

2014

( 1st Semester )

CHEMISTRY

FIRST PAPER (CHEM-111)

( Organic Chemistry—I )

Full Marks : 55

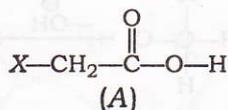
Time : 2 hours

( PART : B—DESCRIPTIVE )

( Marks : 35 )

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

1. (a) Draw the orbital structure for the hybridization of methane and mention the shape of the molecule. . 2
- (b) Why is the dissociation constant ( $K_a$ ) for fluorine stronger than chlorine for the following compound (A)?



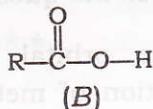
[where X = F, Cl]

2

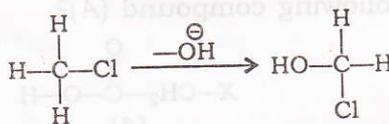
- (c) Draw the orbital structure for the hybridization of ketone and discuss the nature of the covalent bonding. 3

OR

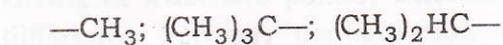
2. (a) Draw hydrogen bonding for a water molecule. 2
- (b) What kind of a hydrogen bond would increase the boiling point of organic molecules? 2
- (c) Explain the orbital representation for the hybridization of acetylene. 3
3. (a) Show the resonance for a mono-carboxylic acid (B) to show its acidity : 2



- (b) Draw arrows to connote how reaction will proceed for the following reaction : 2

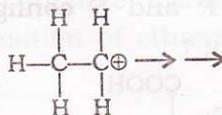


- (c) Arrange the following carbocations in increasing order and state which is the stablest and why : 3

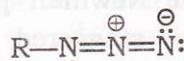


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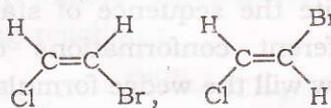
4. (a) What is carbene? Give an example. 2  
 (b) Write the hyperconjugation structures for the following : 2



- (c) What are the two energetic states of nitrenes? Which state is the stable energetic state? Attempt to get nitrene with appropriate movement of arrows for the following : 3



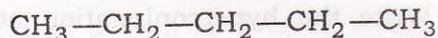
5. (a) What is structural isomer? Write the structure of 2-methylpropane. 2  
 (b) Assign *E* and *Z* nomenclature for the following : 2



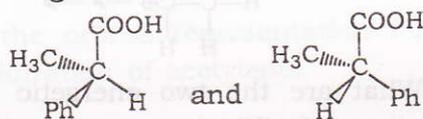
- (c) Write the difference between meso-compound and diastereoisomers with appropriate examples. 3

OR

6. (a) Write the other two chain isomers for the molecular formula  $C_5H_{12}$ , an example of the first given below : 2



- (b) Assign *R* and *S* configuration for the following : 2

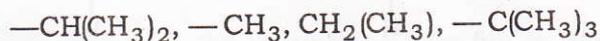


- (c) Show inversion of configuration with appropriate reaction example. 3
7. (a) Draw the Newman projection formula for a staggered and eclipsed conformations of propane. 2
- (b) What is the interaction encountered in showing the structure of methyl cyclohexane with methyl in the axial position? 2
- (c) Write the sequence of stability for the different conformations of *n*-butane. How will the wedge formula look like for the eclipsed conformation for *n*-butane? 3

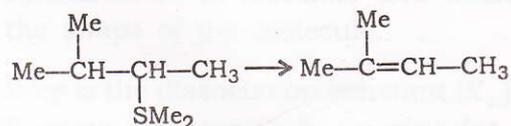
OR

8. (a) Giving at least two points, what is the difference between configuration and conformation? 2
- (b) Draw the Newman projection formula for methyl cyclohexane with methyl in the equatorial position. 2
- (c) Write the complete transformation of the conformation of ethane. 3

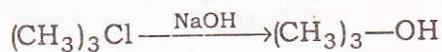
9. (a) Arrange the order of reactivity for various alkyl groups for  $S_N2$  reaction : 2



- (b) What kind of an orientation do you expect for the following elimination reaction? Briefly explain : 2

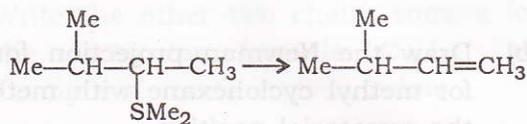


- (c) Show complete mechanism for the following reaction : 3

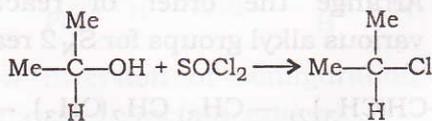


OR

10. (a) What kind of an orientation do you expect for the following elimination reaction? Briefly explain : 2



