



WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 1st Semester Examination, 2019

CEMACOR01T-CHEMISTRY (CC1)

Time Allotted: 2 Hours

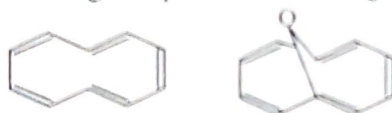
Full Marks: 40

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.

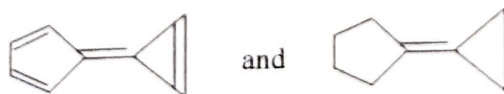
Answer any *three* questions taking *one* from each unit

UNIT-I

1. (a) Draw the orbital picture of $\text{CH}=\text{C}=\text{CHO}$ indicating the state of hybridization of each carbon atom. 2
- (b) Which one of the following compounds shows higher stability and why? 2

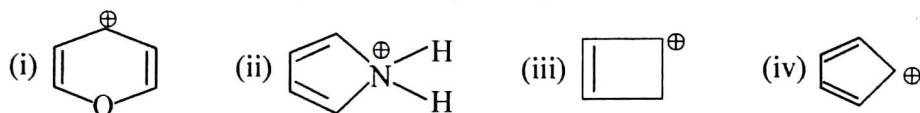


- (c) Calculate the DBE and suggest a suitable structure for the following: $\text{C}_7\text{H}_5\text{NO}_4$. 2
- (d) Compare the 'heat of combustion' values of the following compounds with reason: 1-butene, 2-butene (*cis* and *trans*) and isobutene. 3
- (e) *cis*-1, 2-dibromoethene has higher boiling point than its *trans* isomer, but melting point of the *trans* isomer is higher than that of the *cis*-isomer. Explain. 2
- (f) Draw the following π MOs: 3
- SOMO of allyl radical,
 - LUMO of 1, 3-pentadienyl cation,
 - HOMO of buta-1, 3-diene.
- (g) Which one of the following exhibits greater dipole moment and why? 2



2. (a) Justify the following statements with proper reasoning: 3
- When dissolved in concentrated H_2SO_4 , cyclooctatetraene forms a monocation which shows aromatic character.
 - When treated with CH_3MgBr , cyclopenta-1, 3-diene forms a mixture of CH_4 and another Grignard reagent.
- (b) Write all the canonical structures of $\text{H}_2\text{N}-\text{CH}=\text{CH}-\overset{\oplus}{\text{C}}=\text{O}$ and identify the stablest one with reason. 2
- (c) The bond dissociation energy of aliphatic $\text{C}-\text{H}$ bond is considerably smaller in PhCH_3 than in CH_4 . — Explain. 2

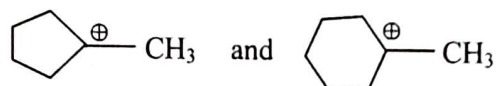
- (d) Assign the following species as aromatic, antiaromatic, nonaromatic or homoaromatic. Give explanation (any *three*). 3



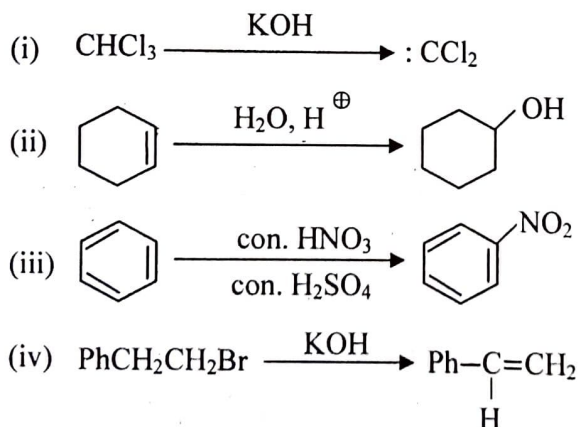
- (e) Compare the dipole moment of *p*-nitroaniline and 2, 3, 5, 6-tetramethyl-*p*-nitroaniline giving reason. 2
- (f) What do you mean by Valence tautomerism? Give an example. 2
- (g) Why the boiling point of 2-nitroresorcinol is lower than that of resorcinol? 2

