

[This question paper contains 6 printed pages.]

997

Your Roll No. ....

**B.Sc. (Hons.) / III**

**C**

**BIOCHEMISTRY – Paper XIII**

(Membrane Biochemistry and Bioenergetics)

(Admissions of 2000 and onwards)

*Time : 3 hours*

*Maximum Marks : 60*

*(Write your Roll No. on the top immediately  
on receipt of this question paper.)*

*Attempt five questions in all, including  
Question No. 1, which is compulsory.*

1. (a) Explain the role of the following :

- (i) Bacteriorhodopsin in *Halobacterium halobrium*
- (ii) Brown fat in new born mammal
- (iii) Extensin protein in plant cell wall
- (iv) Arrestin in visual transduction
- (v) Flippases in membranes

P.T.O.

- (b) Explain why ?
- (i) The electrochemical gradient in chloroplast is almost entirely as a result of pH gradient.
  - (ii) Myelination increases the velocity of impulse conduction.
  - (iii) Oxidative phosphorylation is irreversible.
- (2×8)
2. (a) Explain how the combined evidence from the freeze fracture technique and FRAP technique led to the development of the Fluid mosaic model for membranes.
- (b) Give the function of the following in membranes :
- (i) Caveole
  - (ii) Gap junctions
  - (iii) GP-I anchors
- (5.6)
3. (a) Give the detailed mechanism of transport of  $3\text{Na}^+$  out of the cell and  $2\text{K}^+$  into the cell by  $\text{Na}^+\text{K}^+$  ATPase.
- (b) How is Glucose transported in E.coli via group translocation ?

- (c) The parietal cells of the stomach lining transport  $H^+$  ions from cytosol (pH 7) into the stomach, contributing to the acidity of gastric juice pH 1.0. Calculate the free energy of transport of 1 mol of  $H^+$  through the pump at  $25^\circ C$ ,  $\Delta\psi = 0.05V$  (-ve inside).
- (d) What makes Aquaporins selective channel for water molecules? (3,3,3,2)
4. (a) Why do the following molecules have high free energy of hydrolysis :
- (i) Phosphoenolpyruvate
  - (ii) ATP
- (b) Given the **two** reactions :
- $$\text{Glucose-6-P} + H_2O \rightarrow \text{Glucose} + Pi \quad K'_{eq} = 270$$
- $$\text{ATP} + \text{Glucose} \rightarrow \text{ADP} + \text{Glucose-6-P} \quad K'_{eq} = 890$$
- Using this information calculate the free energy of hydrolysis of ATP at  $25^\circ C$ .
- (c) Give the different mechanisms present in the cell to destroy the Reactive oxygen species (ROS) produced. (3,4,4)

5. (a) Show how the P/O ratio for NADH is dependent on the shuttle system used to transfer cytosolic NADH into the mitochondria for oxidation.
- (b) Show how  $F_0F_1$  ATP synthase catalyses ATP synthesis by rotational catalysis.
- (c) Show how Myxothiazol and Antimycin A have helped in elucidating the electron flow through Complex III via the Q cycle in ETC. (3,5,3)
6. (a) Compare cyclic photophosphorylation and non cyclic photophosphorylation in terms of :
- (i)  $O_2$  evolved
  - (ii) NADH produced
  - (iii) Quantum yield
- (b) What is the functional significance of segregation of PS I and PS II.
- (c) Show how Luciferase enzyme can be used to assay ATP produced.
- (d) Show how water is split by water splitting complex to generate  $O_2$ . (4,3,2,2)

7. (a) Show how ?

(i) Nerve transmission is all or none phenomenon.

(ii) The action potential is transmitted with constant intensity and not diminished with distance.

(b) How do the following neurotoxins act :

(i) Tetrodotoxin

(ii) Botulinus toxin

(iii) Dendrotoxin

(c) Give the sequence of events at the axonic terminal that leads to the exocytosis of the neurotransmitter. (4,3,4)

8. Explain the mechanism how ?

(a) Liposomes can be used as model membrane systems.

(b) Water soluble  $\alpha$  hemolysin forms channel forming toxin.

(c) Tumor cells frequently become simultaneously resistant to several chemotherapeutic drugs.

- (d) Cold blooded animals undergo homeoviscous adaptation when surviving in sub zero temperatures.
- (e) LDL receptor is endocytosed and transported to lysosomes. (2,2,2,2,3)

$$[R = 8.314 \text{ J/mol.K, } F = 96,480 \text{ J/V.mol}]$$