FREE EDITION · NOTES + 3 SAMPLE MCQS

CUET · BIOLOGY · CLASS XI · CODE 304

Biomolecules

CUET unit: Cell Structure and Function → Biomolecules

By **UniDrill** · NCERT-grounded study material

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📌 Snapshot

- Establishes the chemical inventory of living tissue: same elements as Earth's crust but with relative abundance of C, H, N much higher in life.
- Introduces the operational distinction between the **acid-soluble pool** (micromolecules, MW 18–800 Da) and the **acid-insoluble fraction** (macromolecules: proteins, nucleic acids, polysaccharides, plus lipids by accident of membrane vesicles).
- Catalogues primary metabolites (amino acids, sugars, fatty acids, nucleotides) versus secondary metabolites (alkaloids, flavonoids, rubber, pigments, scents).
- Builds the four-level architecture of proteins and concludes with enzymes — active site, induced fit, activation energy, IUBMB six-class system, cofactors and competitive inhibition.
- A high-yield CUET chapter: factual recall on monomers, abundance records (collagen, RuBisCO, water), and enzyme classification reliably appear every year.

📖 Detailed Notes

2.1 Core concepts

- **Elemental composition.** Elemental analysis of any living tissue (plant tissue, animal tissue, microbial paste) yields the same list of elements as a sample of earth's crust, but the **relative abundance of carbon and hydrogen (and oxygen) is higher in living organisms** than in earth's crust. Table 9.1 shows representative weights: H 9.5% (body) vs 0.14% (crust), C 18.5% vs 0.03%, O 65.0% vs 46.6%, N 3.3% vs "very little", Si 'negligible' vs 27.7% (NCERT §9 intro and §9.1, pp. 104–105).
- **How to analyse chemical composition.** Take any living tissue (a vegetable or a piece of liver) and grind it in trichloroacetic acid (Cl_3CCOOH) using a mortar and pestle, producing a thick slurry. Strain through cheesecloth or cotton — two fractions result: the **filtrate / acid-soluble pool** and the **retentate / acid-insoluble fraction**. Scientists have found **thousands of organic compounds in the acid-soluble pool** (NCERT §9.1, p. 104).
- **Wet weight, dry weight & ash.** Weigh small living tissue → **wet weight**; dry it → **dry weight** (water evaporates); burn the dry tissue → all carbon compounds are oxidised to CO_2 and water vapour; the remaining inorganic residue is **ash** containing

Ca, Mg, etc. Inorganic compounds like sulphate and phosphate also occur in the acid-soluble fraction. Table 9.2 lists representative inorganic constituents — **Na^+, K^+, Ca^{2+}, Mg^{2+}**, water and compounds **NaCl, $CaCO_3$, PO_4^{3-}, SO_4^{2-}** (NCERT §9.1, p. 105).

