FREE NOTES · NCERT + JEE/NEET LEVEL

Biomolecules

Carbohydrates (glucose, fructose, disaccharides, polysaccharides), proteins (amino acids, peptide bond, structure, denaturation), enzymes, vitamins aur nucleic acids (DNA, RNA).

01 Carbohydrates: classification
02 Glucose
03 Cyclic structure & fructose
04 Disaccharides & polysaccharides
05 Amino acids
06 Proteins
07 Enzymes & vitamins
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01 Carbohydrates: classification

Carbohydrates optically active polyhydroxy aldehydes ya ketones hain, ya aise compounds jo hydrolysis pe ye dete. General formula aksar $C_x(H_2O)_y$.

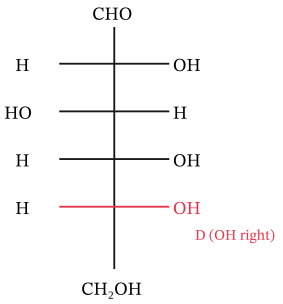
Class	Hydrolysis pe	Examples
Monosaccharides	Hydrolysis nahi hota	Glucose, fructose, ribose
Oligosaccharides (2–10)	2–10 monosaccharides	Sucrose, maltose, lactose
Polysaccharides	Bahut saari units	Starch, cellulose, glycogen

- **Sugars** meethe aur crystalline (mono aur oligo); polysaccharides non-sugars.
- **Reducing sugars** Tollens'/Fehling's ko reduce karte (free aldehyde/ketone group): saare monosaccharides, maltose, lactose. **Sucrose non-reducing hai.**
- Aldose (–CHO) vs ketose (C=O): glucose aldohexose, fructose ketohexose.

02 Glucose

Banana: sucrose + dil. HCl → glucose + fructose; starch + dil. H_2SO_4 (393 K, 2–3 atm) → glucose.

Reaction	Kya saabit karta
HI, garam → n-hexane	Seedhi chain me 6 C
NH_2OH → oxime; HCN → cyanohydrin	C=O hai
Br_2 water → gluconic acid	C=O aldehyde hai
Acetic anhydride → pentaacetate	5 –OH groups
HNO_3 → saccharic acid	Ek 1° alcohol (–CH_2OH)



D-(+)-glucose, Fischer projection

"D" sabse neeche wale chiral C ki configuration batata (–OH right me, D-glyceraldehyde jaisa); "+" matlab dextrorotatory. Dono ka aapas me koi rishta nahi.

03 Cyclic structure & fructose

Open-chain glucose kuch baatein explain nahi karta: Schiff's test nahi deta, $NaHSO_3$ adduct nahi banata, pentaacetate NH_2OH se react nahi karta, aur α aur β do forms hote. Isliye glucose **chhe-member ring** (pyranose) banata, C5 ka –OH C1 ke –CHO pe attack karta (hemiacetal).

- **Anomers:** α aur β sirf C1 pe alag (anomeric carbon).
- **Fructose:** ketohexose, C=O C2 pe; paanch-member ring (**furanose**) banata. D-(−)-fructose laevorotatory.

04 Disaccharides & polysaccharides

Sugar	Units	Linkage	Reducing?
Sucrose	α-D-glucose + β-D-fructose	C1–C2 glycosidic	Nahi
Maltose	2 α-D-glucose	C1–C4	Haan
Lactose (doodh ki sugar)	β-D-galactose + β-D-glucose	C1–C4	Haan

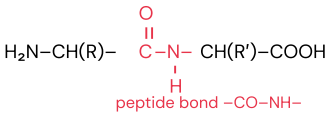
Invert sugar: sucrose (+66.5°) hydrolyse hoke glucose (+52.5°) + fructose (−92.4°); mixture laevorotatory, isliye sign "ulat" jaata.

Polysaccharide	Kisse bana	Note
Starch	Amylose (15–20%, seedhi chain, paani me ghulta, α C1–C4) + amylopectin (80–85%, branched, branches pe C1–C6)	Paudhon ka storage
Cellulose	β-D-glucose, C1–C4 seedhi chain	Paudhon ki cell wall; insaan pacha nahi sakta
Glycogen	Amylopectin jaisa, bahut branched	"Animal starch", liver aur muscles me

05 Amino acids

$-NH_2$ aur $-COOH$ dono hote. **α-amino acids** (dono same C pe) proteins banate. Glycine ke alawa sab optically active (zyada tar L-form).

- **Essential** (khane se): valine, leucine, isoleucine, lysine, threonine, methionine, phenylalanine, tryptophan, histidine, arginine. **Non-essential**: sharir khud banata (glycine, alanine, ...).
- Neutral, acidic (extra $-COOH$: aspartic, glutamic acid) ya basic (extra $-NH_2$: lysine, arginine).
- **Zwitterion:** paani me H^+ $-COOH$ se $-NH_2$ pe chala jaata ⇒ $H_3N^+-CHR-COO^-$. Amino acids amphoteric, high melting, paani me ghulte. **Isoelectric point** pe net charge zero.



