Regular Class Notes

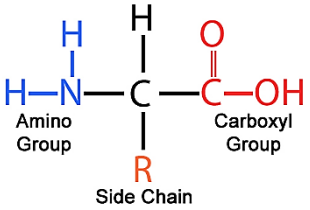
Faculty of Biology: Atul K Goyal
Content Source: NCERT/Internet

Class 11th Standard Book: NCERT Biology Unit 3: Cell : Structure And Functions Chapter 9: Biomolecules Page No. 142	Topics: 9.1 How to Analyze Chemical Composition? 9.2 Primary and Secondary Metabolites 9.3 Biomacromolecules 9.4 Proteins 9.5 Polysaccharides 9.6 Nucleic Acids 9.7 Structure of Proteins 9.8 Nature of Bond Linking Monomers in a Polymer 9.9 Dynamic State of Body Constituents- Concept of Metabolism 9.10 Metabolic Basis for Living 9.11 The Living State 9.12 Enzymes

Biomolecules: Carbon containing compounds in living tissue

Amino Acids:

-Organic compounds containing
- -Hydrogen
- -Carboxyl group
- -Amino group
- -R-chain



-Based on type of R-chain, 20 types of amino acid found in biological system

Chemical Nature of Amino Acids:

-Acidic- Glutamic acid
-Basic- Lysine
-Neutral- Valine
-Aromatic- Tyrosine, Tryptophan, Phenylalanine

Zwitter Ion Structure of Amino Acid:

Proteins:

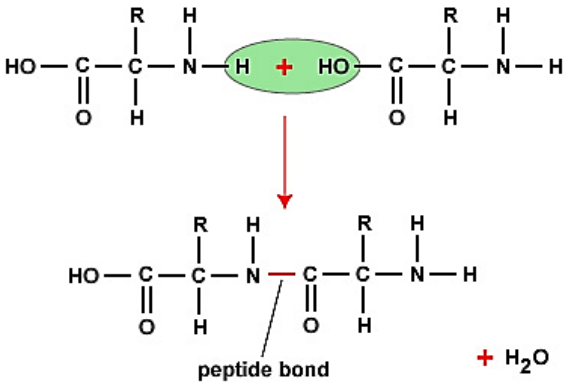
-Amino acids linked with the peptide bond

-Peptide bond formed when carboxyl group of one amino acid reacts with amino group of another amino acid with elimination of water

-Proteins are heteropolymers not homopolymers

-First amino acid- N-terminal

Last amino acid- C-terminal



Examples:

Collagen- Most abundant protein in animal world

RuBisCo- Most abundant protein in biosphere

Structure:

Primary- Linear chain of amino acids

Secondary- alpha-helix

Tertiary- Long protein chain folded around itself like a hollow woolen ball

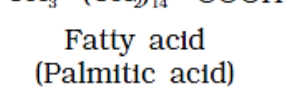
Quandary- Multi-subunit. E.g. Haemoglobin- 4 subunits (2α+2β)

Lipids:

Carboxyl acids:

-Fatty acids having carboxyl group attached to R-chain

-Ex-Palmitic acid and Arachidonic acid

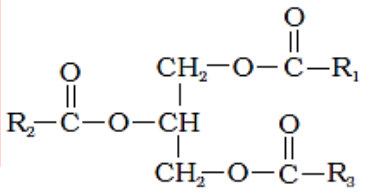


Fatty acid (Palmitic acid)

Glycerides:

-Fatty acids having glycerol

-Ex- Monoglycerides, Diglycerides and triglycerides.

