

2021

CHEMISTRY — HONOURS

First Paper

(Group - A)

Full Marks : 50

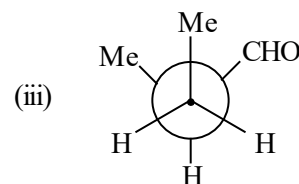
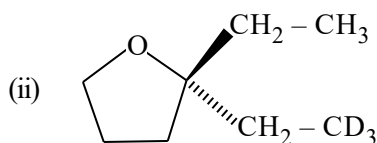
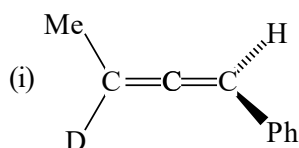
*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

CHT-12a

Unit - I

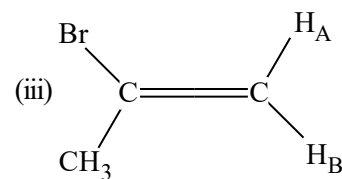
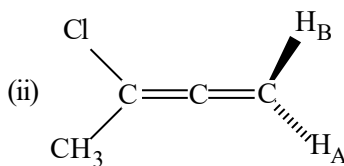
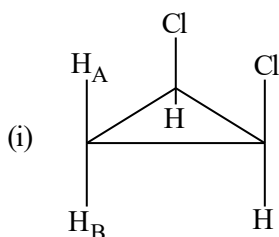
Answer *any three* questions.

1. (a) Give R / S configurational descriptor of the following compounds. Mention the priority of the ligands around the chiral centre.



- (b) Write the Fischer projection formula of *meso*-tartaric acid and represent it in Newman and Sawhorse projection formula. 3+2

2. (a) Identify H_A and H_B in each of the following compounds as homotopic, enantiotopic or diastereotopic and explain.



- (b) Contrary to $\text{ClCH}_2-\text{CH}_2\text{Cl}$, in $\text{FCH}_2-\text{CH}_2\text{F}$ gauche conformer is the more stable conformer. Explain the fact. 3+2

3. (a) Draw the energy profile diagram for rotation around C – C bond of $\text{HO}-\text{CH}_2-\text{CH}_2-\text{OH}$ with proper labelling.
- (b) Active phenyl *sec*-butyl ketone undergoes easy racemization in aqueous sodium hydroxide solution— Explain. 3+2

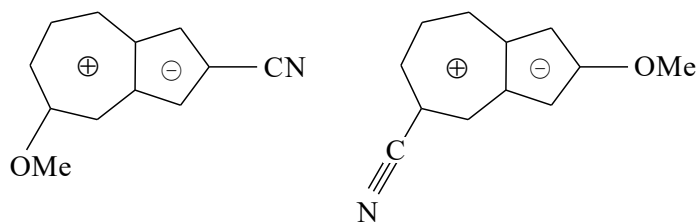
Please Turn Over

4. (a) All chiral centres are stereogenic centres but all stereogenic centres are not chiral centres.— Explain.
- (b) Give example/write down the structure of the following :
- (i) A chiral molecule having C_2 axis.
- (ii) 2R, 3R*, 4R - 1, 2, 3, 4, 5-penta bromopentane. 3+2
5. (a) Specific rotation of an enantiomeric mixture is $(+)20^\circ$ and that of pure laevorotatory enantiomer is $(-)60^\circ$. Find out the optical purity of the sample and also the percentage composition of the enantiomers.
- (b) Indicate symmetry elements present in (i) $\overset{\ominus}{C}H_3$ (ii) $H - C \equiv C - H$ 3+2

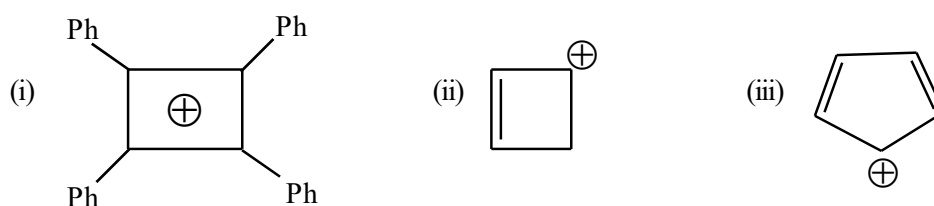
Unit - II

Answer *any two* questions.

