

2020

**BIOCHEMISTRY — HONOURS**

**Paper : SEC-A-1**

**(Tools & Techniques in Biochemistry)**

**Full Marks : 80**

*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 ten** questions : 2×10
- (a) How many grams of glycine are there present in 10 ml of a 20 mmol/lit solution?  
(M.W of glycine = 75 g)
  - (b) How would you prepare 10 ml of 0.8 mg/ml BSA solution in water from an aqueous 100 ml 10 mg/ml solution of it?
  - (c) What do you mean by pH? Determine the pH of a 0.01 N NaOH solution.
  - (d) What is the value of neutral pH of boiling water where  $K_w$  of it is given as  $1 \times 10^{-13}$ ? Is it acidic in nature? Comment on your answer.
  - (e) Calculate  $[H_3O]^+$  and  $[OH^-]$  concentrations of human blood having pH = 7.4.
  - (f) Will the pH of a  $10^{-8}$  M HCl solution be 8? Give reason for your answer.
  - (g) What are auxochromes? Mention their significance.
  - (h) What do you mean by hyperchromism and hypochromism in absorption uv-visible spectroscopy?
  - (i) What spectral measurement would you make to distinguish 1 mM solutions of tyrosine and isoleucine?
  - (j) What is the full form of BCA assay? Mention its use.
  - (k) State mathematical expression of Lambert Beer Law. Explain the terms involved therein.
  - (l) What do you mean by extrinsic fluors?
  - (m) What is the full form of MSDS? What is its utility?
2. Answer **any four** questions :
- (a) What is Folin-ciocalteau reagent? Protein itself absorbs in uv region but in presence of it the maximum absorption occurs in visible region – Why? By using this reagent how would you determine the concentration of protein solution? 1+2+2
  - (b) Discuss the biological hazards one may face when working in a biochemical laboratory and also discuss the safety practices one should keep to avoid the risk of such hazards. 3+2
  - (c) What is buffer solution? Give examples of an acidic and a basic buffer. Also mention one biological buffer. How does an acidic buffer work? 1+1+1+2

**Please Turn Over**

- (d) What is the pH of a mixture of 5 ml 0.1 M sodium acetate and 4 ml 0.1 M acetic acid? How is the pH changed on adding 1 ml 0.1 M HCl to the above mixture? Comment on your answer. ( $K_a$  of the acid =  $1.8 \times 10^{-5}$  at 25°C) 2+2+1
- (e) Mention the significance of molar absorptivity. On which factors does it depend? On passing monochromatic light through a solution of 0.004 M in a cell of 2 mm thick, the intensity of transmitted light was reduced by 50%. Calculate the molar absorptivity. 1+1+3

3. Answer **any four** questions :

- (a) (i) Draw a simple schematic block diagram of the instrumentation used in a double beam uv-visible spectrophotometer. Mention the name of light sources used in uv-visible spectrophotometer.
- (ii) Why are the absorbance measurements generally taken in the range of 0 to 1.0 scale? Why is a “baseline correction” important in uv-visible absorption spectroscopy? How is this done? (3+2)+(2+1½+1½)
- (b) (i) Why does a nucleic acid exhibit uv-visible spectra? What happens if a DNA is denatured at high temperature? Give a suitable plot for explanation.
- (ii) How can you follow the melting of DNA using uv-vis spectroscopy? “Conjugated dienes show absorption maximum at longer wavelengths than isolated alkenes.” —Justify the statement. (2+3)+(3+2)
- (c) (i) What is fluorescence? Draw the Jablonski diagram to explain fluorescence.
- (ii) Discuss about the major types of ELISA tests. (2+3)+5
- (d) (i) Name three important amino acids responsible for protein fluorescence. What do you mean by ‘quantum yield’ and ‘fluorescence quenching’?
- (ii) If a solution of pH 2 is mixed with an equal volume of pH 5, what will be the pH of the resulting solution? (3+4)+3
- (e) (i) What are the advantages of pH metric titration over normal acid base titration? Give the construction of a glass electrode and also derive the expression for the electrode potential of it.
- (ii) State Henderson Hasselbalch equation in case of a basic buffer. Hence calculate the pH of the buffer containing 0.04 M  $\text{NH}_4\text{Cl}$  and 0.02M  $\text{NH}_4\text{OH}$ . [Given  $K_b$  for  $\text{NH}_4\text{OH} = 2.0 \times 10^{-5}$ ] (2+1+3)+(2+2)
- (f) (i) What conditions must be maintained while storing biological samples?
- (ii) Mention the necessary safety precautions that must be maintained while working in a biochemical laboratory.
- (iii) What do you mean by quantitative transfer of a liquid? State its importance. 3+4+(2+1)
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