2019

(April)

BIOCHEMISTRY

(Honours)

SECOND PAPER

(Thermodynamics, Membrane Biophysics and Biostatistics)

Marks : 56

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **four** questions, selecting **two** from each Part

PART—A

(Thermodynamics and Membrane Biophysics)

1. *(a)* "The equivalence between heat and work establishes the first law of thermodynamics." Explain. 7

(b) Outline how Gibbs' free energy values are obtained for biochemical reactions. 7

2. (a) What are redox reactions? In the context of redox reactions, explain the concept of conjugate redox couple. Give an example of redox reaction occurring in biological systems, clearly showing the various components of the reaction. 3+2+2=7

(b) What are high energy compounds? Using phosphoric acid anhydrides, explain why such compounds are considered high energy. 3+4=7

3. (a) What are standard electrode potentials? How is standard electrode potential determined? Explain. 2+5=7

(b) What are coupled reactions? Using a suitable example, explain why cells need coupled reactions. 2+5=7

4. What are symport and antiport? In how many ways can solutes be transported across cell membranes? Describe the types with illustrations. 2+12=14

PART—B

(Biostatistics)

5. (a) State briefly the concepts of a population and a sample. Give an example of each. 5

(Continued)

(b) Define random sampling from a finite population. Explain what we achieve by adopting to random mechanism. 5

(c) Describe briefly the methods of *(i)* simple random sampling and *(ii)* stratified sampling. 4

6. Shelf life of tea produced by two factories *A* and *B* are given below :

Length of life (in hours)	*Factory A* (Number of bulbs)	*Factory B* (Number of bulbs)
550–650	10	8
650–750	22	60
750–850	52	24
850–950	20	16
950–1050	16	12

(a) Compute the mean and standard deviation of life of tea from the two factories. 6

(b) Which factory tea is more consistent from the point of view of length of life? 4

(c) What is meant by confidence interval of a sample statistic? Give an example using the above data. 4

(Turn Over)

7. (a) Define correlation coefficient r_{XY} between two variables X and Y. Interpret the situations, when $r_{XY} = 0$, $+1$ and -1. 4

(b) The following data pertains to a sample of apple trees selected to study the relationship between the percentage (Y) of wormy fruits on the tree and the size (X) of the fruit crop :

Tree	*Size of the crop, X* (hundreds of fruits)	*Percentage of wormy fruits, Y*
1	8	59
2	6	58
3	11	56
4	12	53
5	14	50
6	17	45

Find the correlation coefficient between X and Y. 5

(c) Find the value of the regression coefficient of Y on X and interpret its value. 5

(Continued)

8. (a) A bag contains 2 blue and 3 red marbles. What is the probability of drawing a red marble in the second draw, given that a blue marble is drawn at first? 4

(b) In a hospital, sixty percent of patients are dying of a disease. If on a certain day, 8 patients got admitted in the hospital for that disease, then find—

(i) the chance of 3 of them to survive;

(ii) the chance of at least 2 of them to survive. 6

(c) Write short notes on the applications of the following : 4

(i) F-statistic

(ii) Chi-square statistic

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