

BIOPHYSICS

Solution Key Nov/Dec 2017

[Sol. 1]

(a) Unusual nature of Proline:

- Proline amino-acid structure
- Presence of imino group
Cyclic structure
- Significance in protein folding
- Oftenly found in turns or loops
- cis-conformation in peptides

(b) Co-transporters:

- membrane transport proteins
- secondary active transport
- Include Antiporters & Symporters
- Diagram of cotransporters

(c) Leucine Zipper:

- DNA Binding motifs
- Rich in leucine residues that provide dimerization
- Two α helix
- Y shaped structure, in which zipper comprise stem and two basic regions bifurcate to forms arms that bind DNA
- Schematic diagram

(d) Common disaccharides

- sucrose \rightarrow table sugar (Gluc + fruct)
- Lactose \rightarrow Milk sugar (Gluc + Galactose)
- Maltose \rightarrow Malt Sugar (Gluc + Glucose)
- Structures

② Membrane fluidity :-

- Cell membranes are fluid
i.e. not in fixed position and can adapt various shapes.
- Enhanced at elevated temperature
- Depends on composition of bilayer
- Phospholipids vary in length and saturation level of fatty acids.

[Sol. 2.]

① Ran → definition and working

- small G protein
- essential for translocation of RNA and proteins through the Nuclear Pore Complex.
- transport of macromolecules like RNA & proteins across nucleus require importins and exportins and their activity is regulated by small GTPase Ran.
- Nuclear Export schematic diagram

② Physio-chemical properties of amino-acids

- Optical properties
- Solubility
- Zwitter ion and isoelectric pH.
- Titration curve of amino-acids (acid-base behaviour)
- Chemical reactions etc.

[Sol. 3.]

① Passive transport :-

- down or along the concentration gradient
- i.e. from higher to low concentration
- Does not require energy or ATP
- Eg. Osmosis, Diffusion, facilitated Diffusion etc

facilitated passive transport :-

- With the help of membrane proteins such as Channels and Carriers
- Channel proteins - span membrane and make hydrophilic tunnels across it.
- Carrier proteins can change their shape to move a target molecule from one side to the other.
- Schematic diagram.

- (b)
- Working and Principle of X-ray Crystallography.
 - crystals - definition
 - Mounting of crystals on Goniometer
 - Exposing crystals to X-ray
 - X-ray sources
 - Diffraction patterns at different angles
 - electron density map
 - Atomic model or final structure.

[Sol 4.]

(a) Fluid Mosaic Model of Cell Membrane

- By Singer and Nicolson (1972)
- Basic structural frame of cell membrane is provided by a lipid bilayer in which all kinds of proteins are embedded.
- type of interactions involved
- Structural details
- Main features
- Well labeled diagram.

⑤ Different levels of protein structure :-

- Primary structure
- Secondary structure
→ motifs & domains
- Tertiary structure
- Quaternary Structure of protein folding

[Sol 5.]

⑥ DNA-Binding proteins .

- Classification and examples
- Sequence-specific DNA-Binding proteins
→ Helix-turn-Helix family
→ Zinc-finger family
→ Basic domain
etc
- Non-specific DNA-Binding proteins
→ Histone fold
→ polymerase cleft etc .

⑦ Phospholipids :-

- Structure
- function

[Sol 6.]

⑧ Transmission electron Microscope (TEM)

- Principle involved
- Working
- Diagram

⑨ Nuclear Magnetic Resonance (NMR) spectroscopy

- Construction
- Working
- Diagram