[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 1775 **C** **Roll No.....**

Unique Paper Code : 249401

Name of the Course : B.Sc. (Hons.) Biochemistry

Name of the Paper : Bioenergetics : BCHT-406

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all, including Question No. **1** which is compulsory.
3. Log tables and/or scientific calculators may be provided.

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

   (i) Isoprenoid side chain of Ubiqinone

   (ii) Carotenoids in Photosystem II

   (iii) Bacteriorhodopsin in Halobacterium Halobium

   (iv) Phosphocreatine in skeletal muscle

   (v) Adenine nucleotide translocase in mitochondria

   (b) Give explanation for the following :

   (i) Oxidative phosphorylation is not reversible.

   (ii) Dinitrophenol acts as an uncoupler of oxidative phosphorylation

   (iii) Electrochemical gradient across the thylakoid membrane is almost entirely as a result of pH gradient.

P.T.O.

(iv) Cyanide and carbon mono-oxide both specifically inhibit cytochrome c oxidase but cyanide is more lethal.

(c) Explain why solutions of chlorophyll appear to be green. (10,8,1)

2. (a) What is the difference between Iron-sulfur proteins and Reiske Iron sulphur protein.

(b) Describe the flow of electrons from ubiquinone to cytochromes c. Write down the net equation for the redox reactions of the Q cycle.

(c) How is ATP hydrolysis by F0F1 ATP synthase prevented during Hypoxia ? (6,5,3)

3. (a) Compare the flow of electrons in photosynthetic machinery of purple bacteria and green sulphur bacteria.

(b) Calculate the free energy of hydrolysis of ATP in a rat liver cell in which the ATP, ADP and Pi concentrations are 3.4 mM, 1.3 mM and 4.8 mM respectively.

(c) What are phycobilisomes ? How does the energy of photons absorbed travels to the reaction centre in red algae. (6,4,4)

4. (a) Illustrate the flow of electrons from the supramolecular complex of PS I to $NADP^+$

(b) Calculate the free energy change for the transfer of two electrons from NADH through the respiratory chain to molecular oxygen. The standard reduction potential of NAD^+/NADH and O_2/H_2O redox pairs are –0.320 V and +0.816 V, respectively.

(c) Explain the malate-aspartate shuttle for transporting the reducing equivalents from the cytosol to the mitochondria. (6,4,4)

5. (a) Compare the photosynthetic efficiency of cyclic and non-cyclic photophosphorylation.

(b) What are reactive oxygen species ? How does the cell prevent the oxidative damage ?

(c) Draw the structure of F_0F_1 ATP synthase complex. (6,4,4)

6. (a) What is the chemical basis for the large standard free energy change associated with ATP hydrolysis.

(b) Write a note on dual role of cytochromes b6f and cytochrome C6 in cyanobacteria.

(c) What is energy charge ? How is it buffered ? (4,6,4)

7. (a) Discuss the Peter Mitchell's chemiosmotic theory.

(b) What is the role of thermogenin protein ? What is its significance ?

(c) Write the two half reactions for the oxidation of ferrous ions by cupric ions

$$Fe^{2+} + Cu^{2+} \rightarrow Fe^{3+} + Cu^{+}$$

(d) What are the different electron carriers in complex I of the mitochondrial electron transport chain ? (6,4,2,2)

8. (a) What is the mode of action of the following inhibitors :

(i) Oligomycin

(ii) DCCD

(iii) Atractyloside

(iv) DCMU

P.T.O.

(b) Comment on the following :

(i) Cytochrome c oxidase acts as a proton pump

(ii) Bioluminescence is reverse of photosynthesis (8,6)

R = 8.315 J/Mol.K

F = 96,480 J/V.mol.