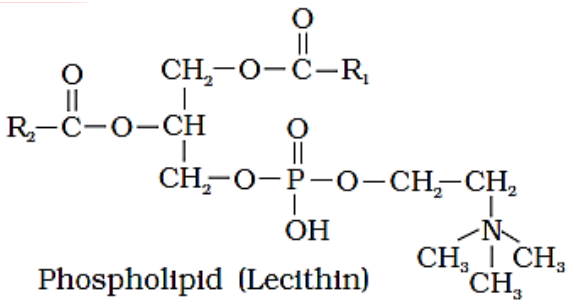


Triglyceride (R_1, R_2 and R_3 are fatty acids)

Phospholipids:

-Fatty acids having phosphate group

-Ex- Lecithin- found in cell membranes



Phospholipid (Lecithin)

Oils:

-Having lower melting point

-Remain in liquid state in winters (Ex- Gingely oil)

- Having high unsaturation (with double bonds)

Polysaccharides:

-Long chains of sugar linked via glycosidic linkage

Examples:

-Cellulose- Homopolymer of glucose

- Plant cell wall is made up of cellulose
- Paper made from plant pulp and cotton fibre are also cellulose

-Starch- Energy storage form of plants

- Forms a helical secondary structure
- Starch-I2 is blue in color

-Glycogen- Energy storage form in animals

- Glucosamine and N-acetyl galactosamine- Chitinous exoskeleton in arthropods

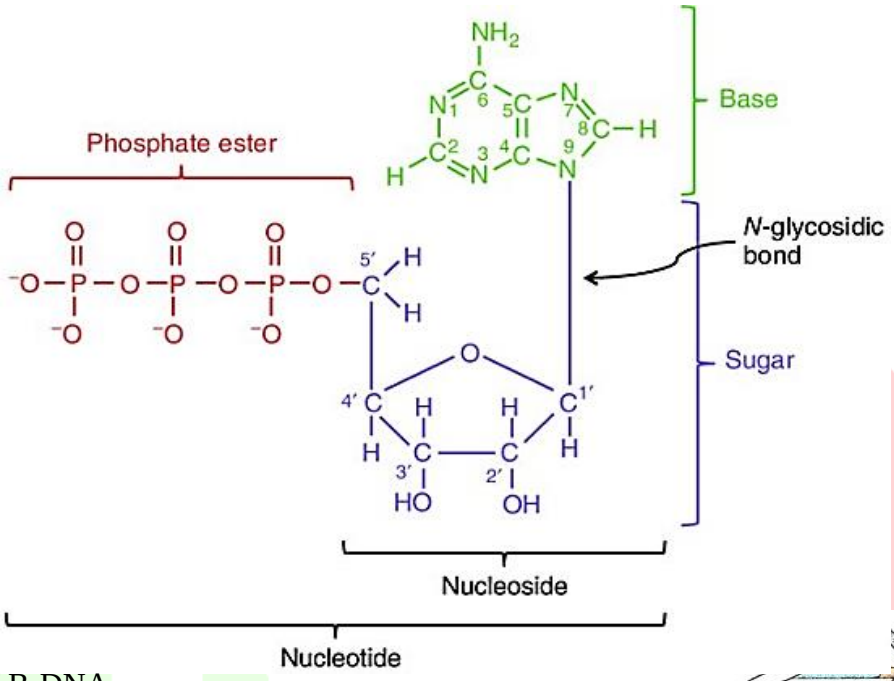
Nucleic Acids:

-Heterocyclic rings of nitrogenous base attached to sugars

-Nitrogenous bases- Purines (Adenine, Guanine) and Pyrimidine (Thymine, Cytosine)