UNIT-2

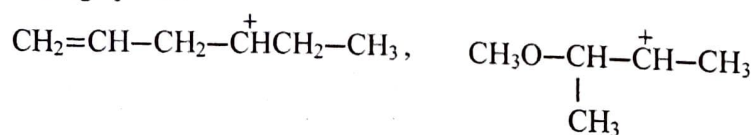
3. (a) Dichlorocarbene (:CCl₂) mainly exists in singlet state whereas diphenyl carbene (:CPh₂) prefers the triplet state. Explain with orbital picture. 2
- (b) Rate of thermal decomposition to yield nitrogen is much faster for dibenzyl diazene (PhCH₂-N=N-CH₂Ph) in comparison to di-^tbutyldiazene (Me₃C-N=N-CMe₃)— Explain. 2
- (c) Though nitro group is more powerful electron withdrawing group than cyano group, trinitromethyl carbanion is more or less of same stability as tricyanomethyl carbanion. Explain. 2
- (d) Which of the following two carbocations is more stable and why? 2



4. (a) Classify the following reactions as addition, elimination and substitution reaction: 2



- (b) H₃C⁺ is planar but F₃C⁺ is pyramidal. Explain. 2
- (c) Explain the following nucleophilicity order 2
- (i) Cl⁻ > Br⁻ in DMSO;
- (ii) Br⁻ > Cl⁻ in MeOH.
- (d) Write the structure of the stabilised cation formed after possible 1, 2-shift in the following species— 2



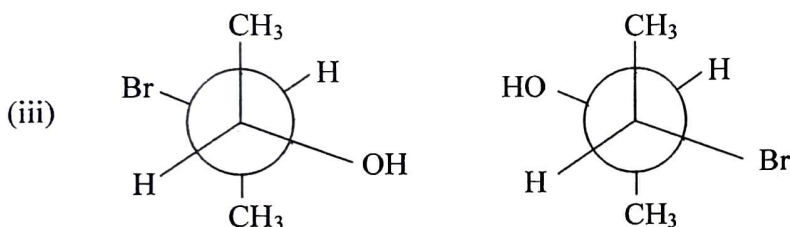
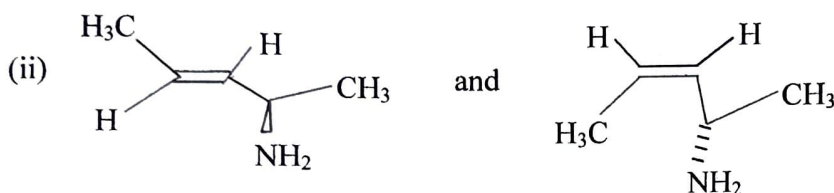
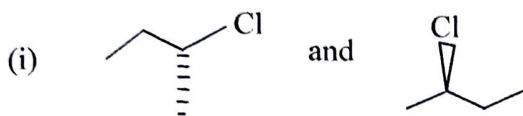
UNIT-3

5. (a) Justify or criticise the following statements with proper examples: 3

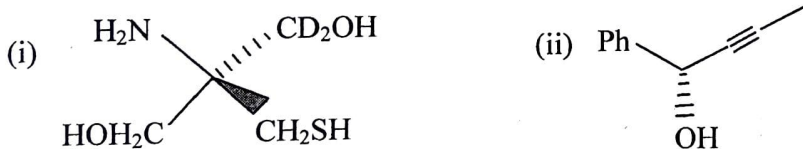
(i) All meso-compounds are optically inactive in spite of the presence of more than one chiral centres.

(ii) *E*-isomer of an alkene will be necessarily the *trans* isomer.