- **Carbon compounds → 'biomolecules'.** From a chemistry viewpoint these can be functional groups (aldehydes, ketones, aromatics); from a biology viewpoint they are classified as **amino acids, nucleotide bases, fatty acids etc.** (NCERT §9.1, p. 105).
- **Amino acids.** Organic compounds containing an amino group and an acidic group as substituents on the same carbon — the **α-carbon**; hence called **α-amino acids** and they are **substituted methanes** with four substituents (H, –COOH, $–NH_2$, variable R). The R group could be hydrogen (**glycine**), methyl (**alanine**), hydroxymethyl (**serine**), etc. There are only **20 types of amino acids in proteins**. Based on R-group: **acidic (glutamic acid), basic (lysine), neutral (valine), aromatic (tyrosine, phenylalanine, tryptophan)**. The $–NH_2$ and –COOH groups are **ionizable**, so amino-acid structure changes with pH: the doubly-ionised form **H_3N^+–CHR–COO^-** is the **zwitterionic form (B)** (NCERT §9.1, pp. 105–106).
- **Lipids.** Generally water-insoluble. **Simple fatty acids** carry a –COOH group on an R group of 1–19 carbons; **palmitic acid has 16 carbons** including the carboxyl carbon; **arachidonic acid has 20 carbons**. Fatty acids may be **saturated (no double bond)** or **unsaturated (one or more C=C double bonds)**. **Glycerol** is trihydroxypropane. **Triglycerides** are glycerol esterified with three fatty acids; they are also called **fats and oils** based on melting point — **oils** have lower melting point (e.g. gingelly oil remains oil in winter). **Phospholipids** contain phosphorus and a phosphorylated organic group; found in **cell membranes** (**lecithin** is one example). Some tissues, especially neural tissues, contain lipids with more complex structures (NCERT §9.1, p. 106).
- **Nitrogen bases & nucleotides.** Living organisms contain heterocyclic rings — nitrogen bases: **adenine, guanine, cytosine, uracil, thymine**. When attached to a sugar, they are called **nucleosides** — adenosine, guanosine, thymidine, uridine, cytidine. With a phosphate group also esterified to the sugar, they are called **nucleotides** — **adenylic acid, thymidylic acid, guanylic acid, uridylic acid, cytidylic acid**. Nucleic acids like DNA and RNA consist of nucleotides only and function as genetic material (NCERT §9.1, p. 106).
- **Primary and secondary metabolites.** A list of biomolecules in animal tissues — amino acids, sugars, etc. — covers **primary metabolites**, which have identifiable functions and play known roles in normal physiological processes. In contrast, plant, fungal and microbial cells contain thousands of compounds we do not yet understand — **secondary metabolites** (Table 9.3): **Pigments — carotenoids, anthocyanins**; **Alkaloids — morphine, codeine**; **Terpenoides — monoterpenes, diterpenes**; **Essential oils — lemon grass oil**; **Toxins — abrin, ricin**; **Lectins — concanavalin A**; **Drugs — vinblastin, curcumin**; **Polymeric substances —**

rubber, gums, cellulose. Many are useful to human welfare (rubber, drugs, spices, scents, pigments); some have ecological importance (NCERT §9.2, p. 108).

- **Biomacromolecules.** All compounds in the acid-soluble pool have molecular weights ranging from **18 to around 800 Da**. The acid-insoluble fraction has only four types of organic compounds — **proteins, nucleic acids, polysaccharides and lipids**. These have MW in the **range of ten thousand daltons and above**. Hence biomolecules <1000 Da are **micromolecules** and those in the acid-insoluble fraction are **macromolecules / biomacromolecules**. **Lipids** appear in the macromolecular fraction not because they themselves are large but because cell membranes form **vesicles** that are not water-soluble and sediment along with proteins/polysaccharides/nucleic acids. Therefore lipids are **not strictly macromolecules** (NCERT §9.3, pp. 108–109).
- **Cellular composition (Table 9.4, p. 109). Water 70–90%**, **Proteins 10–15%**, **Carbohydrates 3%**, **Lipids 2%**, **Nucleic acids 5–7%**, **Ions 1%** — water is the most abundant chemical in living organisms.
- **Proteins.** Proteins are **polypeptides** — linear chains of amino acids linked by peptide bonds; a heteropolymer of 20 amino-acid types (homopolymer would have one monomer repeating n times). **Dietary proteins** are the source of **essential amino acids** (those our body cannot make). Proteins carry out many functions — transport, defence, hormones, enzymes, structural support, sensory reception. **Table 9.5** lists: **Collagen — intercellular ground substance; Trypsin — enzyme; Insulin — hormone; Antibody — fights infectious agents; Receptor — sensory reception (smell, taste, hormone); GLUT-4 — enables glucose transport into cells**. **Collagen is the most abundant protein in the animal world** and **RuBisCO (Ribulose bisphosphate Carboxylase-Oxygenase) is the most abundant protein in the whole biosphere** (NCERT §9.4, pp. 109–110).
- **Polysaccharides.** Long chains of sugars (literally cotton threads of monosaccharide building blocks). **Cellulose** is a polymeric polysaccharide consisting of only one type of monosaccharide (glucose) — a **homopolymer**, the structural component of **plant cell walls** (paper and cotton fibre are cellulosic). **Starch** is the **plant storage** variant; **glycogen** is the **animal storage** variant. **Inulin** is a polymer of fructose. In a glycogen chain the **right end is the reducing end** and the **left end is the non-reducing end**; it has branches (Fig. 9.2). **Starch forms helical secondary structures** and can hold I_2 molecules in the helical portion — **starch-I_2 is blue**; **cellulose does not contain complex helices and hence cannot hold I_2**. More complex polysaccharides have amino-sugars and chemically modified sugars (e.g. **glucosamine, N-acetyl galactosamine**); **chitin** in **arthropod exoskeletons** is a complex polysaccharide (NCERT §9.5, pp. 110–111).
- **Nucleic acids.** Polynucleotides; building block is the **nucleotide** with three components — (i) a **heterocyclic compound** (nitrogen base), (ii) a **monosaccharide** (pentose sugar: **ribose** in RNA or **2'-deoxyribose** in DNA), and (iii) **phosphoric acid / phosphate**. **Adenine and Guanine are substituted**