- Nucleoside- Nitrogenous base+ Sugar

-Nucleotide: Nucleoside (Nitrogenous base+ Sugar) + Phosphate group



Structure of B-DNA

-Antiparallel double helix

-Sugar-Phosphate back-bone

-Nitrogenous base face inside

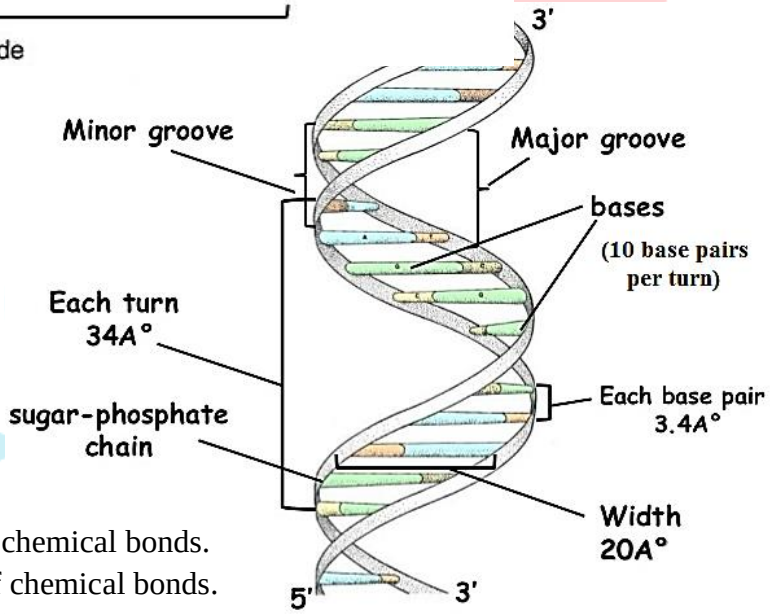
-A=T and G≡C

-Stand turn-36°

-One helical turn- 10 base pair

-Pitch- 34 A°

-Rise per base pair- 3.4 A°



Chemical Reactions:

Physical Reactions: Without breakage of chemical bonds.

Chemical Reaction: With the breakage of chemical bonds.

Enzymes:

-Enzymes are biocatalyst which affect the rate of reaction

-They can accelerate the reaction rate by 10 million times

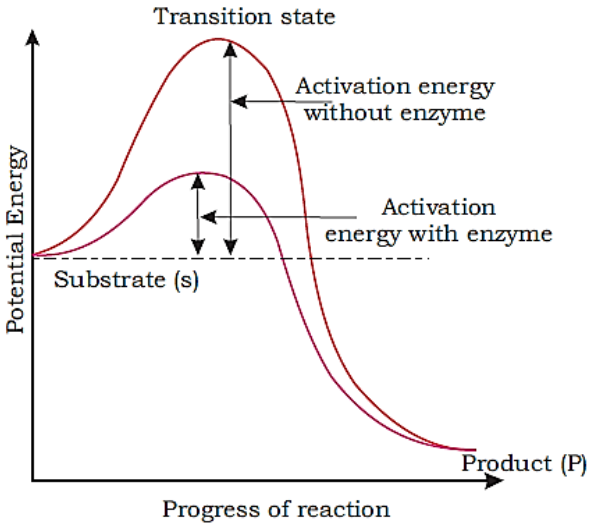
-Almost all enzymes are proteins with three-dimensional structure

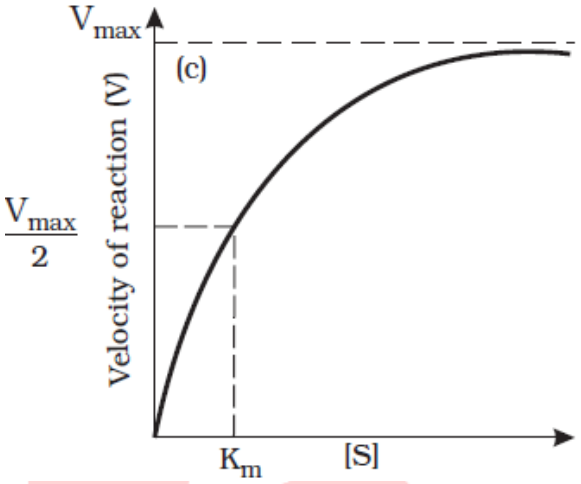
-Ribozymes: Nucleic acid behave like an enzyme

-Active Site: Catalytic pocket of enzyme where substrate binds

-Transition State: High energy state where substrate binds with enzyme to form enzyme-substrate complex

-Activation Energy: Amount of energy require to achieve the transition state





Enzyme Mechanism:

Vmax: Maximum velocity of reaction which can be achieved. After Vmax, further increase in substrate concentration does not have any effect as there are no free enzyme to bind with the additional substrate.

Vmax/2: Half of maximum velocity which could be achieved.

