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3 (Sem-2/CBCS) CHE HC 1

2025

CHEMISTRY

(Honours)

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 **any seven** questions : $1 \times 7 = 7$

(a) Out of the following, which one exhibits positive inductive (+I) effect ?

(i) $-\text{CH}_3$

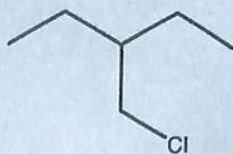
(ii) $-\text{OH}$

(iii) $-\text{F}$

(iv) $-\text{C}_6\text{H}_5$



- (b) BCl_3 is a planar molecule whereas NCl_3 is pyramidal. Why ?
- (c) Find the optically active compound among the following
- (i) Glycerine
 - (ii) Acetaldehyde
 - (iii) Glyceraldehyde
 - (iv) Acetone
- (d) Are the following molecules enantiomers, diastereomers or same ?
(R,R)-Tartaric Acid and (R,S)-Tartaric Acid
- (e) Write the IUPAC name of the following compound.

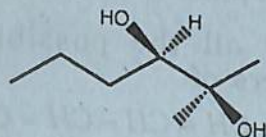


- (f) Write the name of the reaction when alkyl halide is allowed to react with metallic sodium in presence of dry ether.
- (g) Name the products formed when propene is subjected to ozonolysis.
- (h) What products are obtained when alkenes are subjected to hydroxylation ?
- (i) Define angle strain.
- (j) Explain why alkynes are more acidic than alkenes and alkanes.
2. Answer **any four** questions fromt the following : 2×4=8
- (a) Explain why $(\text{CH})_4\text{N}^+$ is neither an electrophile nor a nucleophile.
- (b) Draw all the possible geometrical isomers of
 $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH} = \text{CH} - \text{C}_2\text{H}_5$.
- (c) What are the similarities and differences between achiral and meso compounds ?

(d) Peroxides are good initiators for radical reactions. Given the peroxide RO-OR, draw the initiation and propagation step of the nperoxide radical to create bromine radical with HBr.

(e) With proper stereochemistry, write the products obtained when 1,2-dimethylcyclopentene is reacted with Br_2 .

(f) Give a reaction scheme starting with alkene and required reagents to produce the following compound :



(g) Draw the most stable conformations of cis-and trans-1,2-dimethylcyclohexane.

(h) Draw the Newman projection formula of the eclipsed and staggered conformers of 1,2-dichloroethane.

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

(a) State the differences between substitution and elimination reaction. What are the factors that determine whether a reaction will follow substitution mechanism or elimination mechanism ? $2+3=5$

(b) What are carbenes ? Give one method of preparation of carbene. Write the structures of singlet and triplet methylene. $1+2+2=5$

(c) With the help of examples, explain $2.5 \times 2 = 5$

(i) conformation and

(ii) configuration

(d) A tertiary alkyl halide **A** of formula $C_6H_{13}Br$ on treatment with potassium *t*-butoxide gives two isomeric alkenes **B** and **C** having the formula C_6H_{12} . Both of these alkenes on hydrogenation give 2,3-Dimethylbutane **D**. Predict the products and write the reactions involved.

(e) Write the E1cb mechanism of elimination reaction. How does it differ from E1 mechanism ? $3+2=5$

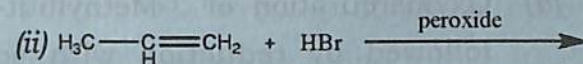
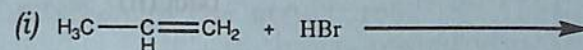
(f) Hydrogenation of Hex-3-yne produces *cis*- and *trans*-Hex-3-ene under different reaction conditions. Write the reactions involved. How can you convert Hex-3-ene back to Hex-3-yne ? $1.5 \times 2 + 2 = 5$

(g) What is 1,3-diaxial interaction in cyclohexanes ? How does it affect the stability of the molecule ? Draw the most stable and most unstable conformers of 1,3-disubstituted cyclohexane. $1+2+2=5$

(h) What do you understand by *ortho*- and *para*-directing effects of substituent groups ? Give examples for each. Explain the terms activating and deactivating group. $2+1+2=5$

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

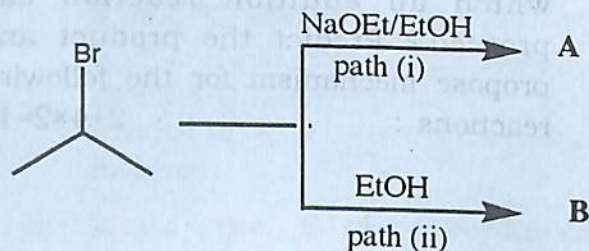
(a) What are the different pathways via which an addition reaction can proceed ? Predict the product and propose mechanism for the following reactions : $2+4 \times 2 = 10$



(b) Draw the Fischer projections for (2*R*, 3*S*)-2-Bromo-3-chlorobutane and (2*S*, 3*R*)-2-Bromo-3-chlorobutane, with the carbon chain on the vertical line. Label each structure as (2*R*, 3*S*) or (2*S*, 3*R*). Assume that you have a mixture of equal amount of each of the above compounds. What is this mixture called ? can they be separated into two containers based on their physical properties ? Explain. $3+3+1+3=10$

- (c) Predict the products **A** and **B** and write mechanism for their formation.

$$1+4+1+4=10$$



- (d) Oxymercuration of 3-Methylbut-1-ene followed by reduction with sodium borohydride leads to the formation of 3-Methylbutan-2-ol via Markovnikov's addition. Draw the mercurinium ion intermediate and rationalize the formation of the Markovnikov's product. Can 3-Methylbutan-1-ol also be obtained from 3-Methylbut-1-ene? How? Is there any stereochemical control in the oxymercuration-demercuration process?

$$1+4+1+2+2=10$$

- (e) Trans-1,2-Dimethylcyclobutane is more stable than

cis-1,2-D-Dimethylcyclobutane.

Explain this observation. Draw all the different structures with the formula C_6H_{12} with only one ring and name them. Also, draw the energy profile diagram and label the position of the structures.

- (f) Explain the process of racemization through cation formation with suitable examples. How would you resolve optically active alcohols from a racemic mixture?

$$5+5=10$$

- (g) Discuss $\text{S}_{\text{N}}\text{Ar}$ and Benzyne mechanism for aromatic nucleophilic substitution reaction. Discuss effect of leaving group and attacking nucleophile on aromatic nucleophilic substitution reaction.

$$3+3+2+2=10$$

(h) Write the structure of products and reagents (A)-(J). $1 \times 10 = 10$

