

Total number of printed pages-8

3 (Sem-2/CBCS) CHE HC 1

2023

**CHEMISTRY**

(Honours Core)

Paper : CHE-HC-2016

**(Organic Chemistry-I)**

Full Marks : 60

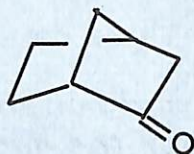
Time : Three hours

**The figures in the margin indicate full marks for the questions.**

1. Answer **all** the questions :  $1 \times 7 = 7$
- (a) Draw the orbital diagrams of singlet and a triplet carbon.
- (b) Write the structure of (R,R)-tartaric acid.
- (c) Draw the Newman projection formula of the lowest energy conformer of butane.

Contd.

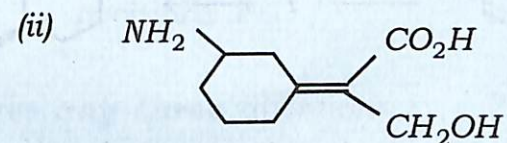
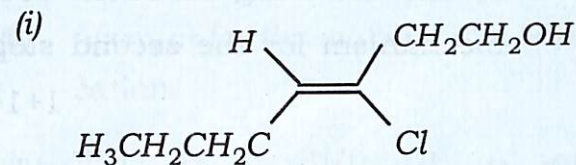
- (d) Between ammonia and trimethylamine which one is more likely to favour elimination over substitution and why?
- (e) Define a meso compound.
- (f) Is cyclopentadiene acidic? Give reasons.
- (g) Write the IUPAC name of the following compound :



2. Answer **all** the questions :  $2 \times 4 = 8$

- (a) What product is obtained when cyclohexane is subjected to ozonolysis? Write the reaction involved.
- (b) Suggest two ways by which you can convert  $-OH$  group into good leaving group.  $1+1=2$
- (c) Invoking hybridisation, explain the structure of methyl free radical.

(d) Label the following as *E*- or *Z*-isomer :

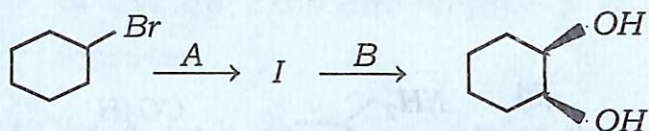


3. Answer **any three** questions :  $5 \times 3 = 15$

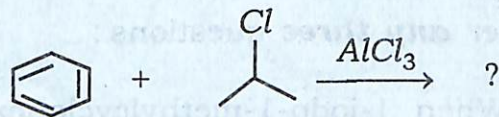
- (a) When 1-iodo-1-methylcyclohexane is treated with  $NaOCH_2CH_3$  as the base, the more highly substituted alkene product predominates. When  $KOC(CH_3)_3$  is used as the base, the less highly substituted alkene predominates. Write the reactions, giving the structure of the two products and offer an explanation.  $3+2=5$

- (b) Identify the reagents and intermediate in the following reaction. Propose a mechanism for the second step.

$$1+1+1+2=5$$



- (c) What product is expected to be formed in the following reaction ?



Write the name of the above reaction and propose a mechanism, clearly explaining the steps involved.

$$1+1+3=5$$

- (d) Write the steps involved in a  $E2$  mechanism. Provide one evidence in favour of  $E2$  mechanism. Under what condition  $E2$  is favoured over  $E1$  mechanism ?

$$2+1+2=5$$

- (e) (i) State one method by which carbocations can be generated.

- (ii) Account for the stability of a benzyl cation.

- (iii) Why is it difficult to form carbocations at bridgehead positions ?

$$1+2+2=5$$

4. Answer **any three** questions :  $10 \times 3 = 30$

- (a) (i) Toluene undergoes benzylic bromination when heated with NBS. Write the product obtained in the reaction. Propose a mechanism for the reaction.

$$1+4=5$$

- (ii) Why are terminal alkynes acidic ? Write the reaction involved in the conversion of propane to pent-2-yne.

$$1+2=3$$

- (iii) How can you convert propyne to propan-2-one ?

$$2$$

(b) Give the 1,2- and 1,4- products of the addition of one equivalent of HBr to 2,4-hexadiene. Draw the transition states involved and predict which of them would be the major product and which will be the minor product. What are the 1,2- and 1,4- addition products of HBr to 2-methyl-1,3-cyclohexadiene? What is about the products of 1,2- and 1,4-addition of HX to an unsubstituted cyclic-1,3 diene?

$$2+4+2+2=10$$

(c) (i) What do you mean by a racemic mixture? Why is resolution of a racemic mixture a difficult process? How can you resolve a racemic mixture? Suggest one method.

$$1+1+3=5$$

(ii) The addition of HBr to propene is regioselective. Write the reaction involved. Propose a mechanism to justify the regioselectivity.

$$1+4=5$$

(d) (i) State whether the following compounds are aromatic, non-aromatic or antiaromatic. Give reasons.

$$2+2=4$$



(ii) Define hyperconjugation. How many hyperconjugation structures are possible for an isopropyl radical?

$$1+1=2$$

(iii) What do you mean by partial bond fixation? Which position of anthracene is attacked by electrophiles and why?

$$1+(1+2)=4$$

(e) (i) Explain Baeyer strain theory.

$$2$$

(ii) Draw the energy profile diagram of cyclohexane.

$$3$$

(iii) Why is the chair form of cyclohexane the most stable?

$$1$$

(iv) Convert meso-tartaric acid from Fischer to Newman projection and Sawhorse projection.

$$2$$

(v) Let (S)-2-bromobutane have a specific rotation of  $+23.1^\circ$  and (R)-2-bromobutane have a specific rotation of  $-23.1^\circ$ . What is the percentage purity and % composition of a mixture whose specific rotation was found to be  $+18.4^\circ$  ?

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(f) (i) What are the factors which determine whether an aliphatic nucleophilic substitution reaction proceeds by SN1 or SN2 reaction ? Discuss *any two* factors in brief.

1+4=5

(ii) Using appropriate example write briefly about Saytzeff and Hofmann elimination.

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