

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.

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(Turn Over)



(c) Write the electronic configuration of 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 ψ in Schrödinger equation. 2

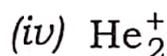
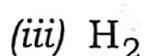
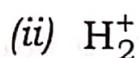
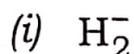
(ii) Write the essential conditions to be fulfilled by ψ to become an well-behaved wave function. 2

(iii) What is meant by dual nature of particles in motion? 1

UNIT—II

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

(a) Which of the following species is diamagnetic in nature?



(b) 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) $AlCl_3$ is mostly covalent while 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 : 5
- (a) (i) Write the basic features of LCAO. 2
(ii) Bond dissociation energy of N_2 molecule is higher than that of O_2 molecule. Explain the observation using MOT. 3
- (b) Describe Born-Haber cycle to calculate the lattice energy of a solid. 5

SECTION—B

UNIT—III

7. Answer any *three* questions from the following : $1 \times 3 = 3$
- (a) Which of the following is more nucleophilic and why?
- (i) $\ominus NH_2$
- (ii) $\ominus OH$
- (b) Which of the following carbanion is more stable and why?
- (i) $\ominus CH_3$
- (ii) $CH_3 \ominus CH_2$

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(Continued)



(c) Why is ethanoic acid weaker than methanoic acid?

(d) Carbon tetrachloride has zero dipole moment. Explain.

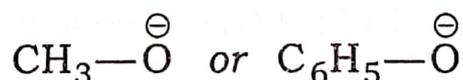
8. Answer any *one* question from the following : 2

(a) What is resonance? Draw the resonance structure of $\text{CH}_3\text{CO}_2\text{H}$. 1+1=2

(b) Distinguish between inductive effect and resonance. 2

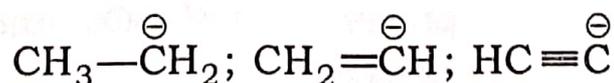
9. Answer any *one* question from the following : 5

(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

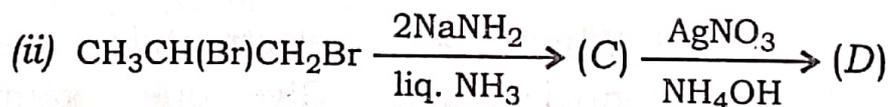
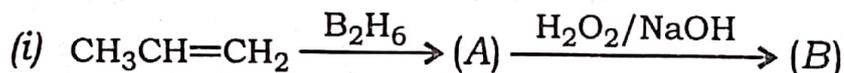
UNIT—IV

10. How can you prepare the following (any three)? $1 \times 3 = 3$

- (a) Ethane from sodium propionate
 (b) Benzene from ethyne
 (c) Ethene from ethanol
 (d) 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 Cl_2 and water;

(ii) propyne is treated with water in the presence of H_2SO_4 and 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 ($C_6H_5-C(CH_3)_3$) does not give benzoic acid on oxidation with acidic $KMnO_4$. Why?

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

(d) In monoalkylation of benzene with a haloalkane and AlCl_3 an excess of benzene is used. Why?

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

(a) Why does benzene undergo electrophilic substitution reactions instead of electrophilic addition reactions? 2

(b) What is Friedel-Craft alkylation reaction? Give an example. What are the limitations of this reaction? 1+1=2

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

(a) (i) Write the mechanism, including generation of electrophile, of nitration of benzene with acid mixture. 4

(ii) What happens when sodium benzoate is heated with soda lime? (Write equation.) 1

(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. 4

(ii) How can you convert benzene to acetophenone? (Write equation.) 1
