BITS PILANI,INTERNATIONAL ACADEMICCITY ,DUBAI
III YEAR BIOTECH FIRST SEMESTER,2011-2012
COMPREHENSIVE EXAMINATION

Course Title :Biophysical Chemistry **Course No:BIOT C339**
Date:4.1.2012 **Total Marks:40**
Time: 3 Hours **Weightage:40%**

1.Answer all questions sequentially
2. Useful data : $c = 3 \times 10^8$ m/s

1.(i) What form of glutamic acid would you expect to predominate in (a) strongly acidic solution (b) strongly basic solution and at its isoelectric point
(ii) What is the ratio of occurrence of a particular set of side chains in the classification of proteins based on polarity of primary structure.
(iii) Describe the experiment used to estimate the hydrogen bond energy in biomolecules in water.

[2+1+2M]

2. (i) The force constant of CO is 1840 Nm^{-1}. Calculate the vibrational frequency in cm^{-1} .Given the atomic masses $^{12}C = 19.9 \times 10^{-27}$ Kg $^{16}O = 26.6 \times 10^{-27}$ Kg.
(ii) Explain the α –helix structure of proteins.
(iii) Give the geometrical requirement of two center hydrogen bonds.
(iv) Explain the origin of hydrophobic effect using Tanford's approach.

[2+2+1+2M]

3. (i)Mention the characteristic features of the tertiary structure of Myoglobin.
(ii) Give the significance of cubic symmetry in protein structures.
(iii)Write the important interactions present in Nucleic acid structure .
(iv) Schematically represent the Deoxyribose purine nucleotide. (Adenosine monophosphate).

[2+1+2+1M]

4.(i)Write a note on the forces and factors governing the aggregation in bilayer and monolayer.
(ii) Give the significance of R and S enantiomer of Limonene.
(iii) Mention any 4 topological chiral objects observed in protein structure.
(iv) Explain the terms (a) Donnan equilibrium (b) Hypertonicity (c) Mie Scattering
(v) Give any two applications of X-ray fluorescence spectroscopy.

[3+2+2+3+1M]

5.(i)Mention any two denaturation methods used to disrupt hydrogen bonds and ionic linkages.

(ii) Explain the random flight and rotational isomeric state theory of protein folding.

(iii) What will be the outcome of the dielectric relaxation spectrum of the aqueous protein solutions?

(iv) With a neat diagram describe the Laue's transmission method used to study the diffraction of crystal.

(v) Calculate R_{rms} and R_G for a linear polymeric chain containing 350 monomeric units each being 30 Å long.

[2+2+2+3+2M]

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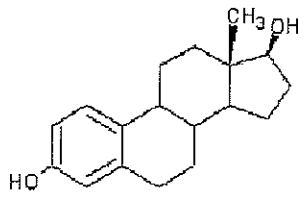
BITS PILANI-DUBAI,INTERNATIONAL ACADEMIC CITY ,DUBAI
III YEAR BIOTECH FIRST SEMESTER,2011-2012
TEST- 2 (Open book)

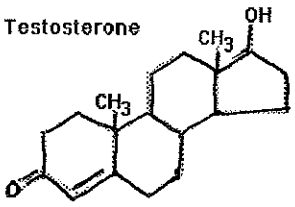
Course Title :Biophysical Chemistry **Course No:BIOT C339**
Date:20.11.2011 **Total Marks:20**
1.Answer all questions sequentially
2.Only prescribed Text book and original hand written Notes are allowed.

1.Identify the chiral centres and indicate the number of stereoisomers possible for the structures given below.

Estrogen



Testosterone



[2M]

2. What should drug companies consider when they develop and market new chiral drugs? **[2M]**

3.Two solutions, a 0.1% (m/v) albumin solution (compartment A) and a 2% (m/v) albumin solution (compartment B), are separated by a semi-permeable membrane.
(a)Define osmotic pressure.
(b)Which compartment will have the higher osmotic pressure?
(c)Which compartment will lose water? Why? **[3M]**

4.Arginine vasopressin is a pituitary hormone. It helps to regulate the amount of water in the body by reducing the flow of urine from kidneys. An aqueous solution containing 21.6 mg of vasopressin in 100 ml of solution had an osmotic pressure of 3.70 mm Hg at 25°C. Calculate the molecular weight of the harmone. **[3M]**

5.Write any two similarities and two differences between diffusion and osmosis. **[2M]**

