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3 (Sem-2/CBCS) CHE HC 1

2022

**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)  $-CH_3$

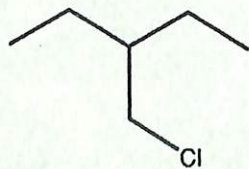
(ii)  $-OH$

(iii)  $-F$

(iv)  $-C_6H_5$

Contd.

- (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 are products obtained when alkenes are subjected to hydroxylation ?
- (i) Define angle strain.
  - (j) Explain why are alkynes more acidic than alkenes and alkanes.

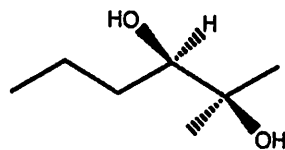
2. Answer **any four** questions from the following : 2×4=8

- (a) Explain why  $(CH_3)_4N^+$  is neither an electrophile nor a nucleophile.
- (b) Draw all the possible geometrical isomers of  $CH_3 - CH = CH - CH = CH - C_2H_5$ .
- (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 peroxide radical to create bromine radical with HBr.

(e) With proper stereochemistry, write the products obtained when 1,2-dimethylcyclopentene is reacted with  $\text{Br}_2$ .

(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  $2.5 \times 2 = 5$

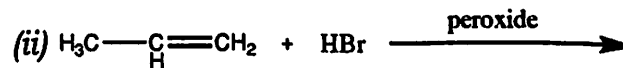
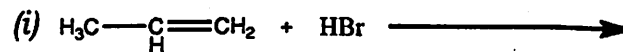
(i) conformation and

(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 :  $10 \times 3 = 30$

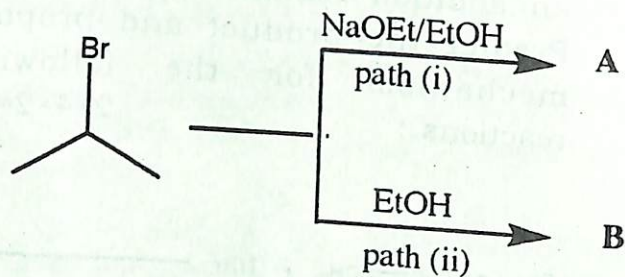
- (a) What are different pathways via which an addition reaction can proceed? Predict the product and propose mechanism for the following reactions :  $2+4 \times 2 = 10$



- (b) Draw the Fischer projections for (2R, 3S)-2-Bromo-3-chlorobutane and (2S, 3R)-2-Bromo-3-chlorobutane, with the carbon chain on the vertical line. Label each structure as (2R, 3S) or (2S, 3R). 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-Dimethylcyclobutane. Explain this observation. Draw all the different structures with the formula  $\text{C}_6\text{H}_{12}$  with only one ring and name them. Also, draw the energy profile diagram and label the position of the structures.

$$2+4+4=10$$

- (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).  $1 \times 10 = 10$