Km: Substrate concentration at which reaction velocity reach to half maximum (Vmax/2)

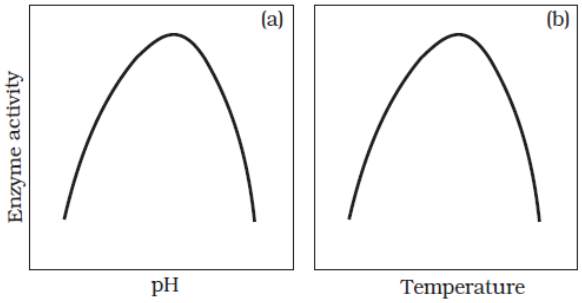
Catalytic Cycle of Enzyme

1. Substrate binds to the active site of the enzyme by fitting into the active site.
2. Enzyme alter its shape and fit more tightly around the substrate.
3. Breakage of chemical bonds of substrate and formation of new enzyme- product complex
4. Enzyme releases the products and ready to bind to another molecule

Effect of Temperature and pH on Enzymatic Activity

-Inorganic catalyst work efficiently at high temperature and pressure but biocatalyst work best at optimum temperature

- High temperature destroys enzymatic activity because proteins are denatured by heat



Enzymes Inhibition:

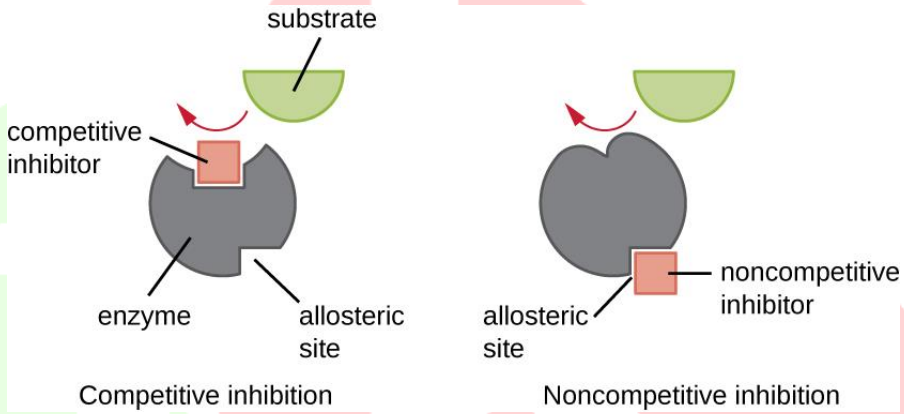
Competitive Inhibition:

-When structure of inhibitor closely resembles with the structure of inhibitor and it compete with substrate for the active site on enzyme

-Vmax remains the same because the reaction can eventually reach its normal Vmax

-Km decrease because it takes a higher concentration of substrate to get Vmax

-Example: inhibition of succinic dehydrogenase by malonate
-Applications: competitive inhibitors used in control of bacterial pathogens.
Non-competitive Inhibition:
-When inhibitor binds to the allosteric site on the enzyme no the active site
-Vmax increases because regardless of how much substrate we add, a subset of the enzyme molecules will always be poisoned by the inhibitor
- Km remains the same because the inhibitor doesn't affect binding of enzyme to substrate, just lowers the concentration of usable enzyme.



Co-factors:
-Non-protein constituents bound to enzyme to make the enzyme catalytically active
- Catalytic activity is lost when the co-factor is removed from the enzyme
Apoenzyme:
-Protein portion of the enzymes (enzyme -- cofactor)
Holoenzyme:
-Enzyme + Co-factor
Prosthetic groups:
-Organic compounds which tightly bound to the apoenzyme.
-Example-Peroxidase and catalase which catalyze the breakdown of hydrogen peroxide to water and oxygen, haem is the prosthetic group and it is a part of the active site of the enzyme.
Co-enzymes:
-Organic compounds having only transient association with the apoenzyme
-Example- Vitamins, e.g., coenzyme nicotinamide adenine dinucleotide (NAD) and NADP contain the vitamin niacin.
Metal Ions:
-Metal ions form coordination bonds with side chains at the active site and with the substrate
-Example: Zinc is a cofactor for carboxypeptidase

Classification and Nomenclature of Enzymes:
1. Oxidoreductases/dehydrogenases: Catalyze oxidoreduction reactions
2. Transferases: Catalyze transfer of a group
3. Hydrolases: Catalyze hydrolysis
4. Lyases: Catalyze removal of groups
5. Isomerases: Catalyze inter-conversion of isomers
6. Ligases: Catalyze linking

