WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 1st Semester Examination, 2021-2

CEMACOR01T-CHEMISTRY (CC1)

ORGANIC CHEMISTRY-I

Time Allotted: 2 Hours | Full Marks: 40

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-1

1. (a) Draw the orbital picture of O_2N-CH_2-CHO and mention the state of hybridization of each atom except hydrogens. 3

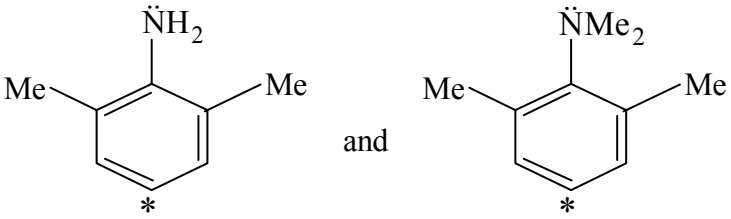
   (b) Draw all possible canonical forms of $\mathbf{EtO_2C-\overline{C}H-\overset{+}{N}\equiv N}$ and justify which one is the most stable structure among them. 3

   (c) Draw a properly labelled π-molecular orbital diagram of allylic anion. Indicate the HOMO and LUMO of the molecule in the ground state. 3

   (d) Arrange the following compounds in order of their increasing heat of hydrogenation values with proper reason. 3

   1-hexene, *cis*-3-hexene, *trans*-3-hexene

   (e) Which compound among the following pair has higher electron density at the marked carbon atom? 3



   (f) Calculate the DBE for the molecule with molecular formula $C_{10}H_7Cl$. 1

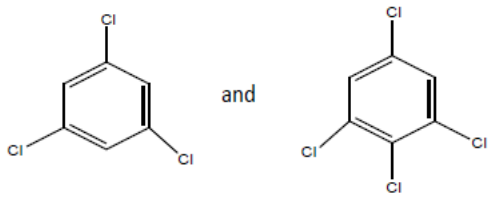
2. (a) Three isomeric pentane molecules have boiling points 9.5°C, 28°C and 36°C. Match each boiling point with correct isomers and give reason. 3

   (b) Show the species formed in the following two cases and also comment on their stability. 4

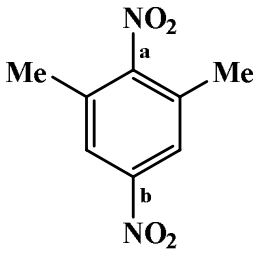
   (i) Cyclooctatetraene is reacted with conc. H_2SO_4

   (ii) 1,3-cyclopentadiene is reacted with NaOH.

(c) Which one of the following pair has the higher dipole moment and why? 2



(d) Compare the bond lengths (a vs b) of the following compound with reason. 3



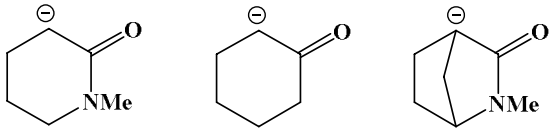
(e) Compare dipole moments of NH_3, NF_3 and BF_3 with explanation. 2

(f) Draw the Frost diagram for the π-MOs of square planar cyclobutadiene. 2

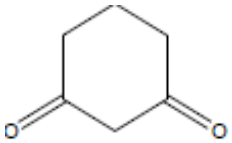
UNIT-2

3. (a) Compare the order of nucleophilicity of NH_3, H_2O and H_2N-NH_2. 2

(b) Explain the order of stability of the following anions. 2



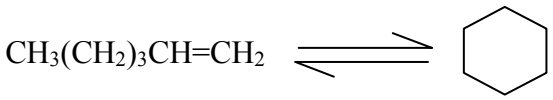
(c) The following compound is readily soluble in aq NaOH but not in water.—Explain. 2



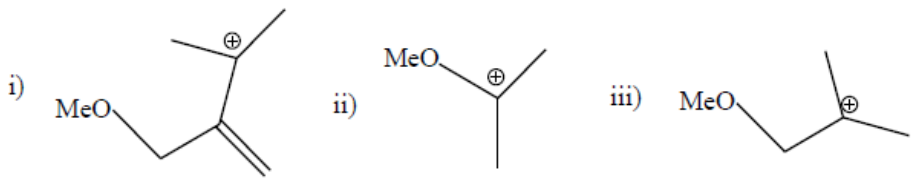
(d) Compare the stability of the following radicals. 2

$\dot{C}F_3$, $\dot{C}H_2F$, $\dot{C}H_3$

4. (a) Predict the sign of the entropy change for the following transformation and justify. 2



(b) Give the correct order of stability of the following carbocations with explanation. 2



(c) What are pericyclic reactions? Explain with one example. 2

(d) Nucleophiles may be charged or neutral species — Justify. 2

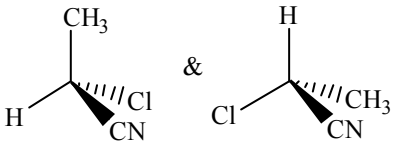
UNIT-3

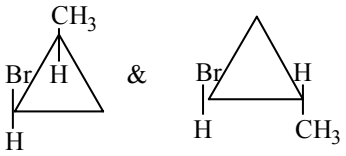
5. (a) Define alternating axis of symmetry with an example. 2

(b) Draw the following as directed. 2

Erythro-3-amino-2-butanol (*anti*-form in Sawhorse representation)

(c) Label the following pair of molecules as homomer, enantiomer or diastereomer with reason 2+2

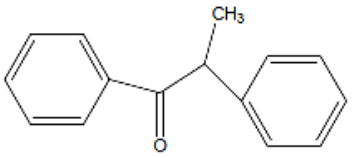
(i) 

(ii) 

(d) Specific rotation of an enantiomeric mixture is (+) 15.90 and the specific rotation of the R-enantiomer is –38.90, determine the percentage of each isomer in the mixture. 3

(e) Define the term "Stereogenic center". Are centres of stereogenicity always centres of chirality? Explain with suitable example. 3

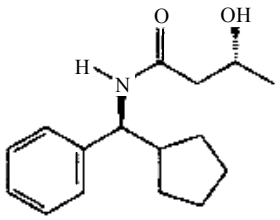
(f) The following optically active ketone loses its optical activity when treated with a little base. Explain showing the mechanism. 2

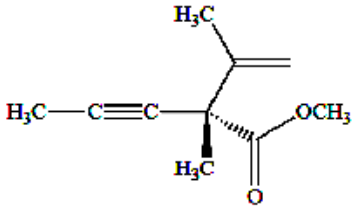


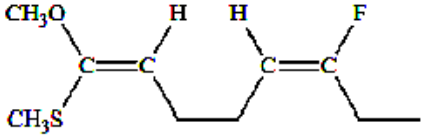
6. (a) What is diastereoisomer? Explain with an example. 2

(b) Give examples of molecules having D_{3h} and C_{3h} point groups. 2

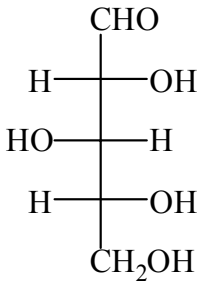
(c) Label each sp^3 stereocenter, as *R* or *S* and each alkene as *E* or *Z*. 1+1+2

i) 

ii) 

iii) 

(d) Convert the following Fischer projection to *zig-zag* projection. 3



(e) What are the symmetry elements present in *trans*-1,2-dichloroethene? 2

(f) Explain whether the following compounds are resolvable or not? 3

(i) $H_3CHC=C=CHCH_3$ (ii) PhN(Me)Et.

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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