

2021

CHEMISTRY — HONOURS

Sixth Paper

(Group-A)

Full Marks : 75

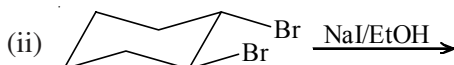
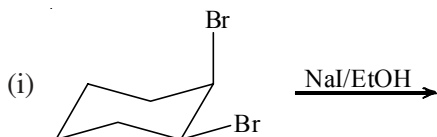
*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

CHT – 32a

Unit – I

Answer *any three* questions.

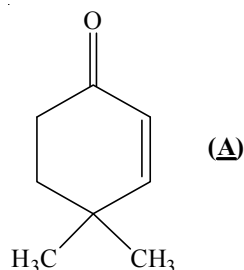
- On treatment with aqueous NaNO_2 and dilute HCl , *trans*-2-aminocyclohexanol produces cyclopentane carboxaldehyde while the *cis*-isomer gives mixture of products. Explain. 3
 - Trans*-4-*t*-butylcyclohexyl tosylate does not undergo base catalysed E-2 elimination reaction but the corresponding *cis*-isomer undergoes. Explain the observation with mechanism. 2
- Draw all the possible conformations of *cis*- and *trans*-1,3-dimethylcyclohexanes. Comment on their relative stability based on steric interaction. 3
 - Explain the observation that *trans*-2-chlorocyclohexanol gives epoxycyclohexane under basic conditions whereas the *cis*-isomer gives cyclohexanone under the same condition. 2
- Predict the product(s) with proper mechanism: 3



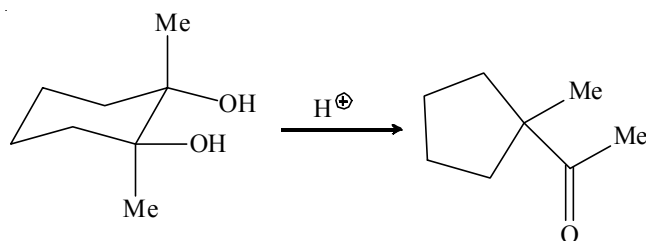
- Draw the preferred conformation of 1-methyl-1-phenylcyclohexane and justify your answer. 2

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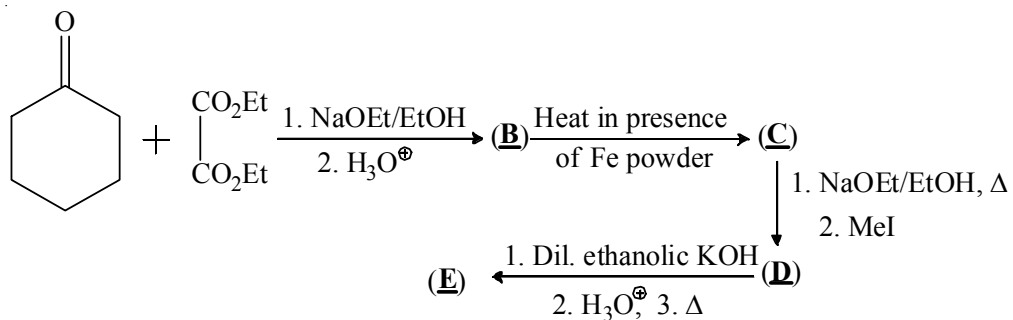
4. (a) Trace the pathway for the formation of the following molecule (**A**) from methyl vinyl ketone and Me_2CHCHO . 3



- (b) Explain the following reaction: 2



5. (a) PhCHO and $\text{CH}_3\text{COCH}_2\text{CH}_3$ give $\text{PhCH}=\text{CHCOCH}_2\text{CH}_3$ in base and $\text{PhCH}=\text{C}(\text{CH}_3)\text{COCH}_3$ in acid. Give mechanistic explanation. 3
- (b) Identify (**B**), (**C**), (**D**) and (**E**). 2



Unit – II

Answer *any two* questions.

6. (a) How can you distinguish between the members of each of the following pairs by IR spectroscopy?
- (i) Methyl benzoate and phenyle acetate
 - (ii) Ethanol and ethylene glycol.
- 3

- (b) Which of the following diatomic molecules are IR inactive (do not absorb in the IR region) and why? 2

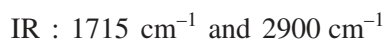


7. (a) Mesityl oxide shows λ_{max} 230 nm ($\epsilon = 12,600$) and 329 nm ($\epsilon = 41$) in hexane and λ_{max} 243 nm ($\epsilon = 10,000$) and 305 nm ($\epsilon = 60$) in water. Explain. 3

- (b) Define the following terms: 2

- (i) Chromophore
(ii) Hypsochromic effect.

