

**2019/TDC/ODD/SEM/CHMDSC/  
CHMGE-101T/132**

**TDC (CBCS) Odd Semester Exam., 2019**

**CHEMISTRY  
( 1st Semester )**

Course No. : CHMDSC/CHMGE-101T

**( Atomic Structure, Bonding, General Organic  
Chemistry, Aliphatic Hydrocarbons and  
Aromatic Hydrocarbons )**

Full Marks : 50

Pass Marks : 20

Time : 3 hours

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

**SECTION—A  
( Inorganic Chemistry )**

**UNIT—I**

1. Answer any *three* questions from the following : 1×3=3

(a) How many orientations possible for *p*- and *f*-subshells?

(b) How many nodal planes are possible in 3s-orbital?

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- (c) Write the possible quantum numbers for an electron present in 3p-orbital.
- (d) Write the stable electronic configuration of chromium atom.

2. Answer any *one* question from the following : 2

- (a) Derive the de Broglie equation for a particle of mass  $m$ , moving with velocity  $v$ .
- (b) Write the significance of  $\psi$  and  $\psi^2$  with respect to Schrödinger equation for hydrogen atom.

3. Answer any *one* question from the following : 5

- (a) (i) What is meant by Pauli's exclusion principle? 1
- (ii) Explain how Pauli's principle rule out of the existence of more than two electrons in an orbital. 2
- (iii) Draw the radial probability distribution curves for 1s- and 2s-electrons respectively.  $1+1=2$
- (b) (i) The five real wave functions of d-orbitals are  $d_{z^2}$ ,  $d_{xz}$ ,  $d_{yz}$ ,  $d_{x^2-y^2}$  and  $d_{xy}$ . Draw the 3-D solid curves for these orbitals. How many radial nodes are possible in 3d-orbital?

$$(\frac{1}{2} \times 5) + \frac{1}{2} = 3$$

( Continued )

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- (ii) Explain the extra stability of exactly half-filled and completely filled orbitals.

2

## UNIT—II

4. Answer any *three* questions from the following :  $1 \times 3 = 3$

- (a) Why the dipole moment of  $\text{CO}_2$  molecule is zero?
- (b) Why does  $\text{He}_2$  not exist?
- (c) Choose the molecule which possesses regular geometry :  
 $\text{NH}_3, \text{H}_2\text{O}, \text{CH}_4, \text{H}_2\text{S}$

- (d) Fill in the blank :  
Bonding MO has energy \_\_\_\_\_ than anti-bonding MO.

5. Answer any *one* question from the following : 2

- (a) AgF is fairly soluble in water, whereas AgCl is sparingly soluble. Justify.
- (b) Draw the MO diagram of  $\text{N}_2$  molecule and calculate the bond order.  $1\frac{1}{2} + \frac{1}{2} = 2$

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( Turn Over )

6. Answer any *one* question from the following : 5

(a) (i) Discuss the structure of  $\text{ClF}_3$  on the basis of VSEPR theory. 2

(ii) What is hybridization? Show the orbital overlapping of the C—C and C—H bonds in ethene molecule.

1+2=3

(b) Define lattice energy. Explain how the lattice energy of NaF can be calculated with the help of Born-Haber cycle. 1+4=5

### SECTION—B

### ( Organic Chemistry )

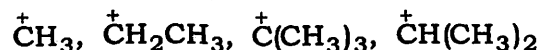
### UNIT—III

7. Answer any *three* questions from the following : 1×3=3

(a) Out of formic acid and acetic acid, which one is more acidic and why?

(b) What is the type of hybridization of central atom in chloromethane?

(c) Arrange in increasing order of stability of the following species :



(d) Out of toluene and nitrobenzene, which one is more reactive towards electrophilic substitution reaction?

8. Answer any *one* question from the following : 2

(a) Benzyl cation is a stable intermediate of many benzyl compounds in organic chemistry. Explain why benzyl cation shows more stability.

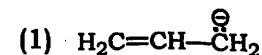
(b) Phenols are more acidic than aliphatic alcohols. With the help of the concept of resonance, explain why phenols are more acidic than aliphatic alcohols.

