**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 : 1×7=7

   (*a*) Draw the orbital diagrams of singlet and a triplet carbon.

   (*b*) Write the structure of (R,R)-tartaric acid.

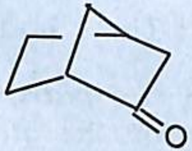
   (*c*) Draw the Newman projection formula of the lowest energy conformer of butane.

(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 : 2×4=8

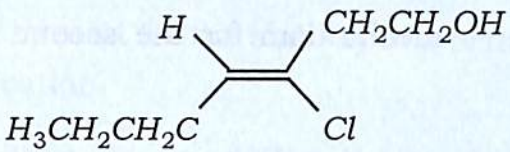
(a) What product is obtained when cyclohexane is subjected to ozonolysis? Write the reaction involved.

(b) Suggest two ways by which you can convert — *OH* group into good leaving group. 1+1=2

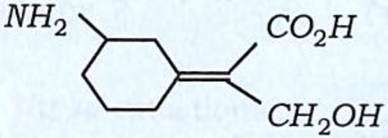
(c) Invoking hybridisation, explain the structure of methyl free radical.

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

(i)



(ii)



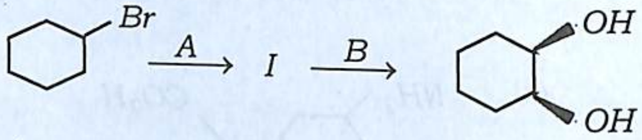
3. Answer ***any three*** questions : 5×3=15

(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

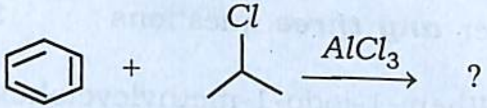
Contd.

(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 *E*2 mechanism. Provide one evidence in favour of *E*2 mechanism. Under what condition *E*2 is favoured over *E*1 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 : 10×3=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

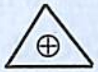
(iii) How can you convert propyne to propan-2-one ? 2

*(b)* Give the 1,2- and1,4- 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 recemic 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 chain 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° and (R)-2-bromobutane have a specific rotation of −23.1°. What is the percentage purity and % composition of a mixture whose specific rotation was found to be +18.4° ? 2

*(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. 5

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