

**BITS PILAN, INTERNATIONAL ACADEMIC CITY, DUBAI**  
**III YEAR BIOTECH FIRST SEMESTER, 2010-2011**  
**COMPREHENSIVE EXAMINATION**

Course Title : Biophysical Chemistry

Course No: BIOT C339

Date: 30.12.2010

Total Marks: 40

Time: 3 Hours

Weightage: 40%

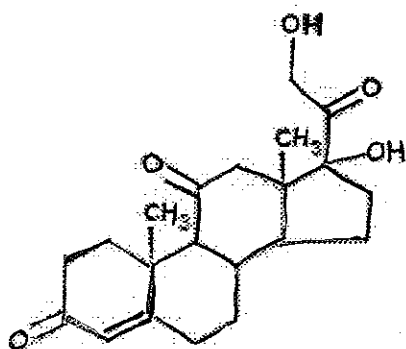
1. Answer Part-A and Part-B separately

2. Answer all questions sequentially

3. Useful data :  $c = 3 \times 10^8$  m/s,  $e = 1.602 \times 10^{-19}$  C,  $\epsilon_0 = 8.854 \times 10^{-12}$  J<sup>1</sup>C<sup>2</sup>m<sup>-1</sup>

**PART-A**

1. (i) Among valine and alanine which is more non-polar ? Why ?  
(ii) The solvation of an amino acid in water and octanol do not make drastic differences in energetics. Why?  
(iii) Explain the  $\alpha$ -helix structure (secondary structure) of proteins. [1+2+2M]
  
2. (i) Calculate the molar energy of repulsion between two hydrogen nuclei at the separation in hydrogen (74.1 pm).  
(ii) Schematically represent all the major interactions involved in the tertiary structure of proteins.  
(iii) Distinguish between strong and weak hydrogen bonds. (any 4 points)  
(iv) Write the interactions disrupted in proteins while denaturation is carried out by heat. [2+2+2+1M]
  
3. (i) The fundamental vibrational frequency of HCl is  $2890 \text{ cm}^{-1}$ . Calculate the force constant of this molecule. The atomic masses are  $^1\text{H} = 1.673 \times 10^{-27}$  Kg  
 $^{35}\text{Cl} = 58.06 \times 10^{-27}$  Kg.  
(ii) Explain Spin-glass model theory of protein folding.  
(iii) Write a note on Levinthal's paradox.  
(iv) Identify the chiral centres and indicate the number of stereoisomers possible for cortisone a naturally occurring steroid hormone. [3+2+2+1M]



- 4.(i) Give the effects of (R) and (S) enantiomer of the chiral drug thalidomide .  
(ii) Calculate the  $R_C$  and  $R_G$  for a freely jointed randomly coiled polymer chain if the number of monomeric units is 3500 and the bond distance is 153 pm.  
(iii) Write the significance of Dihedral group symmetry in protein structures. [2+2+1M]

**PART-B**

1. (i) List some of the features of RNA tertiary structure  
(ii) Define (a) repulsive interaction; (b) Molecular diffusion .  
(iii) Explain the various phases seen in a pressure-area isotherm of a monolayer.  
(iv) Give the equation for **Fick's** first law of diffusion. [3+2+2+1M]
2. (i) Write the expression for minimum wavelength  $\lambda_{min}$  ,  $\lambda_{k_a}$  &  $\lambda_{k_b}$  of x-rays  
(ii) Discuss the principle involved in light scattering by bio molecules.  
(iii) Write about the two state model of dielectric measurements in bio molecules. [2+2.5+2.5M]

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**BITS PILANI-DUBAI, INTERNATIONAL ACADEMIC CITY, DUBAI**  
**III YEAR BIOTECH FIRST SEMESTER, 2010-2011**

**TEST- 2 (Closed book)**

Course Title : Biophysical Chemistry

Course No: BIOT C339

Date: 12.12.2010

Total Marks: 20

Time: 50 min

Weightage: 20%

**1. Answer all questions sequentially**

**2. Only prescribed Text book and original hand written Notes are allowed.**

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1. A 70% alcohol solution is preferred over 95% alcohol as a disinfectant on the skin. Justify. [3M]
  
  2. A hard working human brain, perhaps one that is grappling with physical chemistry operates at about 25 W. What mass of glucose must be consumed to sustain that power output for an hour ? The change in the Gibbs energy that accompanies the oxidation of 1.0 mol  $C_6H_{12}O_6$ (solid) to carbon dioxide and water vapour at 25°C is -2828 kJ. [4M]
  
  3. What are chaperones? Give an example for human chaperone proteins. [2M]
  
  4. Write the importance of Gibbs energy in biological cells. [2M]
  
  5. Explain any two methods employed to disrupt the ionic linkages in the tertiary structure of proteins. [3M]
  
  6. Show the application of Bragg's law in the determination of 'd' the spacing between layers of atoms. [3M]
  
  7. Give a comparative account of principles of different XRD techniques. [3M]

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**BITS PILAN,INTERNATIONAL ACADEMIC CITY ,DUBAI**  
**III YEAR BIOTECH FIRST SEMESTER,2010-2011**