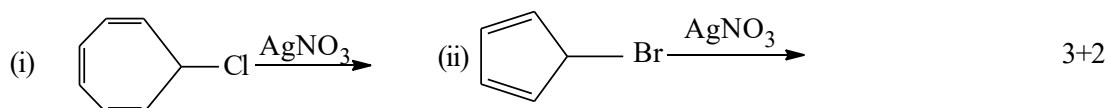
6. (a) Draw the molecular orbital pictures of (i) allene and (ii) $CH_3 - CH = CH - CN$ (*trans*), starting the state of hybridisation of each concerned atom.
- (b) Compare the dipole moment of the following compounds. 3+2



7. (a) Classify the following compounds as aromatic, antiaromatic or homoaromatic and Justify.



- (b) Predict the product, if any and explain.



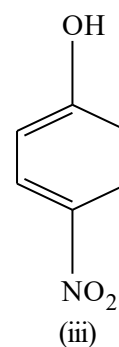
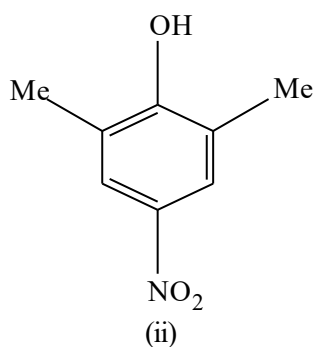
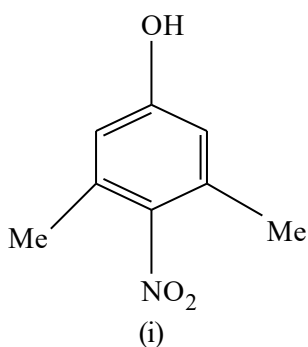
8. (a) "Heat of combustion and not heat of hydrogenation is more suitable to compare the stabilities of 1-butene, 2-butene and isobutene".— Justify with the help of an energy diagram.
- (b) Write down all π -MOs for 1, 3-butadiene and ethylene. Compare their relative energy of HOMOs. 3+2

CHT-12b

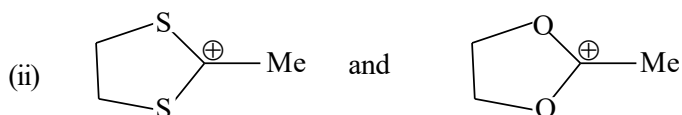
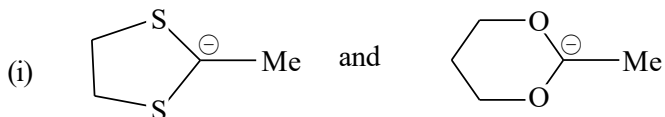
Unit - I

Answer *any three* questions.

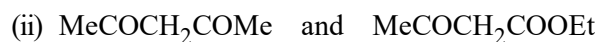
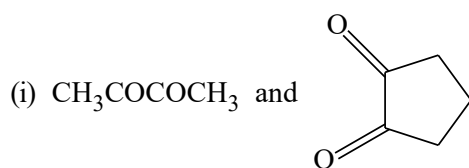
9. (a) Arrange the following compounds in increasing order of acid strength and explain.



- (b) Which one is more stable in each following pairs and why? 3+2



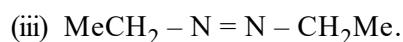
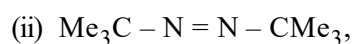
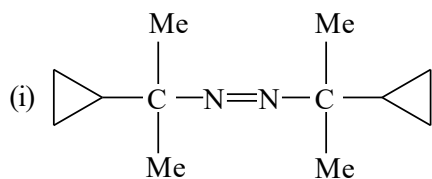
10. (a) Arrange the following in the increasing order of enol content. Give reasons.



