

2017

**CHEMISTRY**

( *Organic* )

[ **Honours** ]

( CBCS )

[ **First Semester** ]

PAPER – C1T

*Full Marks : 40*

*Time : 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*

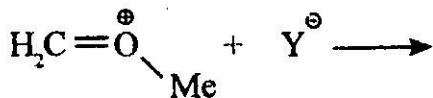
*Illustrate the answers wherever necessary*

**GROUP – A**

1. Answer any *five* questions : 2 × 5

(a) What is meant by DBE ? Calculate double bond equivalent of  $C_5H_4O_2NCl$ .

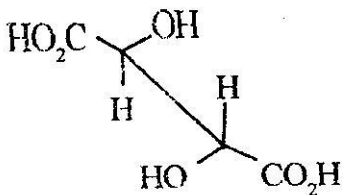
- (b) Show the correct arrow pushing for the following reaction with proper reasoning.



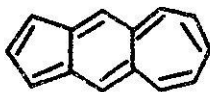
- (c) Why homoallylic carbocation is called non-classical carbocation ?
- (d) Arrange the following carbocations in order of their increasing stability, Give reason.



- (e) Define the term "Homoaromaticity" with a suitable example.
- (f) Convert the following sawhorse formula for one isomer of tartaric acid to a Fischer projection formula. Which isomer of tartaric acid is it ?



- (g) The following molecule shows a very high dipole moment. Give reason.



- (h) Define the term 'Pseudoasymmetry' with suitable example.

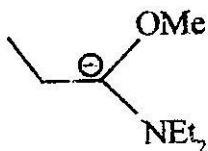
### GROUP – B

Answer any four questions : 5 × 4

2. (a) Calculate formal charges of the molecule,  $\text{CH}_3\text{NO}_2$  1
- (b) Draw the orbital picture of (i)  $\text{CH}_2 = \text{CH}^+$ ,  
(ii)  $\text{CH}_2 = \text{C} = \text{O}$  indicating state of hybridization of each atom. 3
- (c) Which of the following species is likely to behave as electrophile and which as nucleophile or both? 1
- (i)  $\text{CH}_2 = \text{O}$
- (ii)  $\text{CH}_2 = \text{CH}_2$

3. (a) Using Frost diagram label bonding, nonbonding and anti-bonding pi-molecular orbital of cyclobutadiene. Comments on its aromatic/antiaromatic nature. 2 + 1

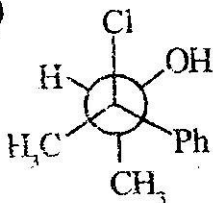
- (b) Draw all the resonance structures of the following species, and hence indicate the greater contributing structure with proper reasoning. 2



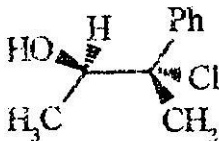
4. (a) Draw all pi-molecular orbital of 1, 3-butadiene and indicate the HOMO and LUMO in ground state. 2

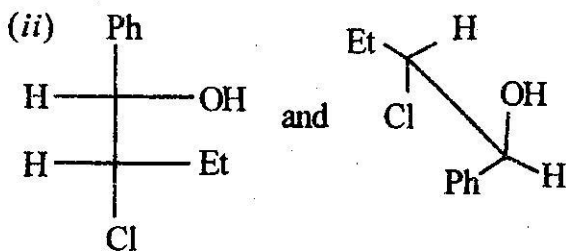
- (b) Assign each of the following pairs of compounds as homomer, enantiomer or diastereomer. 3

(i)



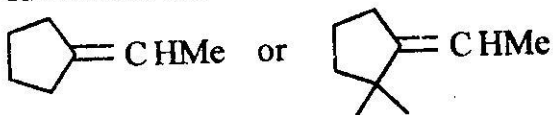
and



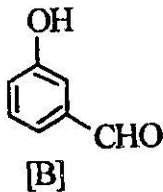
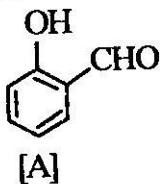


5. (a) Explain why meso-tartaric acid is optically inactive on the basis of Newman projections of its all possible conformers for rotation around  $C_2 - C_3$  bond. 2
- (b) Draw all possible stereoisomers of pentane-2, 3, 4-triol. Label their chirality centers and say which are enantiomers and which are diastereomers. 3
6. (a) An optically pure sample of S-(+)-2 butanol shows a specific rotation of  $[\alpha]_D^{25^\circ} = +13.52^\circ$ . What relative molar proportion of S-(+)-2 butanol and R-(-)-2 butanol would give a specific rotation of  $+6.76^\circ$ . 3

- (b) Which of the following two compounds shows Cis-trans isomerism and why? 2



7. (a) Explain why A is less soluble in water than B even though both have same functional groups. 2



- (b) Arrange the following isomeric alkenes in order of increasing stability and explain.

