

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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- (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

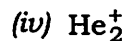
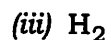
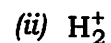
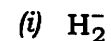
- (a) (i) Draw the radial probability distribution curves for 1s and 2s electrons. What observations are made from the graphs? 2+2=4
- (ii) What is nodal point? 1
- (b) (i) Write the significance of ψ in Schrödinger equation. 2
- (ii) Write the essential conditions to be fulfilled by ψ to become an well-behaved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

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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

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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

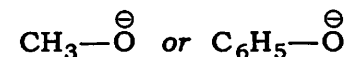
SECTION—B

UNIT—III

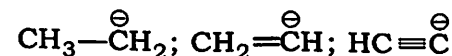
7. Answer any *three* questions from the following : $1 \times 3 = 3$
- (a) Which of the following is more nucleophilic and why?
- (i) NH_2^-
- (ii) OH^-
- (b) Which of the following carbanion is more stable and why?
- (i) CH_3^-
- (ii) CH_3CH_2^-

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- (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



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

2

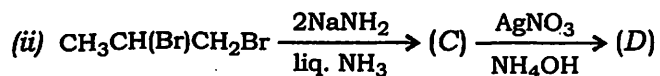
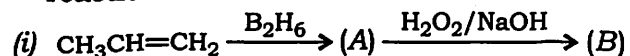
UNIT—IV

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

- (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

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(Continued)

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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 KMnO_4 . Why?
(c) What is the role of catalyst in the electrophilic substitution reactions in benzene?

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(Turn Over)

- (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