purines, while **Cytosine, Uracil and Thymine are substituted pyrimidines**. DNA contains deoxyribose; RNA contains ribose (NCERT §9.6, p. 111).

- **Structure of proteins (four levels). (a) Primary structure** — the sequence of amino acids (positional information: which is first, second, etc.). A protein is imagined as a line with the **N-terminal amino acid on the left** and the **C-terminal amino acid on the right**. **(b) Secondary structure** — the protein thread is folded as a **helix (right-handed only)** or other forms like **β-pleated sheet**. **(c) Tertiary structure** — the long protein chain folds upon itself like a **hollow woollen ball**, giving a 3-D view; **hydrogen bonds and disulphide bonds** appear; tertiary structure is **absolutely necessary for many biological activities**. **(d) Quaternary structure** — assembly of more than one polypeptide/subunit, e.g. **adult human haemoglobin consists of 4 subunits — two α-type + two β-type** (NCERT §9.7, pp. 111–112, Fig. 9.3).
- **Enzymes — overview. Almost all enzymes are proteins**; some catalytic nucleic acids are called **ribozymes**. Like any protein an enzyme has primary, secondary and tertiary structure; when the chain folds, many crevices/pockets are made and one such pocket is the **'active site'** — a crevice into which the substrate fits. **Inorganic catalysts** work at high temperatures and pressures, while enzymes get **damaged above ~40° C**. However, enzymes isolated from **thermophiles (hot vents, sulphur springs)** are stable up to **80–90° C** — **thermal stability** is an important quality (NCERT §9.8, pp. 112–113).
- **Chemical reactions — rate & Q_{10} rule.** Rate (or velocity if direction is specified) = $\delta P/\delta t$. **General rule of thumb: rate doubles or decreases by half for every 10° C change in temperature**. Enzyme-catalysed reactions go vastly faster than uncatalysed; e.g. **$CO_2 + H_2O \rightleftharpoons H_2CO_3$**: without enzyme ~200 molecules form per hour; with **carbonic anhydrase ~600,000 molecules per second** — about **10 million times** acceleration. A **metabolic pathway** is a multistep reaction; **glucose → 2 pyruvic acid** ($C_6H_{12}O_6 + O_2 \rightarrow 2C_3H_4O_3 + 2H_2O$) proceeds through **ten different enzyme-catalysed reactions** (NCERT §9.8.1, pp. 113–114).
- **How enzymes act — induced fit & activation energy.** A substrate (S) binds the enzyme at its **active site** within a cleft; an **ES complex** forms, then a transient **transition state structure**, then an **EP complex**, finally release of product P and unchanged enzyme E. **Catalytic cycle: E + S → ES → EP → E + P** — substrate binding induces the enzyme to alter its shape, fitting more tightly around the substrate (**induced fit**); active site brings substrate bonds close enough to break/make. Enzymes lower the **activation energy** — the difference in average energy content of 'S' from that of its **transition state** (Fig. 9.4). If 'P' lies at a lower energy than 'S', the reaction is **exothermic**; otherwise it is **endothermic** (NCERT §9.8.2–9.8.3, pp. 114–115).
- **Factors affecting enzyme activity. Temperature and pH** — enzymes function in a narrow range; each shows highest activity at an **optimum temperature** and **optimum pH**; activity declines on either side; **low temperature preserves** the

