2021

BIOCHEMISTRY — HONOURS

Paper : CC-5

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.

Group - A

1. Answer ***any five*** questions : 2×5

(a) Why glass cuvettes are not used in UV spectroscopy?

(b) What is buffer capacity? How does the buffer concentration influence its buffer capacity?

(c) Addition of NaOH to 4-nitrophenol deepens its colour. Explain with proper reasoning.

(d) What is hydrophobic effect? How does it account for protein stability in biological solvent?

(e) Why do sample solutions of high concentrations deviate from the linearity of Beer-Lambert's law?

(f) What factors affect fluorescence life time?

(g) What is molar extinction coefficient? On what factors does it depend?

(h) Between the nuclei C^{12} and C^{13}, which is NMR active and why?

(i) What is viscosity coefficient? State its S.I. unit.

(j) Distinguish between dynamic and static quenching.

Group - B

Answer ***any two*** questions.

2. (a) Which of the following molecules will be IR active during symmetric stretching and why?

(i) N_2 (ii) NO.

(b) 'Absorption spectra are generally broad unlike NMR peaks which are sharp'— Justify the statement. (1½×2)+2

3. (a) What is isoelectric point?

(b) Comment on the solubility of an amino acid at its isoelectric point.

(c) The titration curve of the amino acid glycine (with NaOH) shows pH values of 2.34 and 9.60 at 25% and 75% progression of the titration respectively. Calculate the isoelectric point of glycine. 1+2+2

4. (a) What is stretching frequency? On what factors does it depend?

(b) The H atoms in benzene absorb 436 Hz more than the reference compound in a 60 MHz ^{1}H-NMR spectrophotometer. Calculate the chemical shift of the benzene protons. 2+3

Please Turn Over

Group - C

Answer ***any three*** questions.

5. (a) How can DNA melting be followed spectroscopically?

(b) The peptide bonds in proteins show a strong absorption at 190 nm and a weak one between 210-220 nm. Comment on the occurrence and intensities of these bands.

(c) A compound X (molar mass = 220) shows an absorption maximum of 1.30 at 230 nm with an extinction coefficient of 10,000 units. Calculate its concentration in gL^{-1}.

(d) How can α-helices be distinguished from β-sheet spectroscopically? 2+3+3+2

6. (a) What is 'Zero-Point Energy'?

(b) Which is an essential requirement for fluorescence resonance energy transfer, FRET to occur? What parameters affect FRET?

(c) Draw the proton NMR spectrum of the following compound showing the multiplicity of each bond. CH_3 — CH_2 — Br. 2+(2+2)+4

7. (a) What is Stern-Volmer constant? How can it be measured experimentally?

(b) What is quantum yield? Why is its value typically lesser than unity?

(c) The Ramachandran plot for polyglycine shows more allowed regions than for any other amino acid. Explain.

(d) Why is the lifetime of phosphorescence much higher than that of fluorescence? (1+2)+2+3+2

8. (a) Draw a simplified ^{1}H-NMR pattern for the compound 1,3-dichloro propane showing the relative intensity and multiplicity of each band.

(b) State the units of flux and diffusion coefficient. How does the diffusion coefficient for a solute-solvent pair vary with temperature?

(c) Calculate the decrease in the flow rate of a solution through a capillary tube, if its radius is reduced by 5% of its initial value. 3+(2+2)+3

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