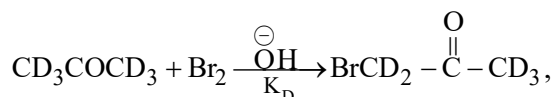
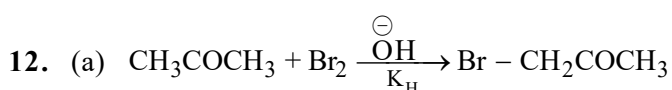
- (b) Explain the stability of an isopropyl cation with respect to ethyl cation. 3+2

Please Turn Over

11. (a) Compare the rate of decomposition of the following azo compounds. Suggest a reason for this.



- (b) Cite a suitable example to show intramolecular nature of rearrangement. 3+2



Given $\frac{K_\text{H}}{K_\text{D}} \approx 7.0$.

Explain the above reaction indicating the rate determining step.

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

ethylamine and guanidine. 3+2

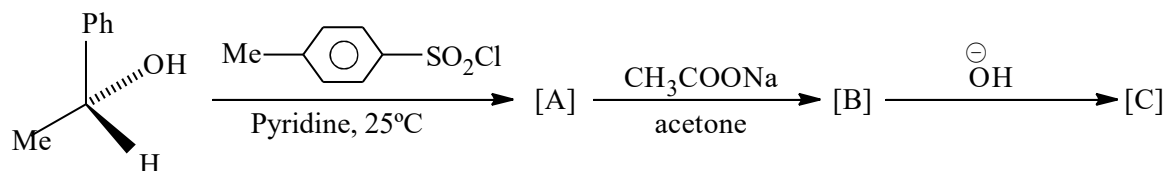
13. (a) 'Intramolecular reactions are thermodynamically more favourable than intermolecular reaction.' — Comment with proper illustration.

- (b) What are electrophilic and nucleophilic carbenes? Give one example of each. 3+2

Unit - II

Answer *any two* questions.

14. (a) Identify [A], [B] and [C] in the following reaction sequence :

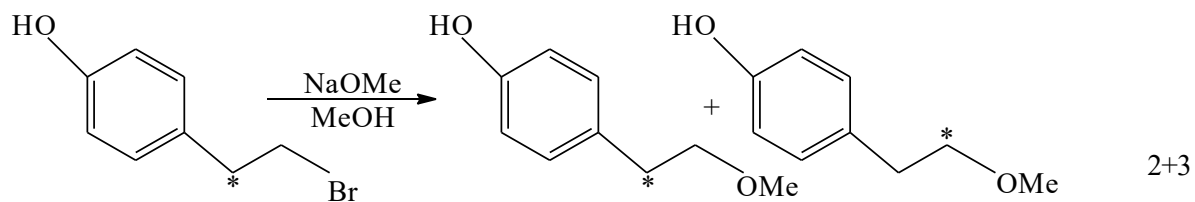


- (b) The reaction rate of CH_3I with N_3^\ominus at 0°C is increased 4.5×10^4 fold on change of solvent from methanol to DMF. 3+2

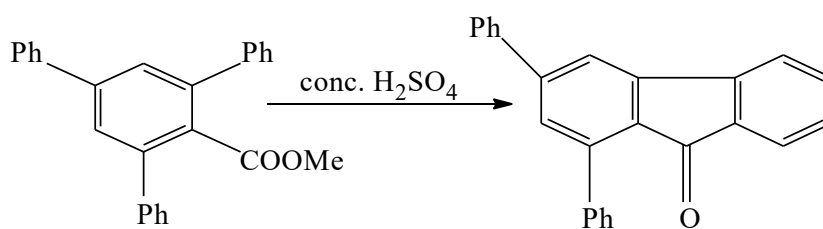
(5)

T(I)-Chemistry – H-1A

15. (a) Compare the nucleophilicity and basicity order of EtO^- and ${}^t\text{BuO}^-$ with proper justification.
(b) Explain the following observation (where * represents radioactive carbon) :



16. (a) Explain the following transformation with mechanism.



- (b) Compare the rate of hydrolysis of the following compounds with proper reason.
 MeCOCl , MeCONH_2 , MeCOOEt

3+2