WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 1st Semester Examination, 2020, held in 2021

CEMACOR01T-CHEMISTRY (CC1)

Time Allotted: 2 Hours | Full Marks: 40

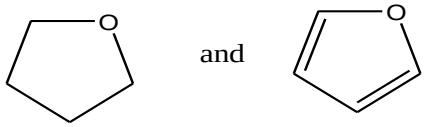
The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

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

UNIT-1

1. (a) Draw the orbital picture of $H_2C=CH-CN$ mentioning the hybridization of each carbon atom and nitrogen atom. 3

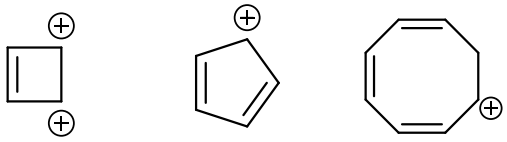
(b) Which of the following compound has higher solubility in water and why? 2



(c) Draw all possible canonical forms of $Me_2N-\overset{+}{C}HOCH_3$ and justify which one is the most stable and which one is the least stable among them. 3

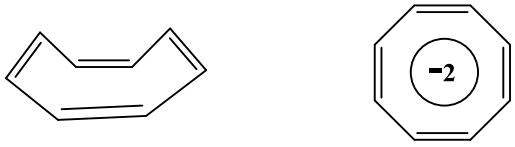
(d) Draw a properly labeled π-molecular orbital diagram of 1, 3-butadiene. Indicate the HOMO and LUMO of the molecule in the ground state. 3

(e) Classify the following molecules as non-aromatic, aromatic, antiaromatic or homoaromatic with reason. 3

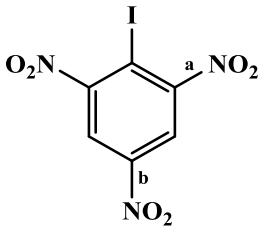


(f) "Heat of combustion and not heat of hydrogenation is more suitable to compare the stability of 1-butene, 2-butene and isobutene" — Justify with the help of energy diagram. 2

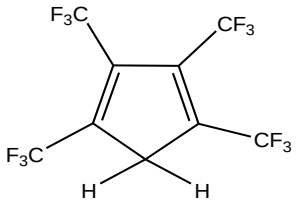
2. (a) Cyclooctatetraene is non-planar but its dianion is planar. Explain. 2



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



(c) Arrange the following compounds in order of increasing pK_a values with explanation. 3



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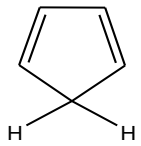
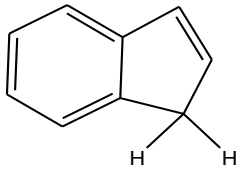


II



III

(d) Could you compare the stabilities of pent-1-ene, cis- and trans-pent-2-enes and 3-methyl-but-1-ene by measuring their heat of hydrogenation? Explain. What method would you use? 3

(e) Calculate the DBE of a compound with molecular formula $C_6H_3Cl_2ON$. 2

(f) Three isomeric chlorotoluenes have μ values 1.3D, 1.9D and 1.8D. Assign which is which with proper explanation. 3

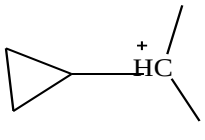
UNIT-2

3. (a) Compare the order of nucleophilicity of EtO^-, PhO^-, $MeCOO^-$. 2

(b) What do you mean by homolytic bond fission? Compare the energy required for homolytic fission of following C–H bonds (indicated as a, b, c). 2

$Me_3C\overset{a}{-}H$ $Me_2CH\overset{b}{-}H$ $MeH_2C\overset{c}{-}H$

(c) Arrange the following carbocations in increasing order of stability and justify. 2



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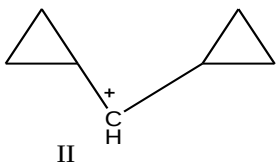

