BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

BIO F211 BIOLOGICAL CHEMISTRY FIRST SEMESTER 2023-24

MAX. MARKS: 50 Mid Semester Exam DATE: October 10, 2023

Note: All questions are mandatory. Please attempt part A and part B in separately. Please be precise in writing answers. You will only be graded for your written answers.

PART -A

Q1. Indicate at least three enzymes each, under the following applications. Indicate the enzyme's function or role in each case. **[3+3 =6M]**

(a) Detergents (b) Food supplements

Q2. What type of enzyme will be required to *activate* chymotrypsinogen to trypsin? Give reason. Also, mention the EC main class and corresponding number, to which that activating enzyme will belong? **[3M]**

Q3. A *reversible* inhibitor binds to the enzyme and gets released, leaving the enzyme in its original state; however, an enzyme bound with an *irreversible* inhibitor cannot regenerated.

(a) Why? What is the difference in each case? **[1M]**

(b) What are the various types of reversible inhibitors? Mention the key difference between each of them. **[3M]**

Q4. *Radha receives her blood test report, and she observes that some biochemical metabolite levels and blood enzyme activities are within the normal reference range, while some are deviating from the normal reference range. She notes that her serum alkaline phosphatase activity is much higher than the normal reference range. Alkaline phosphatase is known to be implicated in two different disease conditions.* **[2+2+1+1 = 6M]**

(a) What are the two different implicated diseases? **(b)** How will her doctor perform a differential diagnosis using the blood test report, and arrive at the possible disease that she is suffering from? **(c)** From activity standpoint, how is alkaline phosphatase different from acid phosphatase? **(d)** As a clinical diagnostic marker, how is acid phosphatase different from alkaline phosphatase?

PART B

Q1. Through all the courses we've understood importance of carbon in life. Carbon atoms practically make backbone of every single biomolecule. However, in may Sci-Fi movies, we often come across Silicone based life. Considering Silicone also belongs to same group of periodic table as Carbon, and can also form four single bonds; is it practical to assume that in future at some point of time, Silicone will replace Carbon? Why or why not? (Hint: Justify your answer mentioning bonding properties of Carbon) **[4M]**

Q2. (a) Suppose you are a novice running enthusiast and you are to participate in a 10K. Though you are new to training, you distinctly remember two things from your Biological Chemistry lectures (i) to eat carbohydrate rich foods a day before the run; and (ii) not to drink excessive water during/after run. Justify the reasons for (i) and (ii). For both explain the biochemistry. (Structures not necessary) [**3+3=6M]**

Q2. (b) Post race, you come across an acquaintance, who is adding a sachet of artificial sweetener instead of sugar to unsweetened tea/coffee made freely available to you guys. Your curiosity is enhanced to know if this person is consuming aspartame and while a casual conversation, you get to know that this person is diabetic but cannot consume aspartame due to a disorder. Explain the disorder and underlying biochemistry. **[5M]**

Q3. There are only 20 Amino Acids in nature, which make up all the proteins we know. Out of these as we have studied, 9 are essential and 11 are non-essential. We have studied an important non-essential amino acid in particular, in details. Mention this particular non-essential amino acid and describe at least two distinct functions of its derivatives. (Reactions are necessary, structures and enzymes are not). **[2+2=4M]**

Q4. One of your friends who does not have Biology as dual argues that only Proteins are denatured with heat, nucleic acids do not. Is your friend right? Justify your choice while stating the important aspects of nucleic acid compositions and structure. **[3M]**

Q5. Through the course of biological chemistry so far, we have already covered a variety of proteins. We have come across storage as well as transport proteins for Oxygen. Name these proteins and explain how their structural features facilitate their functions. Making oxygen binding curve is mandatory. **[5M]**

Q. You have purified a new enzyme and want to determine its kinetic properties in the presence and absence of inhibitor. These are the experimental conditions:

- 1ml reaction volume, pH 7.5, 0.1 M KCl
- The substrate will be varied between 1 and 20 mM
- Amount of enzyme added = 0.2 microgram (molecular weight of enzyme =100,000 g/mol)
  Under these conditions, the following data were obtained:

	Velocity in nanomol/min	
[S] in mM	no inhibitor	5 mM inhibitor
1	0.25	1.17
2	0.4	2.1
5	0.63	4.0
10	0.76	5.7
20	0.9	7.2

i) When we derived the M/M equation we made several assumptions about the way the data were to be collected. Are the conditions outlined in this experiment compatible with the assumptions made in the derivation? **[2]**

ii) Draw Lineweaver and Burk plot on graph paper and determine the K_m and V_{max} for each set of data. **[3]**

iii) From the V_{max} (uninhibited enzyme), estimate the turnover number in molecules/sec? **[2]**

----------ALL THE BEST----------