enzyme in a temporarily inactive state, **high temperature destroys** activity by denaturing the protein (Fig. 9.5a, b). **Substrate concentration** — velocity rises with [S] and reaches maximum velocity **V_max** that cannot be exceeded by further increase in [S] because enzyme molecules are saturated (Fig. 9.5c). **Inhibitors** — when binding of a chemical shuts off enzyme activity it is called **inhibition** and the chemical an **inhibitor**. When the inhibitor closely resembles the substrate in molecular structure it is a **competitive inhibitor**; **malonate inhibits succinic dehydrogenase** because it closely resembles substrate **succinate**. Competitive inhibitors are often used to control bacterial pathogens (NCERT §9.8.4, pp. 116–117).

- **Six IUBMB enzyme classes (with 4–13 subclasses each, four-digit code). (1) Oxidoreductases/dehydrogenases** — catalyse oxidoreduction between substrates S and S′. **(2) Transferases** — transfer of a group G (other than hydrogen) between S and S′. **(3) Hydrolases** — hydrolysis of ester, ether, peptide, glycosidic, C–C, C-halide or P–N bonds. **(4) Lyases** — non-hydrolytic removal of groups leaving double bonds. **(5) Isomerases** — interconversion of optical, geometric or positional isomers. **(6) Ligases** — linking together of two compounds, e.g. C–O, C–S, C–N, P–O bonds (NCERT §9.8.5, p. 117).
- **Cofactors.** The protein portion of enzymes that need a non-protein constituent is called the **apoenzyme**; non-protein constituents required for catalysis are **cofactors**. Three kinds: **(i) Prosthetic groups** — organic compounds **tightly bound** to the apoenzyme; e.g. **haem in peroxidase and catalase** (catalyse breakdown of H_2O_2 to water + O_2; haem is part of the active site). **(ii) Coenzymes** — organic, association with apoenzyme is **transient**, occurring during catalysis; coenzymes serve as cofactors in many different enzyme-catalysed reactions. Essential chemical components of many coenzymes are **vitamins**, e.g. **NAD and NADP contain niacin**. **(iii) Metal ions** — form coordination bonds with side chains at the active site and with the substrate; e.g. **zinc is a cofactor for carboxypeptidase**. **Catalytic activity is lost when the cofactor is removed** (NCERT §9.8.6, pp. 117–118).

2.2 Definitions to memorise

Term	Definition	Page
Biomolecules	Carbon compounds obtained from living tissues	105
Acid-soluble pool	Filtrate after grinding tissue in trichloroacetic acid; thousands of small organic compounds (18–800 Da)	104, 108
Acid-insoluble fraction	Retentate; contains proteins, nucleic acids, polysaccharides and lipid vesicles	104, 108
Wet weight / dry weight / ash	Weight of fresh tissue / after drying / after burning (inorganic residue)	105

Term	Definition	Page
Micromolecules	Compounds with MW <1000 Da	108
Biomacromolecules	Compounds in acid-insoluble fraction; MW ⩾ 10,000 Da	108
α-amino acid	Amino acid with NH_2 and COOH on the same α-carbon; substituted methane	105
Zwitterion	Doubly-ionised amino-acid form H_3N^+–CHR–COO^-	106
Saturated/Unsaturated fatty acid	Without / with one or more C=C double bonds	106
Triglyceride	Glycerol esterified with three fatty acids; fat/oil	106
Phospholipid	Lipid containing phosphorus + phosphorylated organic compound (e.g. lecithin)	106
Nucleoside	Nitrogen base + sugar (adenosine, uridine, etc.)	106
Nucleotide	Nitrogen base + sugar + phosphate (adenylic, thymidylic, etc.)	106
Primary metabolite	Compound with identifiable role in normal physiology	108
Secondary metabolite	Alkaloid, flavonoid, rubber, pigment, scent, gum etc.	108
Polypeptide	Linear chain of amino acids linked by peptide bonds	109
Homopolymer / Heteropolymer	One repeating monomer / multiple types of monomers	109
Essential amino acids	Amino acids supplied by diet (body cannot make)	109
Purines / Pyrimidines	Adenine, Guanine / Cytosine, Uracil, Thymine	111
Primary / Secondary / Tertiary / Quaternary structure	Sequence / helix or β-sheet / 3-D fold / multi-subunit assembly	111–112
Active site	Crevice/pocket in tertiary fold where substrate fits	113
Ribozyme	Nucleic acid with catalytic activity	112
Activation energy	Energy difference between substrate and transition-state structure	115
Competitive inhibitor	Substrate-mimic that binds the active site (e.g. malonate vs succinate)	117
Apoenzyme	Protein part of an enzyme needing a cofactor	118
Prosthetic group	Tightly bound organic cofactor (haem in catalase/peroxidase)	118

