

2021

BIOCHEMISTRY — HONOURS

Paper : CC-2

Full Marks : 50

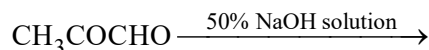
*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer **any five** questions : 2×5
 - (a) Find out the ground state term symbol for fluorine atom and fluoride ion. Which of these you consider to be more stable and why?
 - (b) On the basis of VSEPR theory, write down the most favoured structure of ClF_3 . Justify your answer.
 - (c) What do you mean by coordination number? Mention two factors that influence coordination number.
 - (d) Define half-life and average-life of a radioactive element. Establish the relation between them.
 - (e) Write down two applications of radioisotopes in medicine.
 - (f) Draw the energy profile diagram for an $\text{S}_{\text{N}}1$ reaction.
 - (g) How can you prepare CH_3COOH using a Grignard Reagent?
 - (h) Explain why dry HCl is used in the formation of acetals.
 - (i) Write down the products of ozonolysis of $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_2 - \text{CH} = \text{CH}_2$.
 - (j) Write down the names and structures of one purine and one pyrimidine base found in nucleic acids.
2. Answer **any two** questions :
 - (a) Define 'lattice energy' of an ionic solid. Draw the Born-Haber cycle for the calculation of Lattice Energy of NaCl . 2+3
 - (b)
 - (i) Distinguish between 'double salts' and 'complex salts' with appropriate illustrations.
 - (ii) Explain Werner's theory of coordination compounds with suitable examples. 2+3
 - (c) Explain why :
 - (i) Tropylium bromide gives a precipitate with AgNO_3 solution.
 - (ii) Guanidine is a strong mono-acidic base. 2½+2½
 - (d)
 - (i) Draw the chair and boat conformations of cyclohexane showing all the types of C – H bonds. Compare their stability.
 - (ii) Draw Fischer projection, Newman projection formula of *Meso* - 2, 3 - dihydroxybutane. 3+2

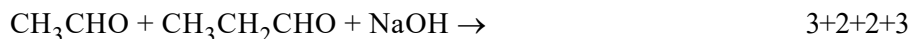
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3. Answer *any three* questions :

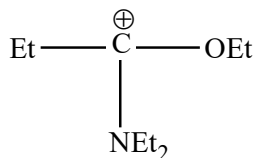
- (a) (i) Write down the names and draw the structures of the possible isomers of the coordination complex of formula $[\text{Co}(\text{en})_2\text{Cl}_2]$, where en = ethylene diamine.
- (ii) On the basis of VBT predict the structure of SO_4^{2-} , ClF_3 , SO_2F_2 .
- (iii) Differentiate between ambidentate and polydentate ligands giving suitable examples of each. 3+3+4
- (b) (i) What are the 'Radius Ratio rules'? What information can be obtained from them? What are the limitations of the Radius Ratio rules?
- (ii) Define formal charge. Draw the Lewis structure of carbonate ion and calculate the formal charge on each atom. (2+2+1)+(2+3)
- (c) (i) What do you mean by 'nuclear binding energy' and 'mass defect'?
- (ii) State the Radioactive Decay Law and give the physical significance of the decay constant.
- (iii) The half-life period of a radioactive isotope is 53300 seconds. Find out the time required in minutes for the element to reduce to 10% of its initial amount. (2+2)+3+3
- (d) (i) Compare the basicities of pyrrole and pyridine with justification.
- (ii) Compare the rates of nucleophilic addition to CH_2O , CH_3CHO , CH_3COCH_3 . Explain your answer.
- (iii) Give the product with mechanism for the following reaction :



- (iv) Write the products of Aldol condensation :

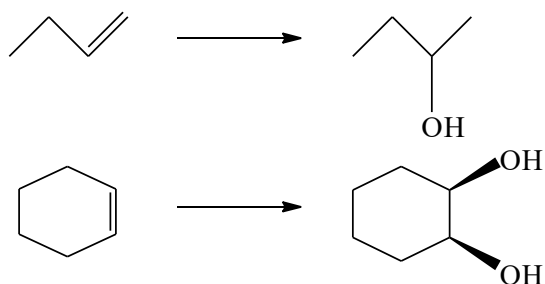


- (e) (i) Explain the difference between configuration and conformation.
- (ii) Draw the energy diagram of *n*-butane as a function of rotation about the $\text{C}_2 - \text{C}_3$ bond and label the maxima and minima with proper conformations.
- (iii) Write down a Fischer projection formula for each enantiomer of 3-methylpent-1-ene and specify the chiral centre of each as R or S. Draw the corresponding flying wedge formula for each enantiomer.
- (iv) Write the canonical forms of the following cation and indicate with reason the most contributing one.



2+3+3+2

- (f) (i) $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{SEt}$ and $\text{CH}_3\text{CH}(\text{SEt})\text{CH}_2\text{OH}$ give the same products when treated with dry HCl . Write the products and explain their formation.
- (ii) What is the stereoelectronic requirement of an $\text{S}_{\text{N}}2$ reaction? Explain why *neo*-pentyl bromide cannot undergo an $\text{S}_{\text{N}}2$ displacement.
- (iii) How can you carry out the following conversions?



- (iv) Write a short note on Friedel-Crafts Reactions. Why is nitrobenzene used as a solvent in Friedel-Crafts alkylation reactions?

3+2+2+3