Regular Chapter Assignment

Faculty of Biology: Atul K Goyal
Questions Source: NEET/NCERT/MOCK

Class 11th Standard Book: NCERT Biology Unit 3: Cell : Structure And Functions Chapter 9: Biomolecules Page No. 142	Topics: 9.1 How to Analyze Chemical Composition? 9.2 Primary and Secondary Metabolites 9.3 Biomacromolecules 9.4 Proteins 9.5 Polysaccharides 9.6 Nucleic Acids 9.7 Structure of Proteins 9.8 Nature of Bond Linking Monomers in a Polymer 9.9 Dynamic State of Body Constituents- Concept of Metabolism 9.10 Metabolic Basis for Living 9.11 The Living State 9.12 Enzymes

Number of Questions: 25 Maximum Marks: 100 Time: 25 Minutes

Instructions: Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores.

Name: _____ Date: _____ Marks: _____

Q 1. What is the role of NAD+ in cellular respiration?
(1) It is a nucleotide source for ATP synthesis.
(2) It functions as an electron carrier.
(3) It functions as an enzyme.
(4) It is the final electron acceptor for anaerobic respiration. [NEET 2018]

Q 2. Select the correct match
(1) T.H. Morgan – Transduction
(2) F2 × Recessive parent - Dihybrid cross
(3) Ribozyme - Nucleic acid
(4) G. Mendel – Transformation
[NEET 2018]

Q 3. The two functional groups characteristic of sugars are
(1) Carbonyl and phosphate
(2) Carbonyl and methyl
(3) Hydroxyl and methyl
(5) Carbonyl and hydroxyl [NEET 2018]

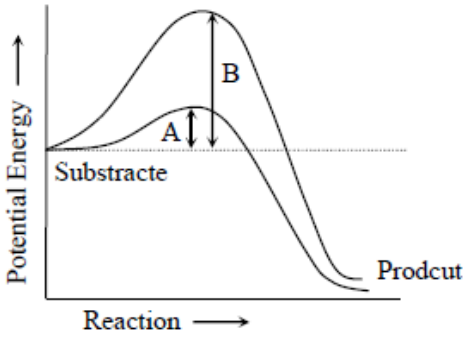
Q 4. Which one of the following statements is not correct?
(1) Catalyst does not initiate any reaction
(2) The value of equilibrium constant is changed in the presence of a catalyst in the reaction at equilibrium
(3) Enzymes catalyze mainly bio-chemical reactions
(4) Coenzymes increase the catalytic activity of enzyme [NEET 2017]

Q 5. Which one of the following statements is correct, with reference to enzymes?

(1) Apoenzyme= Holoenzyme +Coenzyme
(2) Holoenzyme= Apoenzyme +Coenzyme
(3) Coenzyme= Apoenzyme +Holoenzyme
(4) Holoenzyme = Coenzyme + Cofactor
[NEET 2017]

Q 6. A non-proteinaceous enzyme is -
(1) Lysozyme
(2) Ribozyme
(3) Ligase
(4) Deoxyribonuclease [NEET 2016]

Q 7. Which of the following describes the given graph correctly?



(1) Endothermic reaction with energy A in presence of enzyme and B in absence of enzyme
(2) Exothermic reaction with energy A in presence of enzyme and B in absence of enzyme
(3) Endothermic reaction with energy A in absence of enzyme and B in presence of enzyme
(4) Exothermic reaction with energy A in absence of enzyme and B in presence of enzyme [NEET 2016]

Q 8. Which of the following is the least likely to be involved in stabilizing the three—dimensional folding of most proteins?
(1) Hydrogen bonds
(2) Electrostatic interaction
(3) Hydrophobic interaction
(4) Easter bonds [NEET 2016]

Q9. A typical fat molecule is made up of
(1) Three glycerol molecules and one fatty acid molecule
(2) One glycerol and three fatty acid molecules
(3) One glycerol and one fatty acid molecule
(4) Three glycerol and three fatty acid molecules [NEET 2016]