Term	Definition	Page
Coenzyme	Transient organic cofactor (NAD, NADP — niacin-derived)	118

2.3 Diagrams / processes to remember

- **Figure 9.1 (p. 107) — small-MW organic compounds in living tissue. Sugars** (six-membered glucose $C_6H_{12}O_6$, five-membered ribose $C_5H_{10}O_5$). **Amino acids** (Glycine — H, Alanine — CH_3, Serine — CH_2OH on α-carbon). **Fats and oils** — fatty acid $CH_3–(CH_2)_{14}–COOH$ (palmitic acid), glycerol, triglyceride (R_1, R_2, R_3 are fatty-acid chains). **Phospholipid (lecithin)** with phosphate and choline group. **Cholesterol** (steroid ring). **Nitrogen bases** — adenine (purine, fused 5+6 ring with NH_2), uracil (pyrimidine, 6-membered with two C=O). **Nucleosides** — adenosine (adenine + ribose), uridine (uracil + ribose). **Nucleotide** — adenylic acid (adenine + ribose + phosphate).
- **Amino-acid ionisation scheme (p. 106).** Three protonation states: (A) $H_3N^+–CHR–COOH$, (B) $H_3N^+–CHR–COO^-$ — the **zwitterionic form**, (C) $H_2N–CHR–COO^-$.
- **Figure 9.2 (p. 110) — branched glycogen cartoon.** Right end labelled **reducing end**; left end labelled **non-reducing end**; branches off the main chain.
- **Figure 9.3 (p. 112) — protein structure.** (a) Primary — linear amino-acid string; (b) Secondary — α-helix and β-pleated sheet; (c) Tertiary — folded 3-D ball with hydrogen and disulphide bonds shown; (d) Quaternary — multiple subunits assembled.
- **Figure 9.4 (p. 115) — activation energy.** Potential-energy plot vs progress of reaction with two humps: a higher hump = activation energy **without** enzyme; a lower hump = activation energy **with** enzyme; substrate S on left, product P on right (lower energy if exothermic).
- **Figure 9.5 (p. 116) — enzyme activity vs (a) pH (bell), (b) Temperature (bell), (c) [S] hyperbolic** rising to V_max with K_m marked at V_max/2.
- **Table 9.1 (p. 105)** — elemental abundance: C 0.03% (crust) vs 18.5% (body); H 0.14 vs 9.5; O 46.6 vs 65.0; Si 27.7 vs negligible.
- **Table 9.4 (p. 109)** — cellular composition: water 70–90%, proteins 10–15%, nucleic acids 5–7%, carbohydrates 3%, lipids 2%, ions 1%.
- **Tables 9.3 (p. 108) & 9.5 (p. 109)** — secondary metabolites and protein-function table (collagen, trypsin, insulin, antibody, receptor, GLUT-4).

2.4 Common confusions / NTA trap points

- **Nucleoside vs nucleotide** — nucleoside has base + sugar only; the phosphate makes it a nucleotide. NTA frequently swaps these.
- **Most abundant protein: collagen** is most abundant in **animal world**; **RuBisCO** is most abundant in the **whole biosphere** — distractor option usually flips the two.

