

**U.G. 1st Semester Examination - 2020**

**CHEMISTRY**

**[HONOURS]**

**Course Code : CHEM-H-CC-T-02**

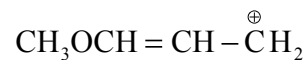
Full Marks : 40

Time : 2½ Hours

*The figures in the right-hand margin indicate marks.*

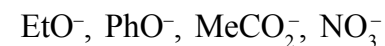
*Candidates are required to give their answers in their own words as far as practicable.*

1. Answer any **five** questions: 2×5=10
- Calculate the double bond equivalent of the compound having molecular formula  $C_3H_7N$  and write down the structures that conform to this double bond equivalent.
  - n-butyl alcohol has much higher boiling point ( $118^\circ\text{C}$ ) than its isomers isobutyl alcohol ( $108^\circ\text{C}$ ) and diethyl ether ( $35^\circ\text{C}$ ).
  - Draw the different canonical forms of the following species indicating the most important contributor towards resonance hybrid:

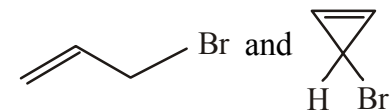


[Turn over]

- Draw the Fischer Projection formula of
  - (2R, 3S)-3-Phenyl-2-butanol
  - (R)-2-Deuteropropanoic acid.
- Explain why C=O bond energy in ketones is greater than the C–O bond energy in ethanol?
- (+) 1-Phenyl ethyl alcohol loses its optical activity in presence of acid– explain.
- Arrange the following in order of decreasing nucleophilicity with proper reasons:

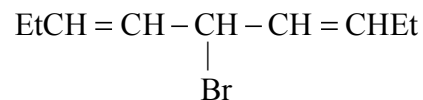


- Which one of the following compounds would undergo  $\text{Ag}^+$  ion assisted hydrolysis at a faster rate and why:



2. Answer any **two** questions: 5×2=10
- Compare the dipole moment in each of the following pairs:
    - Butanal and 2-butenal
    - Vinyl chloride and ethyl chloride

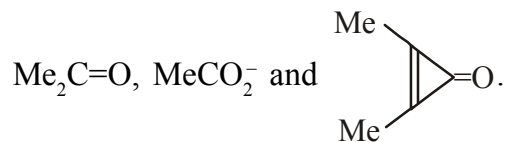
ii) Draw all possible stereoisomers of



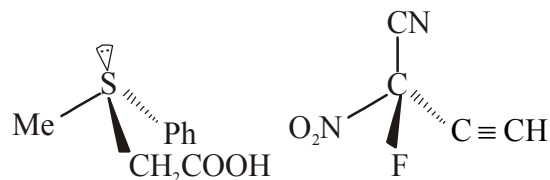
and comment on their optical activity.

2+3

b) i) Compare C–O bond distance in



ii) Assign R/S designation to the following compounds:



3+2

c) i) Write down the basic difference between resonance effect and electromeric effect. Explain with suitable examples.

ii) Draw the  $\pi$ -M.O. pictures of LUMO of 1,3,5-hexatriene and HOMO of allyl radical in the ground state. 3+2

d) i) Depict the symmetry elements of the following molecules in terms of  $\sigma$  and  $C_n$ :

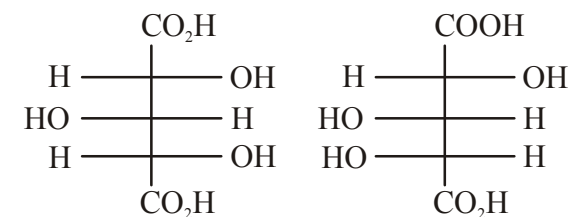
A) Cis-1,3-dimethyl cyclobutane

B) trans-1,2-dibromo ethene

ii) Dimethoxy carbene is reluctant to add to isobutene– explain. 3+2

3. Answer any **two** questions: 10×2=20

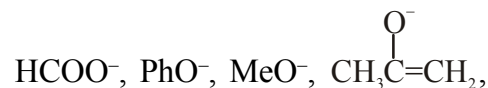
a) i) Label the C-3 centres of the following molecules as stereogenic/non-stereogenic and chirotopic/achirotopic. Justify your answer.



ii) Outline the reaction steps you would employ to carry out the resolution of a racemic alcohol.