Cis-2 butene, trans-2-butene, isobutene and 1-butene. 2

- (c) Explain why glycerol is a viscous liquid? 1

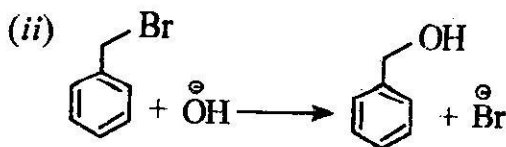
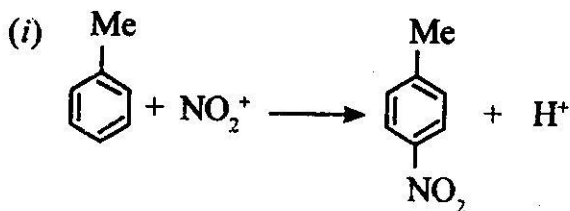
### GROUP - C

Answer any **one** question from this Group : 10 × 1

8. (a) Classify the following reactions according to

the mechanism involved and structural changes occurred.

2



- (b) What is gauche-butane interaction? Draw the energy diagram on *n*-butane as a function of rotation around  $C_2 - C_3$  bond and label the maxima and minima with proper conformations. Is it possible to isolate the different forms? Give reasons.

4

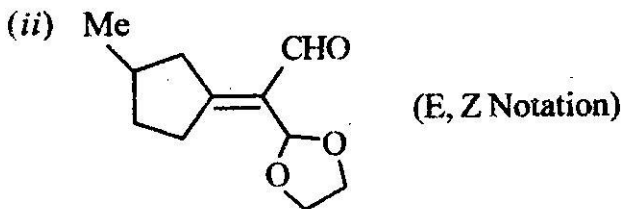
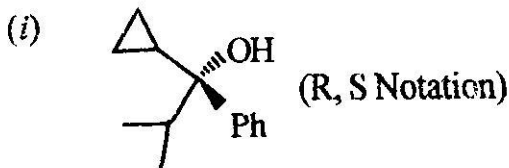
- (c) Draw Fisher Projection formula for the following molecules.

(i) (2R, 3S)-2, 3-dihydroxy-3-methyl-pentanoic acid.

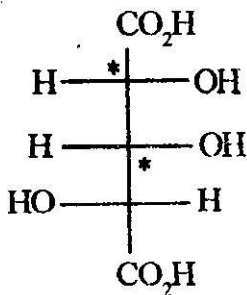
(ii) Butane-2L, 3D-diol.

2

(d) Assign configurational notation (as indicated) for each of the following molecules. 2

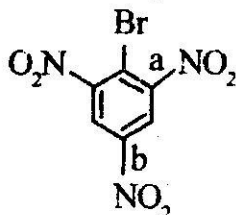


9. (a) Comment on the stereogenicity and chirotopicity of the marked carbons (marked by asterisk) of the following structure. 2

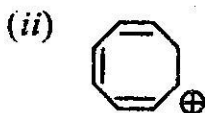
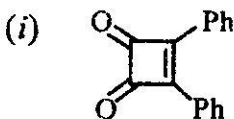




- (b) The bond dissociation energy of  $\text{PhCH}_2\text{-H}$  bond is considerably smaller than  $\text{CH}_3\text{-H}$  bond. Explain. 2
- (c) Explain which C-N bond, 'a' or 'b' has higher bond length and why? 2



- (d) State Hückel rules for aromaticity. Indicate the following species as aromatic, nonaromatic, antiaromatic or homoaromatic with proper reason. Arrange them in increasing order of their stability. 4



- (iii) Cyclopentadienyl cation.