- **Glycogen branching ends: right end = reducing, left end = non-reducing** — NCERT states this explicitly; NTA loves to invert it.
- **Lipids in the acid-insoluble fraction** — they sediment because **cell membranes form vesicles**, NOT because they are macromolecules. Lipids are **not strictly macromolecules**.
- **Competitive inhibitor example: malonate** inhibits **succinic dehydrogenase** (substrate = succinate). Distractors often use fumarate or oxaloacetate.
- **Purines = 2 members (A, G); pyrimidines = 3 (C, U, T)** — a common reversal trap.
- **Haemoglobin quaternary structure: two α + two β** (not 4 identical, not 2α + 2γ which is foetal Hb — and NCERT does not mention HbF).
- **Cellulose vs starch with iodine:** starch holds I_2 (blue colour) because of **helical secondary structure**; cellulose does **NOT** form helices and **cannot hold I_2**. NTA flips this.
- **Right-handed helix only.** In proteins, **only right-handed helices are observed** — left-handed helices are not natural.
- **Q_{10} rule:** rate **doubles** for +10°C or **halves** for −10°C — applies in either direction.
- **Cofactor terminology: prosthetic = tightly bound**; **coenzyme = transient binding**; many students reverse this.
- **NAD/NADP contain niacin**, NOT thiamine or riboflavin.
- **Carbonic anhydrase numbers:** 200 molecules/hour uncatalysed → 600,000/second catalysed; ~10 million-fold acceleration.

2.5 Key processes / classifications

#	Biomolecule / Item	Class	NCERT example / Note	Page
1	Glucose	Monosaccharide	$C_6H_{12}O_6$	107
2	Ribose	Pentose sugar	$C_5H_{10}O_5$ in RNA	107
3	Glycine	Amino acid	R = H	107
4	Alanine	Amino acid	R = CH_3	107
5	Serine	Amino acid	R = CH_2OH	107
6	Glutamic acid	Acidic amino acid	Two carboxyl groups	106
7	Lysine	Basic amino acid	Two amino groups	106
8	Tyrosine / Phenylalanine / Tryptophan	Aromatic amino acids	—	106
9	Palmitic acid	Saturated fatty acid	16 carbons	106
10	Arachidonic acid	Fatty acid	20 carbons	106

#	Biomolecule / Item	Class	NCERT example / Note	Page
11	Glycerol	Trihydroxypropane	Backbone of triglycerides	106
12	Lecithin	Phospholipid	Found in cell membranes	106
13	Adenine, Guanine	Purines	Substituted purines	111
14	Cytosine, Uracil, Thymine	Pyrimidines	Substituted pyrimidines	111
15	Adenosine	Nucleoside	Adenine + ribose	106
16	Adenylic acid	Nucleotide	Adenine + ribose + phosphate	106
17	Cellulose	Homopolymer of glucose	Plant cell walls; no helix; no I_2	110
18	Starch	Plant storage polysaccharide	Helical; blue with I_2	110
19	Glycogen	Animal storage polysaccharide	Branched; reducing end right	110
20	Inulin	Polymer of fructose	—	110
21	Chitin	Complex polysaccharide	Arthropod exoskeleton	111
22	Collagen	Most abundant protein in animal world	Intercellular ground substance	109–110
23	RuBisCO	Most abundant protein in biosphere	Photosynthesis enzyme	110
24	Trypsin	Enzyme	Digestive	109
25	Insulin	Hormone	Adult diabetes	109
26	Antibody	Defence protein	Fights infectious agents	109
27	GLUT-4	Membrane transporter	Glucose into cells	109
28	Haemoglobin (adult)	Quaternary protein	$2\alpha + 2\beta$	112
29	Haem	Prosthetic group	Peroxidase, catalase	118
30	NAD / NADP	Coenzymes	Contain niacin	118
31	Zn^{2+}	Metal-ion cofactor	Carboxypeptidase	118
32	Malonate	Competitive inhibitor	vs succinate (succinic dehydrogenase)	117
33	Morphine, Codeine		Table 9.3	108

