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End semester Exam **Session: 2013-14**
School of Life Sciences **Department: Biotechnology**
Class & Subject: Integrated UG/PG Biotechnology **Sem.: I**
Nomenclature of Paper: LBTC: 101: Biomolecules I

Model Answers AS-2889

MCQ

1. (A) $(CH_2O)n$ 2. (D) 16 3. (D) All 4. (B) Threonine 5. (C) Acyl group 6. (A) Zn^{2+} 7. (A) Nonpolar hydrocarbon chain 8. (A) Saturated fatty acid 9. (A) Uracil 10. (C) Both

1. Explain about the noncovalent interactions which stabilize biomolecules in the cellular cytoplasm.

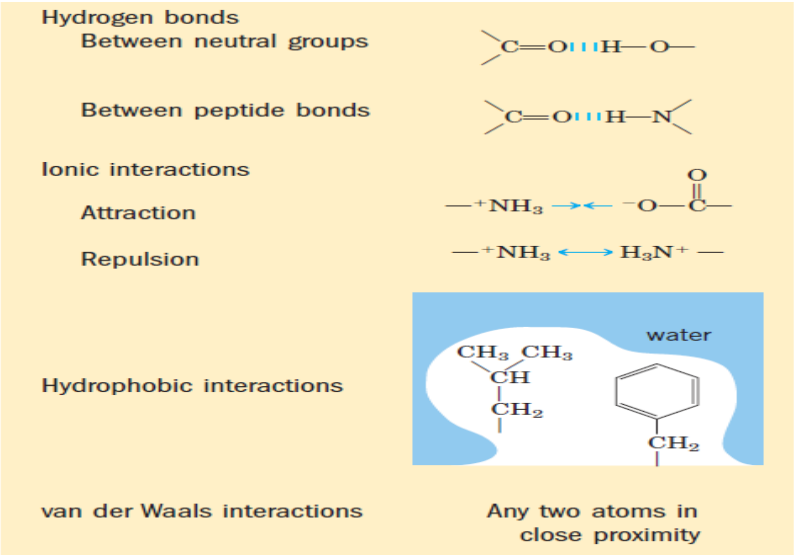
(a) Hydrogen Bonding: there is an electrostatic attraction between the electro negative atom of one molecule and the hydrogen of another called a hydrogen bond. There are two types of H-bonding intramolecular (bonding within the molecule) and intermolecular (bonding between the molecules)**.**

(b) Hydrophobic interactions: The forces that hold the nonpolar regions of the molecules together.

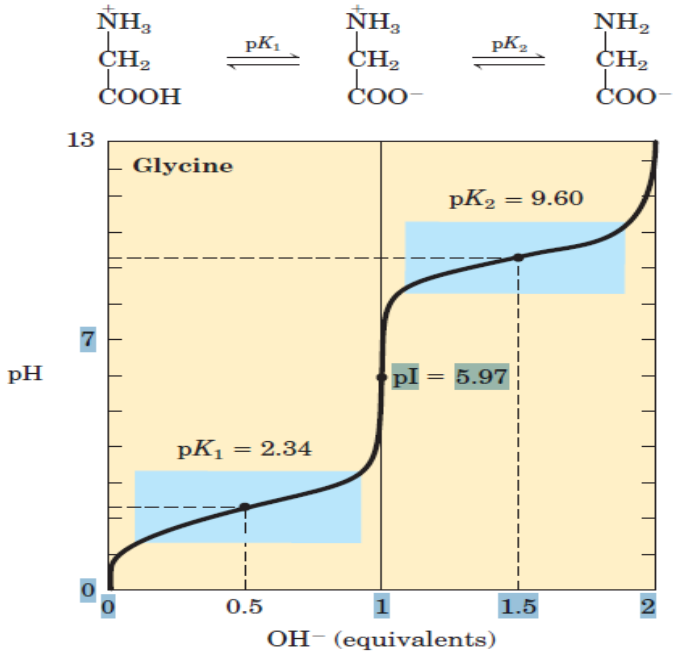
(c)Ionic Interactions: the interaction between positively charged and negatively charged molecules (attraction or repulsion).

(d)van der Waals interactions: Random variations in the positions of the electrons around one nucleus may create a transient electric dipole, which induces a transient, opposite electric dipole in the nearby atom. The two dipoles weakly attract each other, bringing the two nuclei closer.

(Explain)



2. Write short notes on (A) Titration curve (B) Isoelectric point



The plot has two distinct stages, corresponding to deprotonation of two different groups on glycine. At very low pH, the predominant ionic species of glycine is the fully protonated. At the midpoint in the first stage of the titration, in which the –COOH group of glycine loses its proton, equimolar concentrations of the proton-donor and proton-acceptor species are present. At the midpoint of any titration, a point of inflection is reached where the pH is equal to the p*K*a of the protonated group being titrated. For glycine, the pH at the midpoint is 2.34, thus its –COOH group has a p*K*a (labeled p*K*1) of 2.34. The p*K*a is a measure of the tendency of a group to give up a proton, with that tendency decreasing tenfold as the p*K*a increases by one unit.) As the titration proceeds, another important point is reached at pH 5.97. Here there is another point of inflection, at which removal of the first proton is essentially complete and removal of the second has just begun. At this pH glycine is present largely as the dipolar ion. The second stage of the titration corresponds to the removal of a proton from the -NH3 group of glycine. The pH at the midpoint of this stage is 9.60, equal to the p*K*a (labeled p*K*2) for the -NH3 group. The titration is essentially complete at a pH of about 12,

(B) The characteristic pH at which the net electric charge is zero is called the **isoelectric point** or **isoelectric pH,** designated **pI.**

pI = (p*K*1+ p*K*2)/2

(Explain)

3. Write a note on international classification of enzymes.

international agreement, have adopted a system for naming and classifying enzymes. This system divides enzymes into six classes, each with subclasses, based on the type of reaction catalyzed.

