Register Number:

Date:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27
M.Sc. CHEMISTRY - III SEMESTER
SEMESTER EXAMINATION: October 2019
CH-9118 - BIOLOGICAL CHEMISTRY

Time- 2 ½ hrs **Max Marks-70**

This paper contains 2 printed pages and three parts and has a total of 17 questions

Part A
Answer any 6 questions, each question carries 2 marks.

1. In non-productive binding why is the ratio of k_{cat}/ K_M unaffected, explain with a suitable example?
2. What are ferredoxins, how are they classified?
3. Why is the hydrolysis of ATP an irreversible process in the living cell?
4. Draw the structures and name the molecules that are formed during the conversion of dimethylallylphosphate to squalene?
5. Give the reaction for the conversion of deoxyhaemerythrin to oxyhaemerythrin clearly indicating the changes occurring at the active site?
6. Write the Leonard-Jones expression representing attractive and repulsive interactions in non-ionic systems and give the graphical representation of the same?
7. Draw a schematic representation of the active site of carbonic anhydrase, give the reaction it catalyses?
8. What are the changes oxygen undergoes before it is converted to water in the final stages of the electron transport chain involving cytochrome oxidase?

Part B
Answer any 4 questions, each question carries 12 marks.

9. a) What are the features of the graph obtained on titrating ribonuclease? What are the problems associated with this method of analysis?
   b) The hydrolysis of esters and peptides by chymotrypsin follow the same three steps yet the kinetics is different, why? Give the mechanism for the hydrolysis of the following pentapeptide by chymotrypsin T-A-W-M-R-G-F? What are the products formed? (6+6)

10. a) How does the cyclic formation and dissociation of complexes between actin and myosin S1 head lead to a sliding of the thick and thin filaments during muscle contraction?
    b) Give the proposed pathway for the conversion of N_2 to NH_3. What is leghaemoglobin? (6+6)
11. a) In the chemistry of vision, how does light lead to the closure of membrane channels?
    b) Give the reactions involved in the formation of the 70S initiation complex. Explain how the start codon is recognized, what is the use of the various initiation factors? (6+6)
12. a) Explain why the conversion of acetyl CoA to acetoacetylCoA is both thermodynamically and kinetically favourable while the conversion of acetate to acetoacetate is not?
    b) Draw the structure of FAD and indicate the region involved in the reactions it helps catalyse. Give the mechanism for the formation of lipoate from dihydrolipoate? (6+6)
13. a) Give a schematic diagram and explain the mechanism for the peroxidase reduction of hydrogen peroxide?
    b) Draw the active site of carboxypeptidase A and explain the role of Zn^{2+} in the hydrolysis of the peptide bond by the enzyme? (6+6)
14. a) What are siderophores, classify them and give the structure of any one example from each class?
    b) Explain the role of gold complexes in the treatment of rheumatoid arthritis and platinum complexes as anti-cancer drugs? (8+4)

Part C

Answer any 2 questions, each question carries 5 marks.

15. ^{14}C-glucose (with only carbon 5 radioactively labeled; - 5-^{14}C-glucose) is given to metabolically active liver cells in cell culture. The cells are isolated after a short time and the glucose-6-phosphate of the cells analysed. The glucose-6-phosphate contains the ^{14}C label in the carbon 5 and carbon 2 positions. Explain these observations?
16. Studies (kinetic, stereochemical, chemical modification and site specific mutagenesis experiments) on an enzyme X have identified the base “B” as Glu^{165} and the acid “HA” as His^{95}. To aid your understanding draw the active site as a pocket that extends into the enzyme and place the Glu and His on opposite sides of the pocket. How might the replacement of Glu with Asp affect the catalytic rate? Discuss what form His would be in at a physiological pH of 7.2. Would that pH allow it to act as a general acid? Describe the conditions that allow it to act as a general acid.
17. Given that it is possible to measure *v*, the rate of transport of a solute into a cell, how will *v* vary with the concentration of solute $[S]_o$, in which the cells are suspended for (a) carrier mediated transport and (b) simple diffusion?