#	Biomolecule / Item	Class	NCERT example / Note	Page
		Alkaloid secondary metabolites		
34	Abrin, Ricin	Toxins	Table 9.3	108
35	Concanavalin A	Lectin	Table 9.3	108
36	Lemon grass oil	Essential oil	Table 9.3	108
37	Carotenoids, Anthocyanins	Pigments	Table 9.3	108
38	Vinblastin, Curcumin	Drugs	Table 9.3	108
39	Carbonic anhydrase	Lyase-type enzyme	10 million-fold acceleration	113–114
40	Oxidoreductases / Transferases / Hydrolases / Lyases / Isomerases / Ligases	Enzyme classes	IUBMB six-class system	117

🎯 Practice MCQs

Q1. When a living tissue is ground in trichloroacetic acid and strained through cheesecloth, the filtrate that is obtained is technically called the:

A. Acid-insoluble fraction

B. Acid-soluble pool

C. Ash content

D. Retentate

Q2. Which of the following statements about elements in living tissues is correct?

A. Living tissues contain elements that are entirely absent from earth's crust.

B. Silicon is more abundant in the human body than in earth's crust.

C. The relative abundance of carbon and hydrogen is higher in living organisms than in earth's crust.

D. Nitrogen and sulphur together exceed carbon by mass in the human body.

Q3. Read the following statements about amino acids and identify the correct combination: (I) Proteins are made of 20 types of amino acids. (II) Amino acids in proteins are α-amino acids — substituted methanes. (III) Tyrosine, phenylalanine and tryptophan are aromatic amino acids. (IV) The zwitterionic form carries both $-NH_3^+$ and $-COO^-$ groups.

A. Only I and II are correct

B. Only II, III and IV are correct

C. Only I, III and IV are correct

D. I, II, III and IV are all correct

📊 PYQ Alignment

Biomolecules is one of the most heavily tested chapters in CUET (UG) Biology — across 2023–25 it has consistently delivered 8–12 MCQs per year. Recurring question types: identification of the most abundant protein (RuBisCO vs collagen), classification of secondary metabolites from Table 9.3, six IUBMB enzyme classes with their reactions, cofactor types (prosthetic/coenzyme/metal-ion) with named examples, competitive inhibition with the malonate–succinate example, and statement/assertion-reason questions on protein structural levels (especially the $2\alpha + 2\beta$ quaternary structure of haemoglobin).

Biomolecules appeared in CUET (UG) Biology across 3 cycle(s) — 4 question(s) total. The questions below were extracted from official CUET (UG) papers and matched to this chapter by topic. See `/pyq/biology` for the full PYQ archive.

CUET 2023 — Actual PYQs from this chapter

Q.14 (CUET 2023) In DNA, N-glycosidic linkage is present between:

- A) Pentose sugar and phosphate group
- B) Nitrogenous base and pentose sugar
- C) Two nitrogenous bases
- D) Two pentose sugars

Tests: aligns with chapter content Answer: Not in extracted key — verify against official NTA key

CUET 2024 — Actual PYQs from this chapter

Q.12 (CUET 2024) Arrange steps of DNA fingerprinting in sequence: (A) Digestion with restriction enzyme (B) Isolation of DNA (C) Hybridisation with labelled VNTR probe (D) Blotting onto membrane

- A)
- B)
- C)
- D)

Tests: aligns with chapter content Answer: Not in extracted key — verify against official NTA key

CUET 2025 — Actual PYQs from this chapter

Q.16 (CUET 2025) Match gene name with encoded enzyme. Gene Encodes (A) 'i' (i) Permease (B) 'z' (ii) Repressor (C) 'y' (iii) Transace tylase (D) 'a' (iv) β-galacto sidase

- A)
- B)
- C)
- D)

Tests: aligns with chapter content Answer: Not in extracted key — verify against official NTA key

Q.20 (CUET 2025) EcoRI, a significant tool in rDNA technology, is a:

- A) Bacteria
- B) Plasmid
- C) Enzyme
- D) Purine

Tests: aligns with chapter content Answer: Not in extracted key — verify against official NTA key