2022

(May/June)

BIOTECHNOLOGY

(Honours)

(Biological Chemistry)

Marks : 56

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer Question No. **1** which is compulsory and *any* **four** from the rest

1. *(a)* Write the structures of—

(i) the pentapeptide LEKAT (label the N and C terminal ends and the peptide bonds);

(ii) oleic acid (18:1; Δ^9). 4+3=7

(b) What is the pH of a mixture of 0·65 *M* NaH_2PO_4 and 0·032 *M* Na_2HPO_4 (pK_a = 6·86)? 2

(c) Define the terms Gibbs' free energy (*G*), ethalpy (*H*), entropy (*S*) in the context of biological systems. 3

2. *(a)* Describe the functions of transketolase and transaldolase in the pentose phosphate pathway. 6

   (b) Why do allosteric enzymes show deviations from Michaelis-Menten kinetics? 5

3. Present the sequential reactions of glycolysis using appropriate chemical structures. Write the names of enzymes that catalyze each reaction and indicate the steps where substrate-level phosphorylation occur. 8+3=11

4. *(a)* Draw a schematic diagram of the electron transport chain present in the inner mitochondrial membrane and use it to distinguish between the functions of inhibitors and uncouplers, citing suitable examples under each. 3+6=9

   (b) How do brown fat tissue relate to the above? 2

5. *(a)* Describe the oxidative decarboxylation of pyruvate that is catalyzed by the pyruvate dehydrogenase (PDH) complex, highlighting the roles of coenzymes and vitamins. 9

   (b) Name two dietary sources of each of the vitamins of the PDH complex. 2

(Continued)

6. What is the site of the TCA cycle in animal cells? Write the reactions of this metabolic pathway using chemical structures of intermediates and mention the names of enzymes that catalyze each reaction. What is the relevance of the TCA cycle to oxidative phosphorylation? 1+7+3=11

7. Present a comparative account of the two shuttles that transport reducing equivalents from cytosolic NADH to mitochondrial matrix of animal cells. In which tissues are they located? 10+1=11

8. What is photorespiration? What strategies have C4 plants evolved to avoid photo-respiration? Support your answers with relevant chemical structures and diagrams. 6+5=11

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