8. (a) An organic compound of molecular formula, $\text{C}_6\text{H}_{12}\text{O}$ shows the following spectral pattern:



Identify the compound explaining the above spectral data. 3

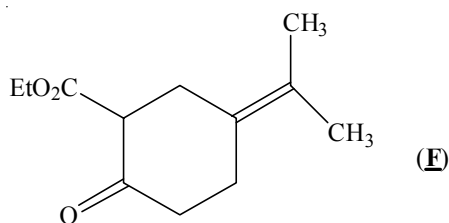
- (b) Find the δ value of a signal if the observed shift of that signal from TMS is 162 Hz in a 60 MHz NMR machine. 2

CHT – 32b

Unit – I

Answer *any three* questions.

9. (a) Show the retrosynthetic analysis of the following compound (**F**) and carry out the synthesis. 3

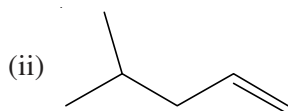
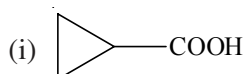


- (b) Write the synthetic equivalents corresponding to the following synthons: 2

- (i) $\ominus \text{CH}_2\text{NH}_2$
(ii) $\ominus \text{CH}_2\text{COOH}$
(iii) $\oplus \text{COOH}$
(iv) $\oplus \text{CH}_2\text{CH}_2\text{OH}$

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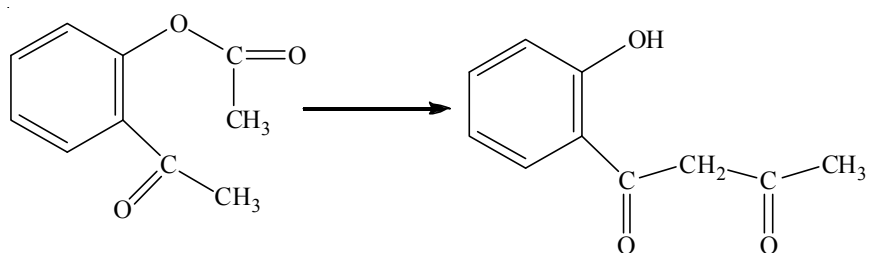
10. (a) Employing disconnection approach, design a suitable synthesis for the following target molecules:



3

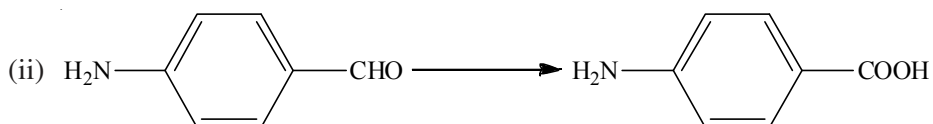
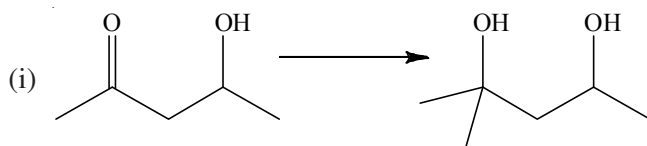
(b) How can you carry out the following conversion?

2



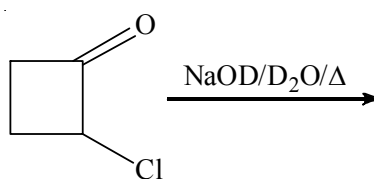
11. (a) Carry out the following conversions using suitable protection and deprotection techniques.

3



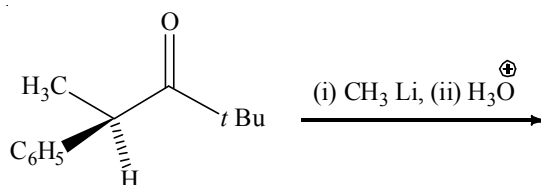
(b) Predict the product(s) with plausible mechanism.

2



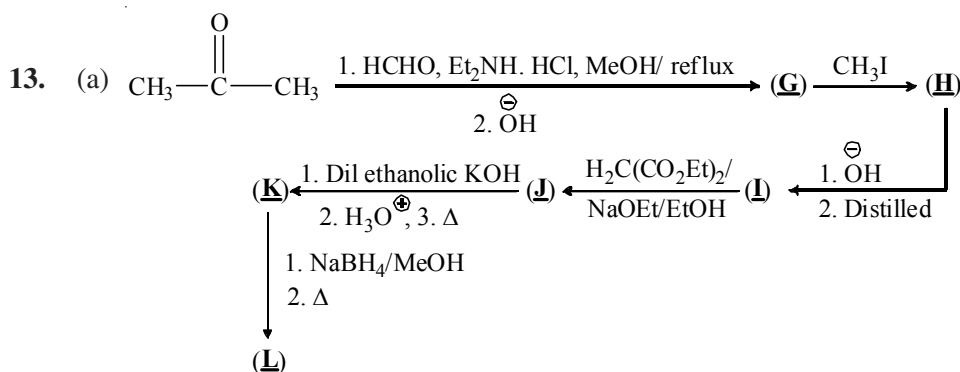
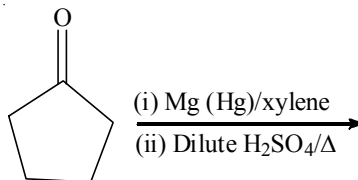
12. (a) Use Felkin-Anh model to explain the formation of major product in the following reaction:

3



(b) Complete the following reaction with plausible mechanism.