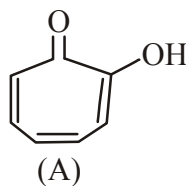
iii) A good base is not necessarily a good nucleophile– explain.

- iv) Which of the following ions are the ambident nucleophiles:



- b) i) What is benzyne? Give chemical evidence in favour of formation of the benzyne as reactive intermediate.

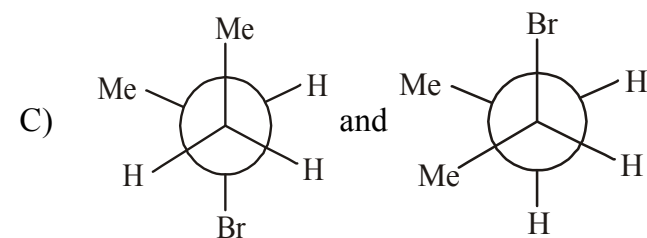
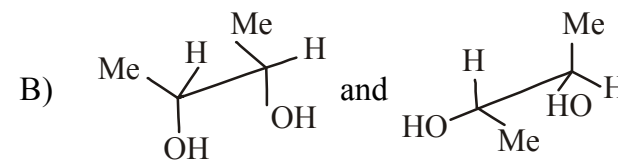
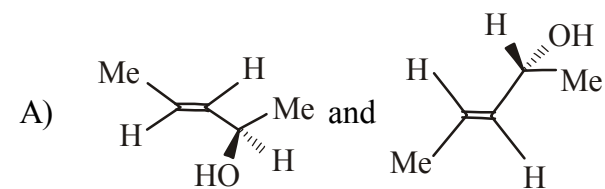
- ii) 1,3,5-cycloheptatriene is not aromatic whereas its derivative tropolone (A) behaves like a typical phenol- why?



- iii) Justify the statement-  $s_2$  and  $i$  are equivalent operations.

- iv) Show that cyclopentadienyl cation is a diradical. 3+2+3+2

- c) i) Identify whether the following pairs of compounds represent enantiomers, diastereoisomers and homomers:



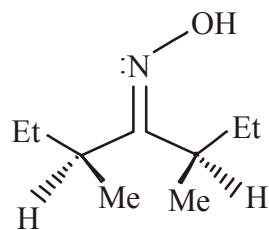
- ii) Calculate enantiometric excess (ee) and the specific rotation of a mixture containing 12gm of (+)-2-butanol and 8gm of (-)-2-butanol. The specific rotation of enantiomerically pure (+)-2-butanol is  $+13.5^\circ$ .

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

- iv) Why acyl halides are more reactive towards water than alkyl halides?

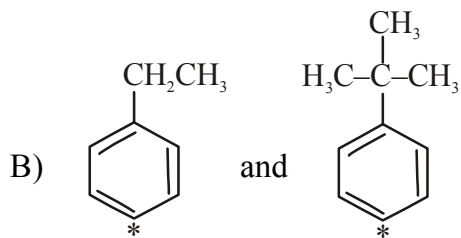
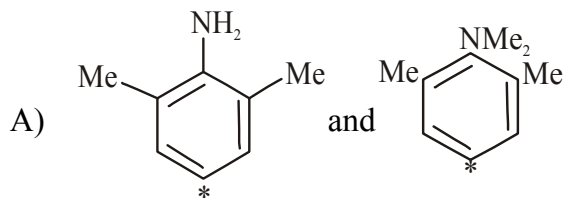
3+3+2+2

- d) i) Does the following oxime(B) show optical activity and E-Z isomerism? Label the configurations of the chiral centres of B.



(B)

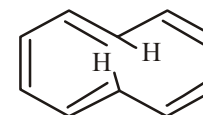
- ii) Is it possible to separate the carbanion  $\text{Et}\overset{\ominus}{\text{C}}\text{HMe}$  into enantiomers?
- iii) Compare the electron density at the marked carbon atoms of each of the following pairs and rationalize:



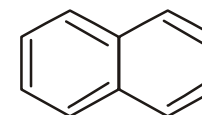
( 7 )

[Turn over]

- iv) Comment on the aromaticity of the following compounds C and D:



C



D

4+2+2+2

-----