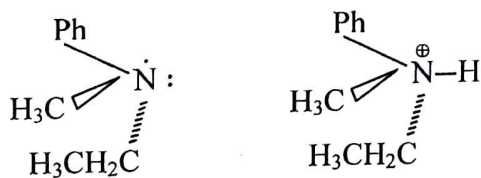
(b) Label each of the following pair of compounds as homomers, enantiomers or diastereomers: 3



(c) Assign the stereocentre in each of the following compounds as R or S: 2



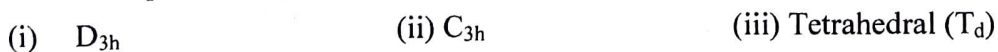
(d) Which of the following compounds will be resolvable? Give reason. 2



(e) When a little acid is added to an aqueous solution of optically active 2-butanol, the solution gradually loses its optical activity. Explain. 2

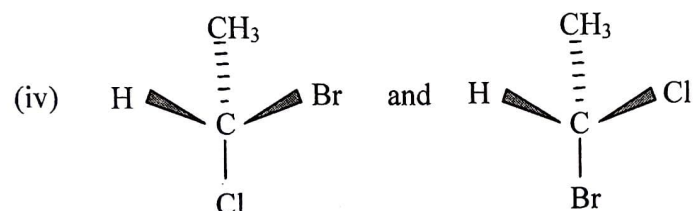
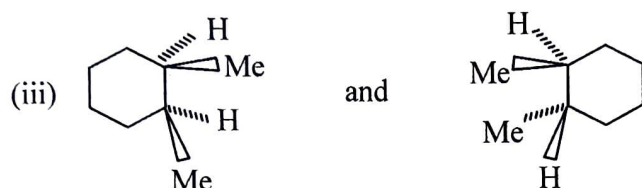
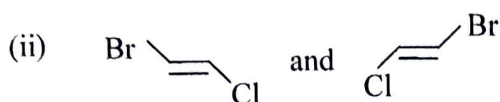
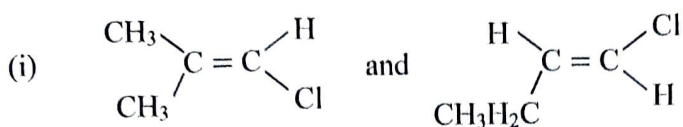
(f) How would you resolve the racemic modification of lactic acid? 2

(g) Give examples of molecules having the following point groups (any two). 2

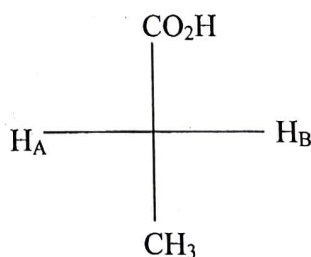
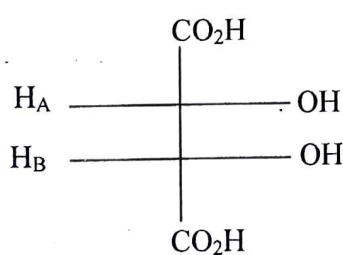


6. (a) Draw the Fischer projection formula of (2R, 3S*, 4S)-2, 3, 4-tribromopentane. Comment on its chirality. 3

- (b) Label the following pairs of compounds as homomers, constitutional isomers, diastereomers or enantiomers (any *three*):



- (c) All epimers are diastereomers, but all diastereomers are not epimers. Justify or criticise the statement with suitable examples. 2
- (d) A sample of 2-butanol shows specific rotation of $+4.056^\circ$. Specific rotation of pure (R) enantiomer is -13.52° . Which enantiomer is in excess in the above sample, the (R) or (S)? Calculate the enantiomeric excess. 2
- (e) Label the marked (H_A , H_B) hydrogens in the following compounds as homotopic, enantiotopic or diastereotopic. Explain. 2



- (f) Indicate the symmetry elements and point group of 1, 3, 5-tribromobenzene. 2
- (g) Designate (S) $-\text{CH}_2\text{OH}-\text{CHOH}-\text{CHO}$ as having D/L -configuration. 2

—x—

