



## 2018/TDC/ODD/CHMG-101(T)/079

**TDC (CBCS) Odd Semester Exam., 2018**

### CHEMISTRY

**( 1st Semester )**

Course No. : CHMGEC-101 T/CHMDSC-101 T

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

Full Marks : 50

Pass Marks : 20

Time : 3 hours

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

#### SECTION—A

#### UNIT—I

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

(a) Write the expression for the time independent Schrödinger equation.

(b) Write the values of  $n$  and  $l$  for  $3d$ -orbital.



- (c) Write the electronic configuration of  $\text{Cu}^+$  ion.
- (d) What does magnetic quantum number signify?

2. Answer any one question from the following : 2

- (a) What is exchange energy? Write its significance.  $1+1=2$
- (b) If the velocity of an electron in Bohr's first orbit is  $2.19 \times 10^6 \text{ m-s}^{-1}$ , calculate the de Broglie wavelength associated with it. 2

3. Answer any one question from the following : 5

- (a) (i) Draw the radial probability distribution curves for 1s and 2s electrons. What observations are made from the graphs?  $2+2=4$
- (ii) What is nodal point? 1
- (b) (i) Write the significance of  $\psi$  in Schrödinger equation. 2
- (ii) Write the essential conditions to be fulfilled by  $\psi$  to become an well-behaved wave function. 2
- (iii) What is meant by dual nature of particles in motion? 1

UNIT—II

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

- (a) Which of the following species is diamagnetic in nature?
  - (i)  $\text{H}_2$
  - (ii)  $\text{H}_2^+$
  - (iii)  $\text{H}_2$
  - (iv)  $\text{He}_2^+$

(b)  $\text{CO}_2$  has zero dipole moment. Justify.

(c) Fill in the blanks :

According to Fajan's rules, covalent bonding is favoured by \_\_\_\_\_ cations and \_\_\_\_\_ anions.

(d) Draw the molecular orbitals obtained by the overlapping of two 1s atomic orbitals.

5. Answer any one question from the following : 2

- (a)  $\text{AlCl}_3$  is mostly covalent while  $\text{AlF}_3$  is mostly ionic. Explain. 2
- (b) (i) What is lattice energy? 1
- (ii) Mention two factors on which the solubility of a solid in a solvent depends. 1



6. Answer any one question from the following :

- (a) (i) Write the basic features of LCAO. 5  
 (ii) Bond dissociation energy of  $N_2$  molecule is higher than that of  $O_2$  molecule. Explain the observation using MOT. 2
- (b) Describe Born-Haber cycle to calculate the lattice energy of a solid. 3

### SECTION—B

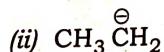
#### UNIT—III

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

- (a) Which of the following is more nucleophilic and why?



- (b) Which of the following carbanion is more stable and why?



- (c) Why is ethanoic acid weaker than methanoic acid? 2
- (d) Carbon tetrachloride has zero dipole moment. Explain. 2

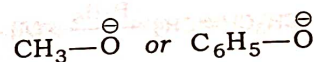
8. Answer any one question from the following : 2

- (a) What is resonance? Draw the resonance structure of  $CH_3CO_2H$ . 1+1=2

- (b) Distinguish between inductive effect and resonance. 2

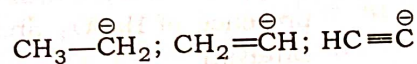
9. Answer any one question from the following : 5

- (a) (i) Which of the following ions is more stable? Give reasons for your choice : 1+2=3



- (ii) What are electrophiles and nucleophiles? Give one example each of a neutral nucleophile and a neutral electrophile. 1+1=2

- (b) (i) Compare the stability of the following species giving proper reasons : 3





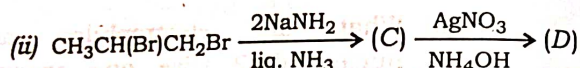
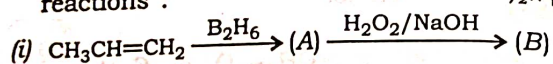
- (ii) Why is C—C bond distance in benzene intermediate between C—C bond distance in ethane and ethene? 2

## UNIT—IV

10. How can you prepare the following (any three)? 1×3=3
- Ethane from sodium propionate
  - Benzene from ethyne
  - Ethene from ethanol
  - Ethane from bromomethane

11. Answer any one question from the following : 2

- (a) Identify A, B, C and D in the following reactions :  $\frac{1}{2} \times 4 = 2$



- (b) What happens when (write equation only)—

(i) 2-methylpropene is treated with  $\text{Cl}_2$  and water;

(ii) propyne is treated with water in the presence of  $\text{H}_2\text{SO}_4$  and  $\text{HgSO}_4$  as catalyst? 1+1=2

12. Answer any one question from the following : 5

(a) (i) State and justify Markownikoff's rule choosing a suitable reaction as an example and depicting the mechanism of the reaction. // 1+2=3

(ii) Convert (x) propyne into 2,2-dibromopropane and (y) 2-bromobutane to but-2-ene. 1+1=2

(b) (i) Convert but-1-ene into 1-bromobutane. 1½

(ii) Convert ethyne into glyoxal. 1½

(iii) State Saytzeff rule and give one example of a reaction where product formation follows Saytzeff rule. 1+1=2

## UNIT—V

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

(a) Suggest the name of a Lewis acid other than anhydrous aluminium chloride which can be used during ethylation of benzene.

(b) *tert*-Butyl benzene ( $\text{C}_6\text{H}_5-\text{C}(\text{CH}_3)_3$ ) does not give benzoic acid on oxidation with acidic  $\text{KMnO}_4$ . Why?

(c) What is the role of catalyst in the electrophilic substitution reactions in benzene?



(d) In monoalkylation of benzene with a haloalkane and  $\text{AlCl}_3$ , an excess of benzene is used. Why?

14. Answer any one question from the following :

(a) Why does benzene undergo electrophilic substitution reactions instead of electrophilic addition reactions?

(b) What is Friedel-Craft alkylation reaction? Give an example. What are the limitations of this reaction?

15. Answer any one question from the following :

(a) (i) Write the mechanism, including generation of electrophile, of nitration of benzene with acid mixture.

(ii) What happens when sodium benzoate is heated with soda lime? (Write equation.)

(b) (i) What is electrophile in sulphonation of benzene? Write the mechanism of the reaction involving generation of this electrophile and its subsequent reaction in sulphonation of benzene.

(ii) How can you convert benzene to acetophenone? (Write equation.)

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