

U.G. 4th Semester Examination - 2026

CHEMISTRY

[MAJOR-IV]

Course Code : CHEM-MJ-T-4

(Organic)

[NEP-2020]

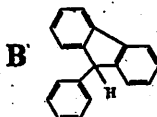
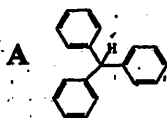
Full Marks : 40

Time : $2\frac{1}{2}$ Hours

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

1. Answer any five questions : 2×5=10

- a) What happens when sodium trichloroacetate (Cl_3CCOONa) is heated?
- b) Which one hydrogen is more acidic and why?

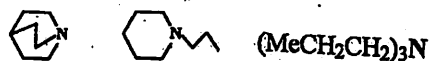


- c) Predict the product of the following $\text{S}_{\text{N}}2$ reaction and give explanation:



[Turn over]

- d) $(\text{CH}_3)_3\text{CBr}$ undergoes SN^1 reaction more rapidly than that of $(\text{CD}_3)_3\text{CBr}$ — Why?
- e) Predict the increasing order of the equilibrium constant of the reaction of the following bases with BMe_3 and explain your answer:



- f) Centres of stereogenicity is not always the centres of chirality.—Explain with an appropriate example.
- g) What is pseudoasymmetric center? Give suitable examples.
- h) What is inverse kinetic isotope effect? Give an example.

2. Answer any two questions :

$$5 \times 2 = 10$$

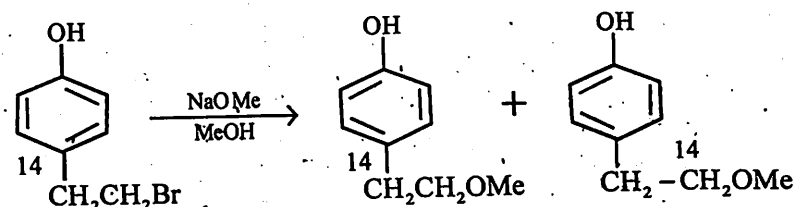
- a) i) Pinacol-pinacolone rearrangement is intramolecular in nature. Explain it by cross over experiment.
- ii) What are the differences between intermediate and transition state? Discuss with suitable examples.
- iii) Give example two optically inactive atropisomers.
- b) i) Basicity of triethyl amine and quinuclidine is almost the same but stability of the complexes formed by them with Me_3B is

$$2 + 2 + 1$$

widely different. Explain.

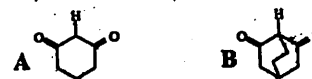


- ii) Squadric acid has acidity comparable to that of sulfuric acid — comment.
- iii) Explain the following observation:

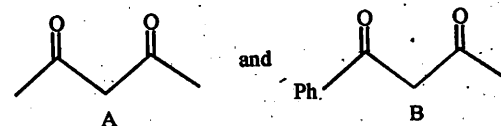
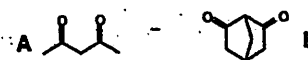


$$1\frac{1}{2} + 1\frac{1}{2} + 2$$

- c) i) In aqueous alkali cyclohexane-1, 3-dione (A) is readily soluble while bi-cyclo-[2, 2, 2]-octane-2, 6-dione (B) is poorly soluble—why?



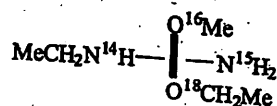
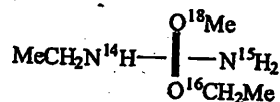
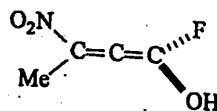
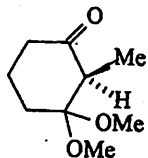
- ii) Compare the enol content of the following molecules A and B:



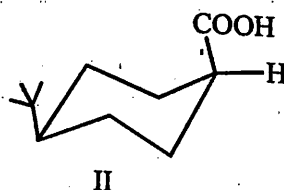
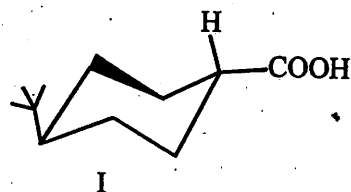
$$2 + 3$$

d) i) Draw the more stable conformer of $\text{FCH}_2\text{CH}_2\text{OH}$.

ii) Assign R/S configuration of the following molecules:



iii) Which one of the following two carboxylic acid is more acidic and why?