Q 10. Which one of the following statements is wrong?
(1) Sucrose is a disaccharide
(2) Cellulose is a polysaccharide
(3) Uracil is a pyrimidine
(4) Glycine is a sulphur containing amino acid [NEET 2016]

Q 11. The chitinous exoskeleton of arthropods is formed by the polymerization of:
(1) Lipoglycans
(2) keratin sulphate and chondroitin sulphate
(3) D – glucosamine
(4) N – acetyl glucosamine [NEET 2015]

Q 12. Which of the following biomolecules does have a phosphodiester bond?
(1) Nucleic acids in a nucleotide
(2) Fatty acids in a diglyceride
(3) Monosaccharides in a polysaccharide
(4) Amino acids in a polyptide

Q 13. Which of the following statements are incorrect?
(1) The competitive inhibitors does not affect the rate of breakdown of the enzyme-substrate complex
(2) The presence of competitive inhibitor decrease the Km of the enzyme for the substrate
(3) A competitive inhibitor reacts reversibly with the enzyme to form an enzyme inhibitor complex

(4) In competitive inhibition, the inhibitor molecule is not chemically changed by the enzyme [NEET 2015]

Q 14. Select the option which is not correct with respect to enzyme action
(1) Substrate binds with enzyme at its active site
(2) Addition of lot of succinate does not reverse the inhibition of succinic dehydrogenase by malonate
(3) A non-competitive inhibitor binds the enzyme at a site distinct from that which binds the substrate
(4) Malonate is a competitive inhibitor of succinic dehydrogenase [NEET 2014]

Q 15. Which one of the following is a non-reducing carbohydrate?
(1) Maltose
(2) Sucrose
(3) Lactose
(4) Ribose 5-phosphate [NEET 2014]

Q 16. A phosphoglyceride is always made up of:
(1) Only a saturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
(2) Only an unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
(3) A saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
(4) A saturated or unsaturated fatty acid esterified to a phosphate group which is also attached to a glycerol molecule
[NEET 2013]

Q 17. Macro molecule chitin is:
(1) Nitrogen containing polysaccharide
(2) Phosphorus containing polysaccharide
(3) Sulphur containing polysaccharide
(4) Simple polysaccharide [NEET 2013]

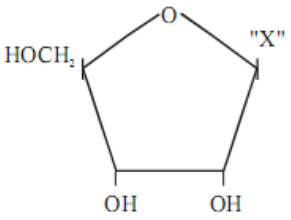
Q 18. Transition state structure of the substrate formed during an enzymatic reaction is
(1) Transient but stable
(2) Permanent but unstable
(3) Transient and unstable
(4) Permanent and stable [NEET 2013]

Q 19. The essential chemical components of many coenzymes are:
(1) Proteins
(2) Nucleic acids
(3) Carbohydrates
(4) Vitamins [NEET 2013]

Q 20. What is the correct order of acidic, basic and neutral amino acids?
(1) Glutamic acid, Valine, Lysine
(2) Glutamic acid, Lysine, Valine
(3) Valine, Lysine, Glutamic acid
(4) Lysine, Valine, Glutamic acid
[MOCK]

Q 21. Which of following is correct:
(1) Nucleotide= Sugar+ Base+ Phosphate
(2) Nucleoside= Sugar+ Base+ Phosphate
(3) Nucleoside= Sugar+ Phosphate
(4) Option 1 and 3 are correct [MOCK]

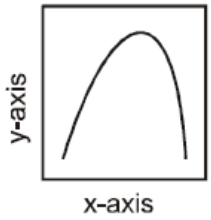
Q 22. Given below is the diagrammatic representation of one of the categories of small molecular weight organic compounds in the living tissues. Identify the category shown and the one blank component 'X' in it



	Category	Component
(1)	Nucleotide -	Adenine
(2)	Nucleoside -	Uracil
(3)	Cholesterol -	Guanin

(4) Amino acid - NH2 [MOCK]

