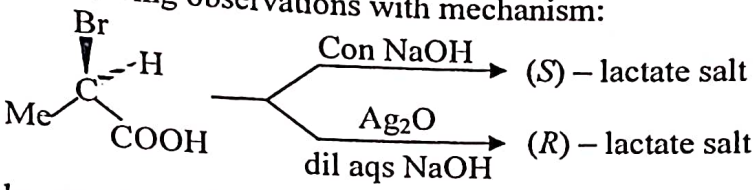
C – C bond energy = 83 kcal / mole

C – H bond energy = 99 kcal / mole

H – H bond energy = 103 kcal / mole

Unit-III

5. (a) Account for the following observations with mechanism: 3



(b) Write down the structure of the products when (*S*)-1-phenylethanol is separately treated with $SOCl_2/Et_2O$ and $SOCl_2$/pyridine. Explain the formation of the product(s). 3

(c) Give the mechanistic interpretation of the following observation: 2

$(+)-C_6H_{13}CH(CH_3)Cl \xrightarrow[80\%\ CH_3COCH_3]{20\%\ H_2O} (\pm)\ C_6H_{13}CHMeOH$

2-Chloro octane — Racemic-2-Octanol

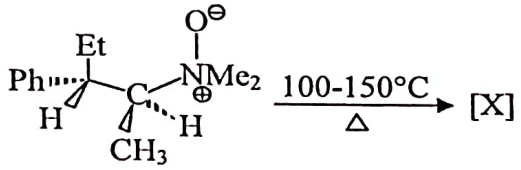
~38% race misatio

(d) Explain the following reactions with mechanism: 3

$ClCH_2CH(CH_3)_2 + ClC(CH_3)_3 \xleftarrow[300°C]{Cl_2} (CH_3)_3C-Br \xrightarrow[127°C]{Br_2} (CH_3)_3C-Br + (CH_3)_2CHCH_2Br$

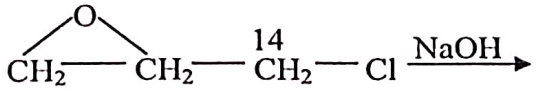
~75% ~25% ~98% ~2%

(e) Write down the structure of product [X] of the following reaction with proper stereochemistry and reaction mechanism. 2



6. (a) Reaction of alkyl halide with NaCN yields mainly alkylcyanide (RCN) whereas reaction with AgCN yields isocyanide compounds (RNC) — Explain. 2

(b) Write the product(s) in the following reaction with proper mechanism. 2



(c) Indicate the products obtained from the following reactions showing the mechanism involved: $2\frac{1}{2} \times 2 = 5$

(i) $Me_2CH-CHBrMe \xrightarrow{\ominus OH}$

(ii) $Me_2CH-\underset{+NMe_3}{CH}-Me \xrightarrow[\Delta]{\ominus OH}$

(d) The rate of reaction of EtCl with KI-acetone mixture decreases with increased percentage of water in the mixture — Give reason for the fact. 2

(e) What is the advantage of using crown ether in a substitution reaction? Explain with any suitable example. 2

——×——