TABLE 6–3 International Classification of Enzymes

No.	*Class*	*Type of reaction catalyzed*
1	Oxidoreductases	Transfer of electrons (hydride ions or H atoms)
2	Transferases	Group transfer reactions
3	Hydrolases	Hydrolysis reactions (transfer of functional groups to water)
4	Lyases	Addition of groups to double bonds, or formation of double bonds by removal of groups
5	Isomerases	Transfer of groups within molecules to yield isomeric forms
6	Ligases	Formation of C—C, C—S, C—O, and C—N bonds by condensation reactions coupled to ATP cleavage

Note: Most enzymes catalyze the transfer of electrons, atoms, or functional groups. They are therefore classified, given code numbers, and assigned names according to the type of transfer reaction, the group donor, and the group acceptor.

4. Write down the importance of lipid molecules.

1. Triacylglycerols Provide Stored Energy and Insulation. Many Foods Contain Triacylglycerols

2. Waxes Serve as Energy Stores and Water Repellents

3. The polar lipids, with polar heads and nonpolar tails, are major components of membranes. Other polar lipids are the sterols.
4. Chloroplast membranes are remarkably rich in galactolipids, composed of a diacylglycerol.
5. Sphingolipids at Cell Surfaces Are Sites of Biological Recognition
6. Cholesterol, the major sterol in animals, is both a structural component of membranes and precursor to a wide variety of steroids.
7. Some types of lipids, although present in relatively small quantities, play critical roles as cofactors or signals.

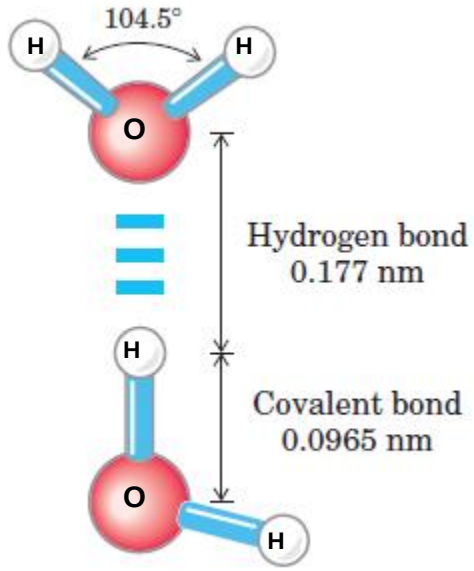
(Explain)

5. Write down the difference between DNA and RNA.

DNA	**RNA**
Found mainly in the chromatin of the cell nucleus.	Most of RNA is present in the cell cytoplasm and a little in the nucleolus.
Normally double stranded and rarely single stranded	Normally single stranded and rarely double stranded
DNA have both sense and antisense strand	The sequence of an RNA molecule is the same as that of antisense strand.
Sugar moiety in DNA is 2'-deoxyribose	Sugar moiety in RNA is 2'-hydroxyribose
Sugar in DNA are in the $C_{2'}$-endo form	Sugar in RNA are in the $C_{3'}$-endo form
DNA contains only few unusual bases	RNA contains comparatively more unusual bases
DNA is alkali stable	RNA is alkali labile
DNA undergoes mutation	RNA does not undergo mutation
DNA having A, T, G, C as nitrogenous bases	RNA having A, U, G, C as nitrogenous bases
DNA is the usual genetic material	RNA is genetic material of some viruses only

6. Write a short note on water molecule and characteristic features making it a good solvent.

Water is both the solvent in which metabolic reactions occur and a reactant in many biochemical processes, including hydrolysis, condensation, and oxidation-reduction reactions. Water having nearly tetrahedral arrangement of the outer-shell electron pairs around the oxygen atom; the two hydrogen atoms have localized partial positive charges and the oxygen atom has a partial negative charge .Two H_2O molecules joined by a hydrogen bond between the oxygen atom of the upper molecule and a hydrogen atom of the lower one. Hydrogen bonds are longer and weaker than covalent bonds.



H bond between the water molecules provide the cohesive forces that make water liquid at room temperature and that favour the extreme ordering of the molecule is typically crystalline water (ice). Polar molecule can replace water water interaction energetically and able to form water solute interaction.

Characteristic features making it a good solvent

(a) High melting point

(b) High boiling point

(c) High heat of vaporization

(d) High dielectric constant (78.5 at 25^0 C)

(Explain)

7. Write short note on denaturation of protein.

All proteins begin their existence on a ribosome as a linear sequence of amino acid residues. This polypeptide must fold during and following synthesis to take up its native conformation which is marginally stable. Modest change in the proteins environment can bring about structural changes that can affect function.

Loss of protein structure results in loss of function. A loss of three dimensional structures sufficient to cause loss of function is called denaturation of protein. The denatured state doesn't necessarily equate with complete unfolding of the protein and randomization of conformation. Undermost conditions, denatured proteins exist in a set of partially folded states that are poorly understood.

Factors effect denaturation of proteins

(a) Heat (b) pH (c) Organic solvent (eg. Urea)

(Explain)