2

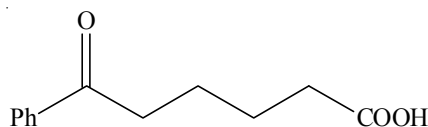


3

Identify **(G)**, **(H)**, **(I)**, **(J)**, **(K)**, **(L)**

(b) Show the retrosynthetic analysis of the following compound and carry out the synthesis.

2



Unit – II

Answer *any two* questions.

14. (a) Discuss the mechanism of osazone formation reaction in aldohexoses. Why osazone formation does not proceed beyond first two carbon atoms? 3
- (b) Convert D-arabinose to D-mannose. 2
15. (a) NaBH_4 reduces the aldose **(M)** to an optically inactive alditol. Ruff degradation of **(M)** yields **(N)**, the alditol of which is also optically inactive. Ruff degradation of **(N)** yields L-glyceraldehyde. Identify the aldoses **(M)** and **(N)**. 3
- (b) Draw the cyclic structure of sucrose. 2
16. (a) Mutarotation of glucose is catalysed by phenol-pyridine mixture and more effectively by 2-hydroxypyridine. Explain with mechanism. 3
- (b) α -Anomer of D-glucose is more stable in non-polar medium although it is conformationally less stable than the β -isomer. Explain. 2

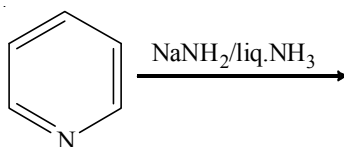
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CHT – 32c

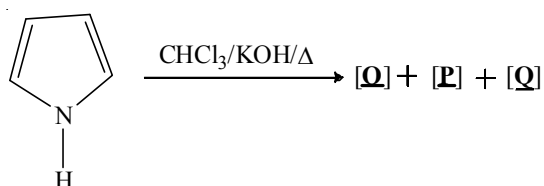
Unit – I

Answer *any three* questions.

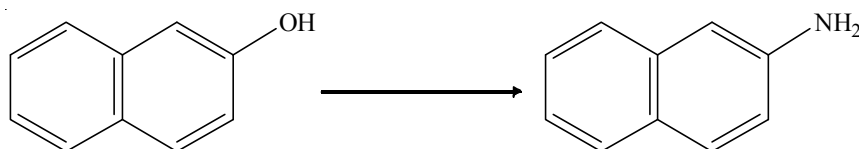
17. (a) How is naphthalene synthesised using Friedel-Crafts reaction? 3
 (b) Phenanthrene reacts with dichlorocarbene in its C-9/C-10 positions but anthracene does not. Explain. 2
18. (a) Furan reacts differently with nitronium fluoroborate and acetyl nitrate in pyridine to give 2-nitrofuran. Explain. 3
 (b) Write down the product of the following reaction with plausible mechanism. 2



19. (a) What happens when phenylhydrazone of ethyl methyl ketone is subjected to Fischer indole synthesis? Give mechanism. 3
 (b) Synthesise 1-methylisoquinoline by Bischler-Napieralski reaction. 2
20. (a) Which one of the following is the least aromatic one? Justify your answer showing a suitable reaction. Furan and pyrrole. 3
 (b) Identify the product(s) and explain their formation. 2



21. (a) 2-, 4-, 6- positions of pyridine-1-oxide are reactive towards electrophilic as well as nucleophilic reagents. Justify your answer with examples. 3
 (b) Carry out the following transformation with plausible mechanism. 2



Unit – II

Answer *any two* questions.

22. (a) Define isoelectric point of amino acids. How can you separate a mixture of alanine and lysine on the basis of their isoelectric point? 3
(b) Write down the pathway to synthesise the dipeptide val-gly using direct method involving DCC. 2
23. (a) How is N-terminal amino acid determined by Edman's method? Why is this method more advantageous than Sanger's method? 3
(b) Convert glycine to phenylalanine using Erlenmeyer's azlactone synthesis. 2
24. (a) Write down the structures of A-T and G-C base pairings in DNA. 3
(b) What are nucleosides and nucleotides? 2
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