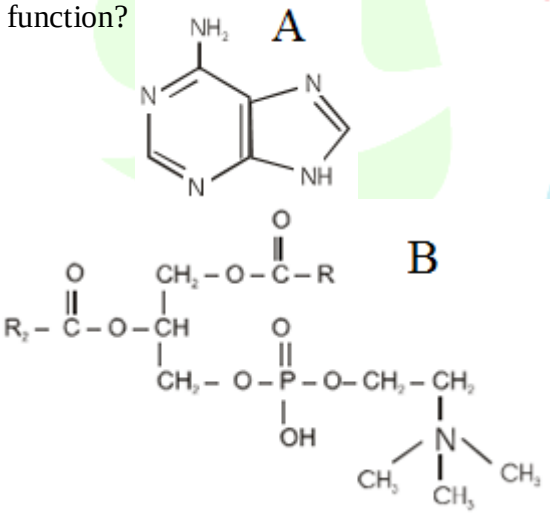
Q 23. The curve given below shows enzymatic activity with relation to three conditions (pH, temperature and substrate concentration.



What do the two axis (x and y) represent?

	X-Axis	Y-Axis
(1)	Enzymatic activity	pH
(2)	Temperature	Enzymatic activity
(3)	Substrate concentration	Enzymatic activity
(4)	Enzymatic activity	Temperature

Q 24. Which one of the following structural formulae of two organic compounds is correctly identified along with its related function?



(1) B: Adenine - a nucleotide that makes up nucleic acids
(2) A : Triglyceride - major source of energy
(3) B : Uracil - a component of DNA
(4) A : Lecithin - a component of cell membrane [MOCK]

Q 25. Which of the following statements regarding enzyme inhibition is correct -

(1) Competitive inhibition is seen when a substrate competes with an enzyme for binding to an inhibitor protein
(2) Non-competitive inhibitors often bind to the enzyme irreversibly
(3) Competitive inhibition is seen when the substrate and the inhibitor compete for the active site on the enzyme
(4) Non-competitive inhibition of an enzyme can be overcome by adding large amount of substrate [MOCK]

Answer Sheet

Q	1	2	3	4	×/√	Marks
1	O	O	O	O		
2	O	O	O	O		
3	O	O	O	O		
4	O	O	O	O		
5	O	O	O	O		
6	O	O	O	O		
7	O	O	O	O		
8	O	O	O	O		
9	O	O	O	O		
10	O	O	O	O		
11	O	O	O	O		
12	O	O	O	O		
13	O	O	O	O		
14	O	O	O	O		
15	O	O	O	O		
16	O	O	O	O		
17	O	O	O	O		
18	O	O	O	O		
19	O	O	O	O		
20	O	O	O	O		
21	O	O	O	O		
22	O	O	O	O		
23	O	O	O	O		
24	O	O	O	O		
25	O	O	O	O		

Regular Chapter Assignment

Faculty of Biology: Atul K Goyal

Questions Source: NEET/NCERT/MOCK

Class 11th Standard Book: NCERT Biology Unit 3: Cell : Structure And Functions Chapter 9: Biomolecules Page No. 142	Topics: 9.1 How to Analyze Chemical Composition? 9.2 Primary and Secondary Metabolites 9.3 Biomacromolecules 9.4 Proteins 9.5 Polysaccharides 9.6 Nucleic Acids 9.7 Structure of Proteins 9.8 Nature of Bond Linking Monomers in a Polymer 9.9 Dynamic State of Body Constituents- Concept of Metabolism 9.10 Metabolic Basis for Living 9.11 The Living State 9.12 Enzymes

Number of Questions: 25 Maximum Marks: 100 Time: 25 Minutes

Instructions: Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores.

Date of Test: _____

Answer Key

Q1	2	Q2	3	Q3	4	Q4	2	Q5	2	Q6	2	Q7	2	Q8	4	Q9	2
Q10	4	Q11	4	Q12	1	Q13	2	Q14	2	Q15	2	Q16	3	Q17	1	Q18	3
Q19	4	Q20	2	Q21	1	Q22	2	Q23	2	Q24	4	Q25	3	Q26		Q27	
Q28		Q29		Q30		Q31		Q32		Q33		Q34		Q35		Q36	
Q37		Q38		Q39		Q40		Q41		Q42		Q43		Q44		Q45	