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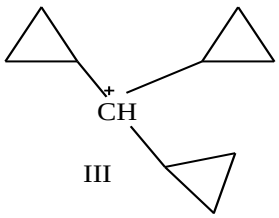
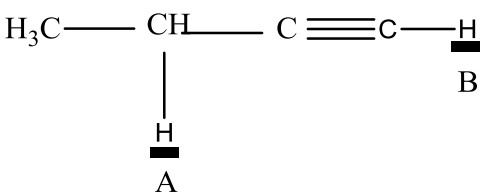


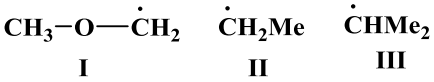
III

(d) Which one of the marked protons (A and B) in the following compound is more acidic and why ? 2



4. (a) All electrophiles are positively charged – justify or criticize the statement. 3

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



I II III

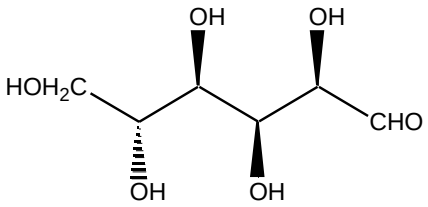
   (c) Write down the structural features of the singlet and triplet carbenes mentioning the hybridization involved herein. 3

UNIT-3

5. (a) Draw all stereoisomers of $CH_3CH=CH–CHBr–CH=CHCH_3$ and comment on their optical activity. 3

   (b) What are asymmetric and dissymmetric molecules? Illustrate with suitable examples. 3

   (c) Convert the following zig-zag projection to Fischer projection. 2



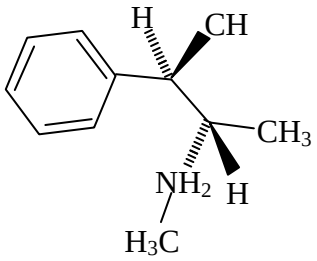
   (d) Draw the Flying wedge formula of the following. 3

      (i) (R)-2-Deuteropropanoic acid

      (ii) (2R, 3S)-3-phenyl-2-butanol

   (e) An optically pure sample of (R)-2-butanol shows a specific rotation of –13.6º. What relative molar proportion of (S)-2-butanol and (R)-2-butanol would give a specific rotation +6.8º? 3

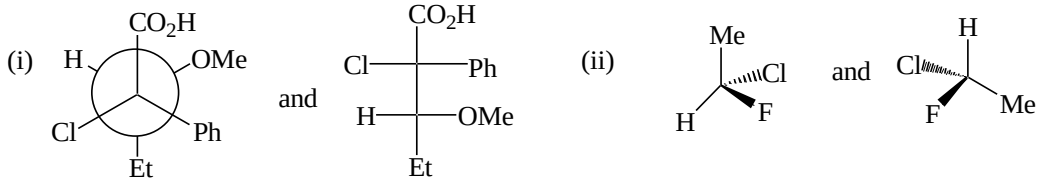
   (f) Assign the R/S of the chiral center of the following compound 2



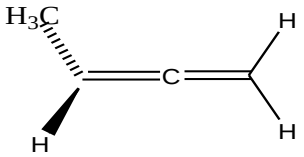
6. (a) Define center of symmetry with an example. 2

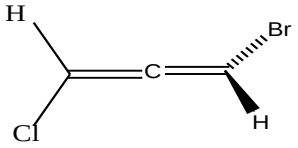
   (b) Draw the *anti*-form in Sawhorse and Newmann projection of threo-3-bromobutan-2-ol. 3

   (c) Label the following pair of molecules as homomer, enantiomer or diastereomer 2+1

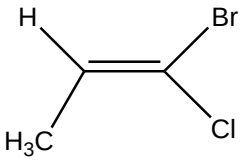


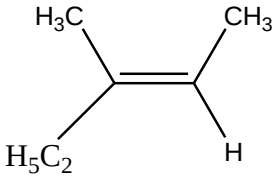
(d) Comments on the optical activity of the following compounds with justification. 3

(i) 

(ii) 

(e) Assign E/Z descriptor to the following stereostructures 2

(i) 

(ii) 

(f) What are the differences between configurations and conformations? Explain with suitable example(s). 3

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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