

2017

**CHEMISTRY**

(Organic)

[Honours]

(CBCS)

[First Semester]

PAPER — CIT

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

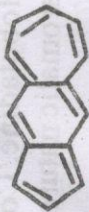
GROUP — A

1. Answer any five questions : 2 × 5
- (a) What is meant by DBE ? Calculate double bond equivalent of  $C_5H_4O_2NCl$ .

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( 3 )

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

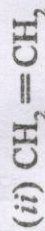
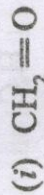


(h) Define the term 'Pseudoasymmetry' with suitable example.

GROUP - B

Answer any four questions : 5 x 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

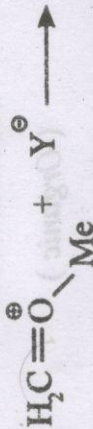


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( 2 )

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



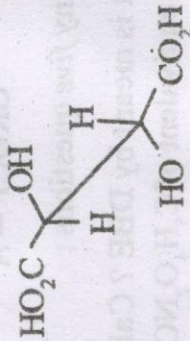
(c) Why homoallylic carbocation is called non-classical carbocation ?

(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 ?



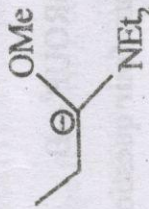
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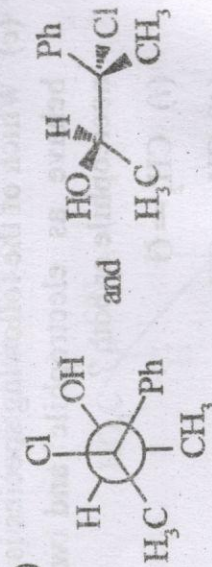
3. (a) Using Frost diagram label bonding, nonbonding and anti-bonding pi-molecular orbital of cyclobutadiene. Comments on its aromatic/antiaromatic nature. 2 + 1

- (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

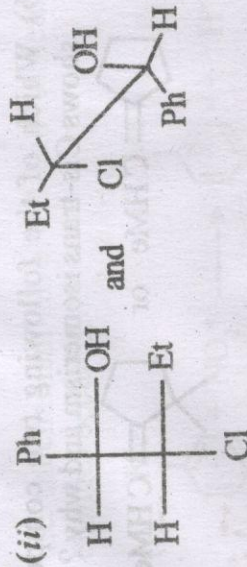
- (b) Assign each of the following pairs of compounds as homomer, enantiomer of diastereomer. 3



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( 5 )



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

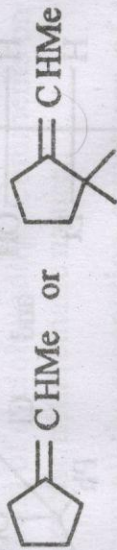
6. (a) An optically pure sample of S-(+)-2-butanol shows a specific rotation of  $[\alpha]_D^{25} = +13.52^\circ$ . What relative molar portion of S-(+)-2-butanol and R-(-)-2-butanol would give a specific rotation of  $+6.76^\circ$ . 3

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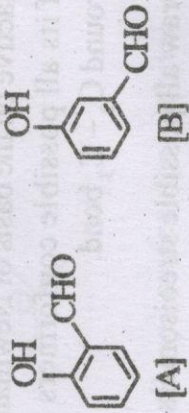
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( 6 )

- (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. 2

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

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

GROUP - C

Answer any one question from this Group : 10 x 1

8. (a) Classify the following reactions according to

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( 7 )

- 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<sub>2</sub>-C<sub>3</sub> 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.

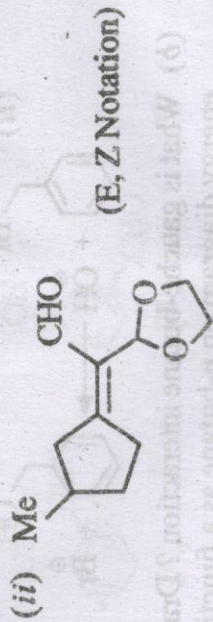
(ii) Butane-2L, 3D-diol. 2

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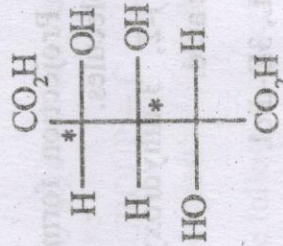
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(d) Assign configurational notation ( as indicated ) for each of the following molecules. 2



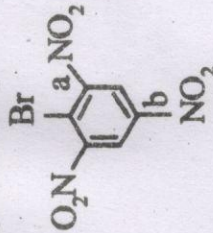
9. (a) Comment on the stereogenicity and chiropticity of the marked carbons (marked by asterisk) of the following structure. 2



( 9 )

(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. \_\_\_\_\_