Ex/M.Sc/CH/2/2051A+B/101/2017

M. Sc. Chemistry Examination, 2017

(2nd Semester)

Biochemistry & Environmental Chemistry

Paper - V

Time : Two hours Full Marks : 50

($12\frac{1}{2}$ marks for each unit)

Use a separate answerscript for each unit.

UNIT - 2051a

Answer ***all*** questions :

1. a) Explain the biological response of essential and beneficial metal ions. 3

   b) Mention the name of three toxic metal ions. $1\frac{1}{2}$

2. Present a brief account of iron toxicity and mention its remedy. 4

3. Explain the co-operativity effect in oxygen binding by Hemoglobin. 4

   Or

   What are the metal ions present in the nitrogenase ? Present, with reactions, the vital steps of nitrogen fixation. Depict the structure of the active site of nitrogenase. 4

UNIT - 2051b

4. Competitive binding of counter ions (K^+, Na^+, Ca^{2+}, Mg^{2+}) with DNA has been studied ; affinity of DNA for cations decrease in the order $Ca^{2+} > Mg^{2+} \gg Na^+ \approx K^+$. Ca^{2+} is more tightly bound to DNA and replaced by monovalent cations to a lesser extent than Mg^{2+}. Quantitative agreement with experimental data on divalent-monovalent competition is known for discretely charged models showing binding competitions of counter ions of same charge (Ca^{2+} with Mg^{2+} or K^+ with Na^+). Elaborate on the above facts mentioning an experiment that clearly proves the presence of counter ions in the vicinity of DNA. $3\frac{1}{2}$

5. Answer ***any three*** questions : 3×3

   a) With a suitable example of your choice, briefly explain active transport of Na^+ or K^+ across bioligical membranes.

   b) Explain why nature has mostly chosen metal ions having two oxidation states differing by one unit either for electron transport or O_2 transport in biological systems ?

   c) Distinguish between primary and secondary pollutants. Why the pollution due to the latter is more harmful ?

UNIT - 2052b

8. Answer ***any five*** questions : $2\frac{1}{2} \times 5$

   a) Deduce the pressure of a surface film of soluble substance in water.

   b) How can the extent of solvation of miceless be determined by ultrasonic method ?

   c) Derive Langmuir equation for adsorption from BET equation.

   d) For a protein having two interacting binding sites find an expression of apparent intrinsic binding constant when binding of a ligand at one site will activate the binding of other ligand.

   e) A sample of spherical micelle has intrinsic viscosity of 3.5 ml gm^{-1}. Calculate mol/mol micellar hydration, the partial specific volume of micelle to be 1.25 ml gm^{-1} and micellar molecular weight (without hydration) equals to 600.

   f) When micelles are formed from surfactants, entropy inceases – explain.

   g) The critical micellar concentration of a non ionic and an ionic surfactant are 1 mN and 10 mN at 27^oC respectively but their standard free energy changes of micellization are the same. Calculate the extent of counter ion binding in ionic micelles.

UNIT - 2052a

6. What do you understand by the term metabolome and metabolomics ? What is β - oxidation ? Calculate the amount of ATP produced in β -oxidation of palmitic acid $(n - C_{15}H_{31}COOH)$ $1+1+1\frac{1}{2}$

5. Answer ***any three*** of the following questions :

   a) What is double-reciprocal plot ? Mention the signification of this plot. What is K_M ? $1+1\frac{1}{2}+\frac{1}{2}$

   b) What is meant by pay off phase of glycolysis ? Write down the steps involved in the glycolysis metabolic pathway. 1+2

   c) What is co-enzyme ? How does NAD^+ act as a co-enzyme during the conversion of UDP-Glucose to UDP-Galactose ? 1+2

   d) Write down the irreversible steps in TCA Cycle. Write down the energy producing steps in TCA-Cycle. 1+2

   e) Write short note on ***(any three)*** 1×3

      i) Zymogen

      ii) Isoenzyme

      iii) Pyridoxal phosphate

      iv) Induced-fit model.

   d) With suitable reactions discuss how various hydrocarbons present in the atmosphere are converted to different radical or molecular products.

   e) Do you think rapid urbanization of the natural environment is a source of pollution ? Discuss with particular reference to increase in concentration of CO in the atmosphere following urbanization.

   f) Describe the non-dispersive infra-red technique for the detection of CO. Mention the advantages of this technique over other known methods.