6. Give the equation for Fick's first law of diffusion. **[1M]**

7.Give the important classes of lipids with one example for each. **[3M]**

8.Write the three-dimensional formulas for all the stereoisomers of 2,3-Dibromopentane. **[4M]**

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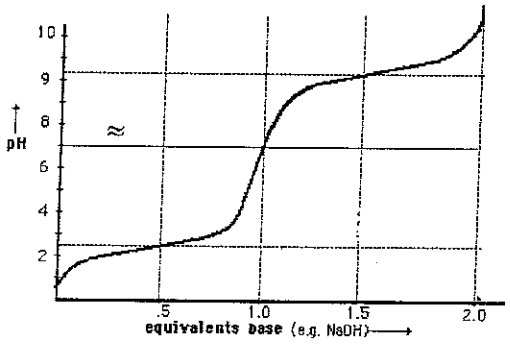
BITS PILANI, INTERNATIONAL ACADEMIC CITY, DUBAI
III YEAR BIOTECH FIRST SEMESTER,2011-2012
TEST- 1 (Closed book)

Course Title :BiophysicalChemistry **Course No:BIOT C339**
Date:2.10.2011 **Total Marks:25**
Time: 50 min **Weightage:25%**

Answer all questions sequentially

1. Amino acid with an amide on the side chain does not produce basic solutions.Why? **(2M)**

2.From the titration curve of alanine , assign the pK_a values of the ionizable groups present in it. Also find the characteristic pH at which the net charge is zero. **(3M)**



3.Indicate the hydrogen bond donors and acceptors in water and ammonia. **(2M)**

4. Covalent bond lengths can be decomposed into covalent radii of the individual atomic radii. However a hydrogen bond cannot be decomposed in the similar way.Why? **(2M)**

5. Write a note on the origin of hydrophobic effect. **(3M)**

6.The attractive force between magnesium and sulphide ions is 1.49×10^{-8} N.If the sulphide ion has a radius of 0.184nm, calculate the ionic radius of the magnesium ion in nanometers.[e = 1.602×10^{-19} C, $\varepsilon_0 = 8.854 \times 10^{-12}$ $J^{-1}C^2m^{-1}$] **(5M)**

7.Write the Schrodinger equation for the two molecule system and write the terms involved in it. **(3M)**

8.Solvation of amino acid in water and octanol do not make drastic differences in energetics.Why? **(2M)**

9.What is meant by the scale of average hydrophobicity ? Why is it not useful to distinguish or classify the proteins. **(3M)**

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BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2011 – 2012

Course Code: BIOT C339 **THIRD YEAR** Date: 15.12.2011

Course Title:Biophysical Chemistry Quiz-2 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. Write any 2 instrumental techniques used to monitor the conformational transitions in proteins. **(1M)**

2. A 95% alcohol solution is not used as a disinfectant on the skin .Justify. **(1M)**

3. What are molecular chaperones ? Give example. **(1M)**

4. Using Bragg's law , calculate the angle at which the n=1 diffraction peak is observed, λ = 1Å and d = 5 nm. **(1M)**

5. Write the expression for minimum wavelength λ_{min} and λk_{β} of x-rays. **(1M)**

6. Write any 2 limitations of hetero polymer collapse theory. **(1M)**

7. What is meant by Levinthal's paradox? **(1M)**

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BITS, PILANI – DUBAI CAMPUS

FIRST SEMESTER 2011 – 2012

Course Code: BIOT C339 **THIRD YEAR** Date: 19.10.2011

Course Title:Biophysical Chemistry Quiz-1 Max Marks: 8

Duration : 20 minutes Weightage: 8%

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

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

1. Calculate the Pitch(P) for the α helix geometry of secondary structure of proteins. **(1M)**

2. Represent the antiparallel beta structure . **(1M)**

3. What contributes to the net dipole moment in proteins? **(1M)**

4. Give any 1 example showing the electrostatic interaction involved in the tertiary structure formation. **(1M)**

5.Calculate the number of modes of vibration for a protein molecule of 3500 atoms. **(1M)**

6.Write the significance of cyclic group symmetry in protein structures. **(1M)**

7.Represent the polymerization of adjacent nucleotides that form a sugar-phosphate strand. **(1M)**

8. List the hydrogen bond donors and hydrogen bond acceptors involved in the nucleic acid structure. **(1M)**

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