1+2+2

10×2=20

3. Answer any two questions:

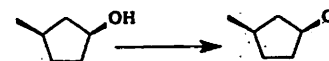
a) i) Rate of formation of methyl ether from t-butyl bromide in MeOH is almost the same even if a strong nucleophile MeO^- is added – why?

ii) The following compound (A) undergoes S_{N}^1 solvolysis reaction in presence of Ag^+ ions extremely slowly even though the Br is doubly allylic. Explain.



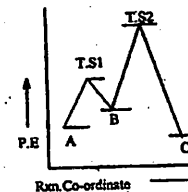
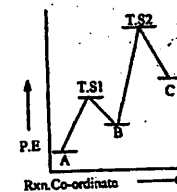
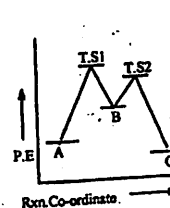
iii) In S_{N}^2 reaction inversion of configuration is observed while the treatment of NaI with optically active 2-iodooctane in refluxing acetone gives optically inactive final product — explain.

iv) How can you carry out the following conversion?



$2\frac{1}{2} + 2\frac{1}{2} + 2\frac{1}{2} + 2\frac{1}{2}$

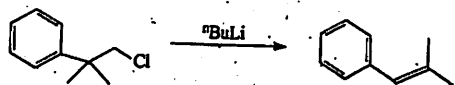
b) i) Considering the following energy profile diagrams, comment on the following:



- x) Which one is the r/d step?
 y) Is the forward reaction is exothermic?
 z) Write down the order of the rate constants for the forward and reverse reactions.

- ii) When $\text{PhCH}_2\text{CH}_2\text{Cl}$ and $\text{PhCD}_2\text{CH}_2\text{Cl}$ are separately treated with aqueous NaOH solution, the $K_H/K_D \sim 1$ at 25°C but under alcoholic NaOH condition $K_H/K_D \sim 7.1$. Explain the observations with mechanistic explanation.

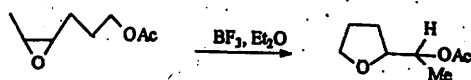
- iii) Suggest a suitable mechanism:



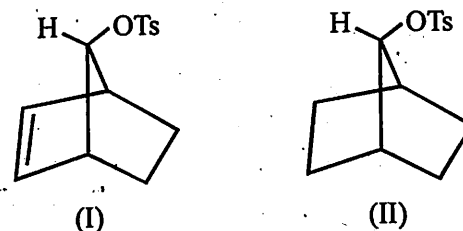
- iv) Pyrolysis elimination of 2-butylacetate given both 2-*E* and 2-*Z*-butene along with 1-butene even through the reaction is a stereospecific *SYN*-process.

$$3+2+2\frac{1}{2}+2\frac{1}{2}$$

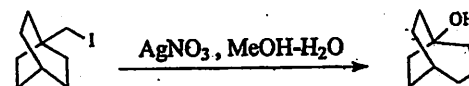
- c) i) Suggest a suitable mechanism for the following conversion:



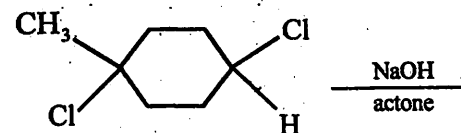
- ii) Acetolysis of Compound I is 10^4 times faster than that of Compound II. Explain the observation:



- iii) Explain the following observation:

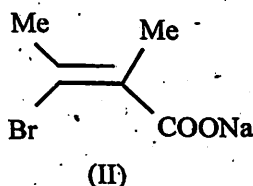
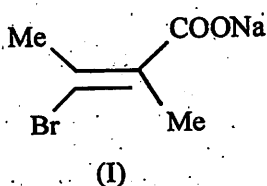


- iv) What will be the products when (*R*)- EtMeCHOH is treated with SOCl_2 ? Give experimental evidence in favor of the proposed reaction mechanism.
 v) Predict the product and suggest mechanism for the following reaction:



$$2+2+2+2+2$$

- d) i) Draw the Newman projections for the anti and one gauche conformation of 1, 2-dihydroxyethane. Which one is more stable in CCl_4 solution?
- ii) What is the most populated conformer of optically active 2, 3-dichlorobutane? Is it an asymmetric or disymmetric molecule?
- iii) Draw the Fischer projection of a meso-isomer of 2, 3, 4-trihydroxy glutaric acid and point out stereogenic and achirotopic centre (s) if any in it. Explain.
- iv) When heated the salt I undergoes decarboxylative debromination at faster rate than its isomeric salt II. Explain.



- v) 2-Hydroxypyridine mainly exists in the keto-form, but 2-aminopyridine exists in the amino-form but not in imino-form-explain.

2+2+2+2+2