(i) Printed Pages : 4] Roll No. .....

(ii) Questions : 9] **Sub. Code :** 0 9 6 2

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B.Sc. (Hons.) 1st Semester Examination

1127

BIOTECHNOLOGY

(Chemistry)

Paper : BIOT-Sem-I-IV-T

Time : 3 Hours] **[Max. Marks : 67**

Note :– Attempt *five* questions in all, choosing any *two* questions from Section A and B each. Section C is compulsory. All questions carry equal marks in Section A and B.

Section–A

1. (a) Define H-bonding. Discuss different types of H-bonding and conditions for forming H-bonds.

   (b) Using VSEPR theory show that ICl_2^- is linear while ClF_3 is T-shaped.

   (c) Which of the following pairs is expected to have a larger size and why ?

   (i) O, O^{-2}

   (ii) Li^+, Be^{2+} 5,6,4

2. (a) Differentiate between the following with examples :

(i) Absorption and emission spectroscopy.

(ii) NMR and mass spectra.

(b) Explain the principle of IR spectroscopy. How will you differentiate between CH_3OCH_3 and CH_3CH_2OH on the basis of their absorption signals ? 8,7

3. (a) The vapour pressure of 2% of an aqueous solution of a non-electrolyte at 100°C is 755 mm. Calculate the molar mass of the solute.

(b) What are ideal and non-ideal solutions ? Explain with examples as to why some solutions show positive and negative deviations ? 7,8

4. (a) The rate constant of a particular reaction increases 4 times when the temperature changes from 293 K to 313 K. Calculate the energy of activation of such a reaction.

(b) What are the advantages of transition state theory over collision theory ? 8,7

Section–B

5. (a) Explain in detail why the quantum efficiency for the photosynthesis of HBr is very low, i.e., 0.01.

(b) Draw a well labelled Jablonski diagram showing all the internal conversions and intersystem crossing. Explain how they arise ? 8,7

6. (a) Define the following terms with examples :

(i) Denticity

(ii) Coordination number

(iii) Ligand

(b) What are Chelates ? Discuss the factors affecting their stability.

(c) A coordination compound $CrCl_3.6H_2O$ gives precipitates of AgCl with $AgNO_3$ solution. The molar conductance of the resultant solution corresponds to total of three ions. Write the structure and IUPAC name of the compound. 6,5,4

7. (a) Discuss the mechanism of S_N2 reaction and draw the energy profile diagram.

(b) Explain the different types and structure of carbenes.

(c) What are rearrangement reactions ? Give one example each for [1,2]-hydride and [1,2]-methyl shift reactions. 6,4,5

8. (a) Explain the order of acidity of the following carboxylic acids :

$ClCH_2COOH$, $BrCH_2COOH$, CH_3COOH

(b) Give the mechanistic details for Hell-Volhard-Zelinsky reaction. 6,9

Section–C

9. (a) Why do some reactions take place higher temperature and not at room temperature ?

(b) State and explain Raoult's law.

(c) How does the addition of a catalyst affect the rate of the equilibrium constant ?

(d) Define Lambert-Beer law.

(e) Arrange the following in order of decreasing stability :

$^+CH(CH_3)_2$, $^+CH_2CH_3$, $^+CH_3$, $^+C(CH_3)_3$

(f) Explain the importance of stability of the corboxylate anion on the acidic strength of carboxylic acids.

(g) Give the IUPAC name for $[Cu(NH_3)_4][Cr(Cl)_4]$.

1×7=7