

Roll No.

OLE-3006

B. Tech. 1st Semester (Common for All Branches)

Examination – April, 2021

CHEMISTRY - I

Paper : BSC-CH-101-G

Time : Three Hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) Calculate the effective nuclear charge experienced by 4s electron of potassium. $2.5 \times 6 = 15$
- (b) What is the effect of solvent polarity on various transitions in UV spectroscopy ?
- (c) Give significance of Vander Waal's constants *a* and *b*.

- (d) Why electron affinity of fluorine is less than chlorine ?
- (e) Define Vander Waal's radii. Why they are larger than covalent radii ?
- (f) Differentiate between Metamers and Enantiomers.

UNIT – I

- 2. (a) Explain the role of doping on band structures. 4
- (b) Draw energy level diagram for NO molecule. Predict its bond order. 4
- (c) Explain why the size of a cation is always smaller while that of an anion is always larger than the size of corresponding atom ? 3
- (d) Discuss various factors on which electron affinity depends. The Electron affinity for nitrogen is negative. Why ? 4
- 3. (a) Define operators, Hamiltonian operators, eigen values and eigen functions ? Write an expression for Schrodinger wave equation. 5

- (b) Write short note on Crystal field splitting in octahedral complexes. 5
- (c) Predict the bond order by drawing energy level diagram for CO molecule. 5

UNIT – II

4. (a) Which of the following alkane can exhibit optical activity ? And Why ? 2
- (i) Neopentane
 - (ii) Isopentane
 - (iii) 3-Methylpentane
 - (iv) 3-Methylhexane
- (b) Which of the following factor can make difference in optical isomers and how ? 2
- (i) heat
 - (ii) temperature
 - (iii) polarized light
 - (iv) pressure

- (c) How do rearrangement reactions differ from isomerization reactions ? Illustrate your answer with suitable examples. 4
- (d) Give a method of synthesis of Paracetamol. 2
- (e) Discuss a method used for resolving a racemic mixture into optically active compounds. 2
- (f) What are different intermediate organic species ? Discuss their stabilities. 3
- 5.** (a) Comment upon 'Elimination versus substitution'. 5
- (b) Which among the following shows geometrical isomerism: 2-butene, 2-methyl-2-butene, 2-pentene, 1,2-dichloropropane ? 2
- (c) Can optical isomerism be possible in a compound having no chiral carbon ? Explain giving two suitable examples. 2
- (d) Differentiate between an intermediate and transition state. 3
- (e) Give a method of synthesis of Aspirin. 3

UNIT – III

6. (a) The hardness of 50,000 litres of a sample of water was removed by passing it through a zeolite softener. The softener then required 200 litres of sodium chloride solution containing 150g/litre of NaCl for regeneration. Calculate the hardness of sample of water. 5
- (b) Derive Van der Waal's equation. 3
- (c) What is excluded volume or co-volume ? How is it related to the actual volume of the gas molecules ? 5
- (d) Write a short note on Differential aeration corrosion. 2
7. (a) An exhausted zeolite softener was regenerated by passing 150 litres of sodium chloride solution containing 150g/litre of NaCl. If the hardness of sample of water is 600 ppm, calculate the total volume of water that is softened by this softener. 5

- (b) Though aluminium has high E_{Ox} (standard oxidation potential) than iron, yet aluminium corrodes to a much small extent. Explain. 2
- (c) What are critical constants ? Explain the methods for the measurement of critical constants. 5
- (d) Derive the relation between Boyle's temperature and van der Waal's constants. 3

UNIT – IV

8. (a) What is the effect of solvent polarity on various transitions in UV spectroscopy ? 4
- (b) Most absorption bands in the Visible-UV spectra are very broad. Give reason. 4
- (c) HCl is both IR and Raman active, but H_2 and Cl_2 are not. Explain. 3
- (d) Explain the technique involved in IR spectrometer for the analysis of carbon monoxide in the atmosphere. 4
9. (a) What information is carried by a NMR spectrum ? Explain. 5

- (b) Why spectroscopic methods are better than the classical methods ? 3
- (c) Why molecules absorb in UV-Visible region ? What are the types of electronic transitions that can occur in a molecule? Discuss by giving examples. 7
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