9. Answer any *one* question from the following : 5

(a) (i) Cyclopentene is a non-aromatic hydrocarbon. However, cyclopentadienyl anion shows aromaticity. Justify. 2

(ii) Why free radicals show paramagnetic behaviour? 1

(iii) Out of the following carbanions, which one is more stable? Explain with suitable reasons : 1+1=2

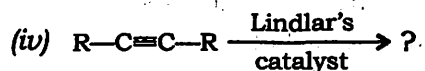
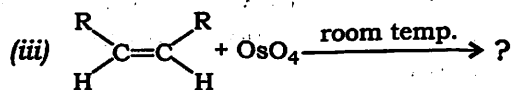
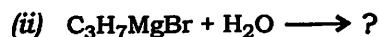
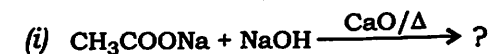


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- (b) (i) Explain Lewis concept of acids and bases.  $1+1=2$
- (ii) What are electrophiles and nucleophiles?  $1+1=2$
- (iii) Explain the stability of tropylium ion  $\left(\text{C}_7\text{H}_7^+\right)$  with the help of the concept of resonance. 1

## UNIT—IV

10. Identify the major organic product from any three of the following :  $1 \times 3 = 3$

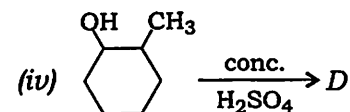
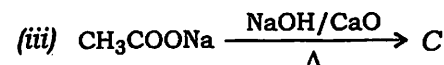
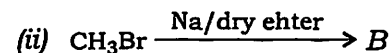
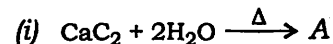


11. Answer any one question from the following : 2

- (a) Show the mechanism of addition of bromine to alkene. Comment on the stereochemistry of the reaction.  $1+1=2$

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- (b) Identify the organic compounds A, B, C, D formed by the following reactions :

 $\frac{1}{2} \times 4 = 2$ 

12. Answer any one question from the following : 5

- (a) (i) Wurtz reaction normally leads to the formation of hydrocarbons having even number carbons. Write the reactions involved in the preparation of ethane, and butane by this reaction. How can you prepare propane (odd no. carbon) by this method? Show only the reactions.  $1+1+1=3$

- (ii) Identify A and B of the following :

 $1+1=2$ 

- (b) (i) Identify A and B of the following :  
1+1=2

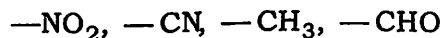


- (ii) Dehydration of neopentyl alcohol  $[(\text{CH}_3)_3\text{C}-\text{CH}_2\text{OH}]$ , in acidic medium gives two alkenes. Figure out the major product and show the mechanism of formation of it. 1+2=3

## UNIT—V

13. Answer any *three* questions from the following :  
1×3=3

- (a) Identify the *ortho*- and *para*-directing groups in electrophilic substitution of benzene derivative from the following :



- (b) What is nitrating mixture?
- (c) Give one example of non-benzenoid aromatic compound.
- (d) What happens when phenol is treated with zinc dust?

14. Answer any *one* question from the following : 2

- (a) Benzene prefers electrophilic substitution reaction. Justify with suitable example and show the mechanism of the reaction involved.

- (b) How can you convert benzene to acetophenone? What is the name of this reaction?  
1+1=2

15. Answer any *one* question from the following : 5

- (a) (i) Friedel-Crafts reaction has immense industrial applications. Write the mechanism involved in the Friedel-Crafts alkylation of benzene to toluene. 2

- (ii) When the above product (toluene) is subjected to oxidation in acidic  $\text{KMnO}_4$  solution, one acid is formed. Write the reaction involved in this conversion. 1

- (iii) Toluene undergoes nitration much easier than benzene. Explain with suitable reasons. 2

- (b) (i) Write the mechanism of sulphonation of benzene. 2

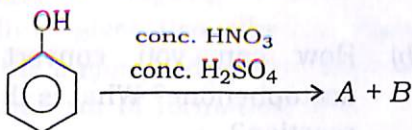
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(ii) What happens when benzoic acid is heated with soda lime? (Write the reaction only)

1

(iii) Identify A and B in the following reaction !

2



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