**TEST- 1 (Closed book)**

**Course Title :Biophysical Chemistry**

**Course No:BIOT C339**

**Date:31.10.2010**

**Total Marks:25**

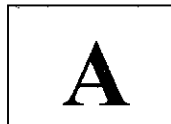
**Time: 50 min**

**Weightage:25%**

**Answer all questions sequentially**

1. Calculate the number of modes of vibration for a protein molecule of 4200 atoms. (2M)
  
2. Carbon monoxide is a poisonous gas since it binds strongly to haemoglobin preventing the transport of oxygen by blood. The bond in a  $^{12}\text{C}^{16}\text{O}$  has a force constant of 1860 N/m. Calculate the vibrational frequency of the molecule in  $\text{cm}^{-1}$ .  
[ 1 a.m.u =  $1.660 \times 10^{-27}$  Kg ] (3M)
  
3. Differentiate between the  $\alpha$  -helix and  $\beta$ - sheet (secondary structure) of the proteins -any three points (3M)
  
4. Calculate the coulombic attractive force between a pair of magnesium ion and sulphide ion that just touch each other. Assume the ionic radius of the magnesium ion to be 0.065nm and that of sulphide ion to be 0.184nm. [ $e = 1.602 \times 10^{-19}$  C ,  $\epsilon_0 = 8.854 \times 10^{-12}$  C<sup>2</sup> / (N.m<sup>2</sup>). (3M)
  
5. Explain any two types of interactions involved in the tertiary structure formation of proteins with suitable example. (4M)
  
6. Write the significance of cubic group symmetry in protein structures. Give an example for a protein with cubic group symmetry. (2M)
  
7. What are the different conformations of the hydrocarbon chains seen in the lipids? (3M)
  
8. Define the following (i) amphiphile (ii) surface tension (iii) Donnan equilibrium. (3M)
  
9. Explain the phenomenon of Osmosis on the basis of entropy of the solution. (2M)

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**BITS, PILANI – DUBAI**  
**FIRST SEMESTER 2010 – 2011**

Course No: BIOT C339

THIRD YEAR

QUIZ-2

Date: 22.11.2010

Course Title: Biophysical Chemistry

Max Marks: 7

Duration : 20 minutes

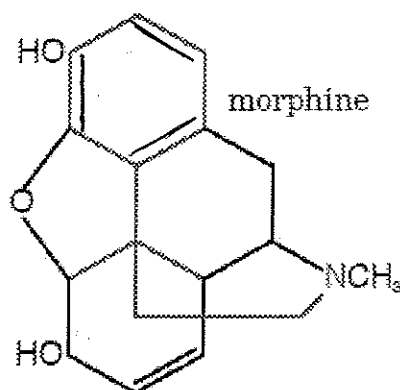
Weightage: 7%

Name: ..... ID No: ..... Sec / Prog: .....

**Instructions:** (if any) Over writing will be taken as wrong answer

1. Give the use of (R) and (S) enantiomer of penicillamine. (1M)
2. Name any two instrumental techniques used to study the chirality of biomolecules. (1M)
3. Mention the various topological chiral objects observed in protein structure. (1M)
4. What will happen in case if either the molecule or the biological receptor site have the wrong handedness? (1M)

5. Identify the chiral centres and indicate the number of stereoisomers possible for the alkaloid morphine. (1M)



6. Write the three-dimensional formulas for both enantiomers of 2,3-dimethyl-3-ethylhexane. (1M)

7. Write the name and structure of the molecule used by Pasteur to develop the concept of molecular chirality. (1M)

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**BITS, PILANI – DUBAI**  
**FIRST SEMESTER 2010 – 2011**  
**THIRD YEAR**

Course Code: BIOT C339  
 Course Title: Biophysical Chemistry  
 Duration : 20 minutes

Date: 6.10.2010  
 Max Marks: 8  
 Weightage: 8%

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|--------------------|---------------------|--------------------------|
| <b>Name:</b> ..... | <b>ID No:</b> ..... | <b>Sec / Prog:</b> ..... |
|--------------------|---------------------|--------------------------|

**Instructions:** (if any) Over writing will be taken as wrong answer

1. Write the dipeptide structure for phe + ser → ? (1M)
  
  
  
  
  
  
  
  
  
  
2. Amino acid with an amide on the side chain does not produce basic solutions. Why? (1M)
  
  
  
  
  
  
  
  
  
  
3. Write the expression for the ratio of frequency of occurrence of a particular set of side chains in the classification of proteins. (1M)
  
  
  
  
  
  
  
  
  
  
4. Write the number of hydrogen bond donors and acceptors in ammonia molecule. (1M)

5. In the partitioning experiment

Amino acid + wet octanol containing 2.5 mM of water, the H-bonding makes small contribution to  $\Delta G_{tr}$ . Why? (1M)

6. In a double stranded DNA the amount of guanine residues was found to be 40 percent.

Determine the amount of the thymine residues in the same. (1M)

7. Define i. phosphodiester bond, ii. Nucleoside.

(1M)

8. List the different interactions that stabilize the Double stranded DNA.

(1M)

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