

U.G. 2nd Semester Examination - 2024

CHEMISTRY

[MAJOR]

Course Code : CHEM-MAT-2

[NEP-2020]

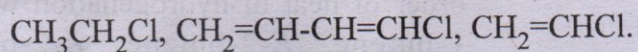
Full Marks : 40

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.*

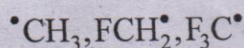
1. Answer any **five** questions : $2 \times 5 = 10$

- a) Arrange with explanation, the following compounds in order of increasing dipole moment.



- b) Compare with proper justification the stabilities of isobutene (*Z*-2-butene and *E*-2-butene).

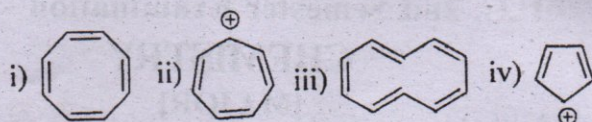
- c) Compare the stabilities of the following radicals.



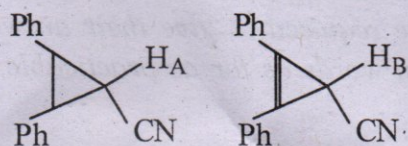
- d) The optical rotation of a compound was found $+60^\circ$. If a mixture is formed along with its enantiomer the optical rotation observed is -40° . The % of dextro form is?

[Turn over]

- e) Classify the following compounds as aromatic, antiaromatic or nonaromatic? Justify.



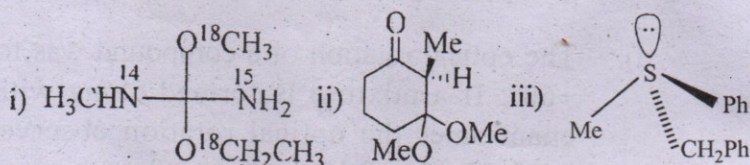
- f) Compound A loses its proton H_A in the presence of a base 10^4 times faster than the proton H_B in compound B. Explain



- g) What is meant by symmetry number? Find out the symmetry number of benzene.
- h) Arrange the following compounds in decreasing order of heat of hydrogenation with reasons: 1-butene, *E*-2-butene, *Z*-2-butene and 2-methylpropene.

2. Answer any **two** questions : $5 \times 2 = 10$

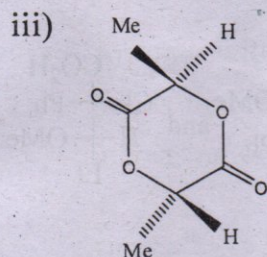
- a) Assign *R/S* descriptors to the following compounds and also show the priority order of the groups: $1+2+2=5$



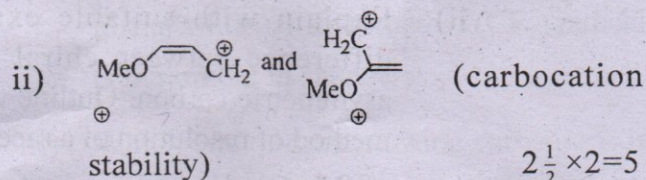
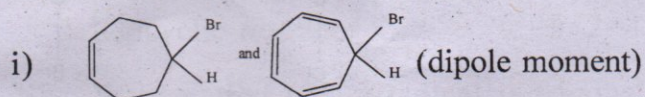
- b) Depict the symmetry elements of the following molecules in terms of C_n , i and σ (any **two**):

$$2\frac{1}{2} \times 2 = 5$$

- i) *cis*-1,3-Dimethylcyclobutane
 ii) *trans*-1,2-Dichloroethane



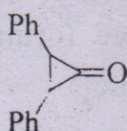
- c) Compare the compounds in each pair with respect to the given attributes:



$$2\frac{1}{2} \times 2 = 5$$

- d) Define homoaromatic compound with proper example. Acetone is unreactive to HBr but 2,3-diphenyl-2-cyclopropenone reacts rapidly with HBr. Explain why?

$$2+3=5$$



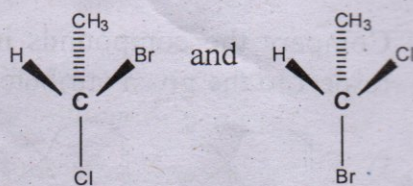
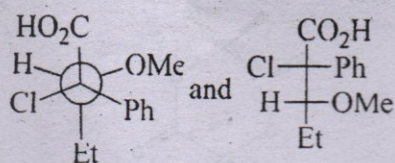
2,3-diphenyl 2-cyclopropenone

3. Answer any **two** questions:

10×2=20

- a) i) Label the following pairs of molecules as homomers, enantiomers or diastereomers. Explain your answer.

$2\frac{1}{2} \times 2 = 5$



- ii) Explain with suitable examples the difference between chiral carbon and asymmetric carbon. Outline the chemical method of resolution of a racemic mixture of 2-butanol. $2\frac{1}{2} \times 2 = 5$

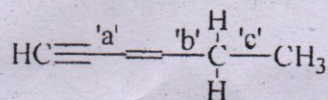
- b) i) Draw the π -MO's showing the nodes of HOMO and LUMO of 1,3-butadiene. 3
- ii) What is benzyne? Give evidence in favour of benzyne formation as a reactive intermediate. 3

- iii) The m.p. of a dicarboxylic acid having even number of carbon-atoms is always higher than that of acids having odd number of carbon-atoms lying immediately below or above the series. –Justify and comment.

2

- iv) Arrange with reason the following C-C bonds marked 'a', 'b' and 'c' in order of increasing bond length:

2



- c) i) Define with proper example, radical and pericyclic reaction.

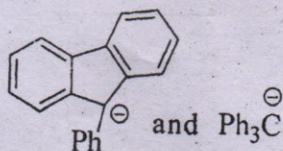
2×2=4

- ii) Why methyl (CH_3) radical is trigonal planar while trifluoromethyl (CF_3) radical is pyramidal in shape?

2

- iii) Which one of the following carbanions is more stable and why?

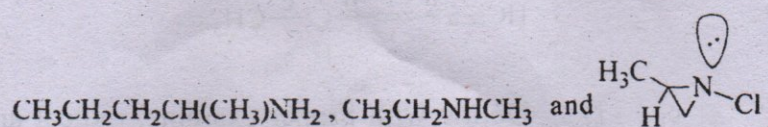
2



iv) Butadiene is more reactive than ethylene towards nucleophilic and electrophilic addition reactions. Explain in terms of molecular orbital theory. 2

d) i) Draw the orbital pictures of diphenylcarbene. Explain the triplet character of diphenylcarbene. 2+1=3

ii) Explain whether the following compounds are resolvable or not. 3×1=3



iii) Cl^- ion in $\text{Bu}_4\text{N}^+\text{Cl}^-$ in acetone is better nucleophile than that of LiCl in the same solvent. Explain. 2

iv) What do you mean by conformational enantiomers? Give one example. 2