- (b) Give at least two points to state the role of solvent in  $\text{S}_{\text{N}}2$  reaction. 2
- (c) Show complete mechanism for the following reaction : 3



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2014

( 1st Semester )

**CHEMISTRY**

FIRST PAPER (CHEM-111)

**( Organic Chemistry—I )**

( PART : A—OBJECTIVE )

( Marks : 20 )

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

SECTION—I

( Marks : 5 )

Put a Tick (✓) mark against the correct answer in the brackets provided for it : 1×5=5

1. In ethylene, each carbon hybridizes the 2s orbitals with 2p orbitals to produce

(a) 1  $sp^2$  orbitals ( )

(b) 2 sp orbitals ( )

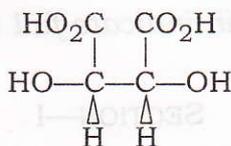
(c) 3  $sp^2$  orbitals ( )

(d) 3  $sp^3$  orbitals ( )

2. The acid strength of carboxylic group in conjugation with unsaturated carbon increases as  $\text{CH}_3\text{—CH}_2\text{—COOH}$  (4.88),  $\text{CH}_2\text{=CH—COOH}$  (4.25),  $\text{HC}\equiv\text{C—COOH}$  (1.84). What is the orbital responsible for this contribution?

- (a) *p*-orbital ( )  
 (b) *s*-orbital ( )  
 (c) *d*-orbital ( )  
 (d) *f*-orbital ( )

3. What is the following compound?



- (a) Meso compound ( )  
 (b) Diastereoisomer ( )  
 (c) Racemic mixture ( )  
 (d) Enantiomer ( )

4. What is the most stable form of conformer?

- (a) Eclipsed ( )  
 (b) Gauche ( )  
 (c) Staggered ( )  
 (d) None of the above ( )

5. Nucleophilic substitution reaction with initial ionisation is

(a)  $S_N2$  ( )

(b)  $S_N1$  ( )

(c)  $S_Ni$  ( )

(d)  $E_1$  ( )



SECTION—II

( Marks : 15 )

Answer the following questions :

3×5=15

1. Why does intermolecular hydrogen bonding lower the boiling point? Show hydrogen bonding for *p*-nitrophenol (structure given below) :



2. What is inductive effect? Explain the role of inductive effect in  $\text{CH}_3\text{OH}$  or  $\text{CH}_3\text{Cl}$ .

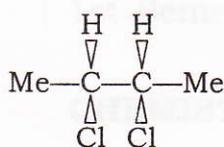
3. What is chiral molecule? How will you know a chiral molecule from its enantiomer?

Answer the following questions :

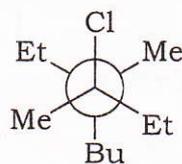
1. Why does intermolecular hydrogen bonding lower the boiling point? Show hydrogen bonding for *p*-nitrophenol (structure given below) :



4. Draw the Newman projection formula for structure (A) and the wedge formula for structure (B) :

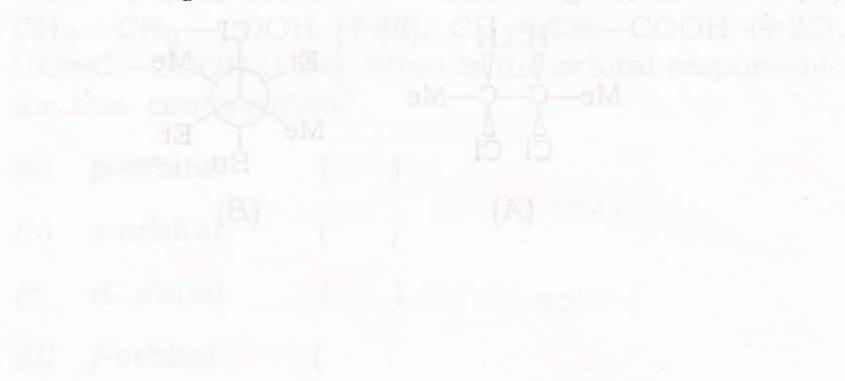


(A)

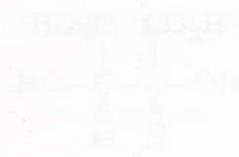


(B)

5. What is the stereochemical outcome for  $S_N1$  reaction? Give example.



3. What is the following compound?



- (a) Meso compound
- (b) Diastereoisomer
- (c) Racemic mixture
- (d) Enantiomer

4. What is the most stable form of conformer?

- (a) Eclipsed
- (b) Gauche
- (c) Staggered
- (d) None of the above \*\*\*