Dipeptide: ek ka $-COOH$ + agle ka $-NH_2$, paani nikal ke

06 Proteins

- **Fibrous** (dhaage jaise, paani me nahi ghulte: keratin, myosin) aur **globular** (gol, ghulte: insulin, albumin).

Structure	Matlab	Kisse judi
Primary	Amino acids ka sequence	Peptide bonds
Secondary	α-helix ya β-pleated sheet	–CO aur –NH ke beech H-bonds
Tertiary	Poori folding (fibrous/globular)	H-bonds, disulphide, ionic, van der Waals
Quaternary	Kai sub-units ki arrangement	Same forces

DENATURATION

Garmi ya pH badalne se H-bonds toot jaate ⇒ 2° aur 3° structure khatam, protein ki biological activity chali jaati; 1° structure bachi rehti. Examples: anda ubalna (albumin jam jaata), doodh ka phatna.

07 Enzymes & vitamins

Enzymes zyada tar globular proteins hain jo specific biological catalyst ka kaam karte (maltase: maltose → glucose). Activation energy ghatate (sucrase ke saath sucrose hydrolysis ka E_a 18 → 6 kJ/mol).

Vitamin	Source	Kami se bimari
A	Fish oil, gajar, doodh	Night blindness, xerophthalmia
B_1 (thiamine)	Yeast, doodh, anaaj	Beri-beri
B_2 (riboflavin)	Doodh, ande ki safedi	Cheilosis, digestive problems
B_6 (pyridoxine)	Yeast, doodh, anaaj	Convulsions (daure)
B_{12}	Meat, machhli, anda (paudhon me nahi)	Pernicious anaemia
C (ascorbic acid)	Khatte phal, amla	Scurvy (masoodon se khoon)
D	Dhoop, machhli, ande ki zardi	Rickets, osteomalacia
E	Vegetable oils, nuts	Kamzor RBCs, muscle weakness
K	Hari pattedar sabziyan	Khoon der se jamna

Fat-soluble (sharir me jama): A, D, E, K. **Water-soluble** (roz lena padta): B group, C. B_{12} exception hai jo liver me jama hota.

08 Nucleic acids

- **Nucleotides** ke polymers. Nucleoside = base + sugar; nucleotide = nucleoside + phosphate. Nucleotides **phosphodiester** link se judte (5′–3′).
- **DNA:** 2-deoxyribose; bases A, G, C, **T**. Double helix; A–T (2 H-bonds), G–C (3 H-bonds). Genetic information rakhta, khud copy banata.
- **RNA:** ribose; bases A, G, C, **U**. Single strand. Types: mRNA, rRNA, tRNA; protein synthesis karte.
- Purines: A, G. Pyrimidines: C, T, U.

09 JEE Extra + Tricks

JEE LEVEL

- Glucose: open-chain se $NaHSO_3$ aur Schiff reagent ke saath reaction na hona aur α, β anomers samajh nahi aate ⇒ cyclic (pyranose); mutarotation.
- Reducing sugars: glucose, fructose, maltose, lactose. Sucrose non-reducing (glucose ka C1 aur fructose ka C2 jude), hydrolysis ke baad invert sugar.
- Starch: amylose (seedha, α-1,4) + amylopectin (shakhayein, branch pe α-1,6); cellulose β-1,4.
- Essential amino acids (10): "**PVT TIM HALL**". Isoelectric point: amino acid zwitterion, net charge zero.
- Vitamins: fat-soluble A, D, E, K (body me store); water-soluble B group aur C (roz chahiye; B_{12} liver me store).
- DNA vs RNA: deoxyribose vs ribose; thymine vs uracil; double vs single strand.

10 Solved questions

Q1. Sucrose non-reducing kyun?

Dono reducing groups (glucose ka C1 aur fructose ka C2) glycosidic bond me lag jaate, koi free C=O nahi bachta.

Q2. Denaturation me protein ki primary structure ka kya hota?

Wo bachi rehti; sirf 2° aur 3° structure khatam hoti.

Q3. Proteins, polysaccharides aur nucleic acids me linkage ka naam?

Kramshah peptide, glycosidic aur phosphodiester.

11 Mistakes & practice

- Sochna ki D/L rotation ki disha batata.
- Sucrose ko reducing sugar kehna.
- DNA me uracil ya RNA me thymine likhna.
- Vitamin C ko fat-soluble kehna.

1. Kis vitamin ki kami se scurvy?
2. Kaun sa carbohydrate animal starch kehlata?
3. α-helix ko kaun sa bond pakadta?
4. Kaun sa amino acid optically active nahi?
5. Cellulose ke monomers?

ANSWERS

1) Vitamin C · 2) Glycogen · 3) Hydrogen bonds · 4) Glycine · 5) β-D-glucose

12 Quick revision: exam se 5 minute pehle

CARBOHYDRATES

- Glucose: aldohexose, pyranose.
- Fructose: ketohexose, furanose.
- Sucrose non-reducing; invert sugar.

POLYSACCHARIDES

- Starch: amylose + amylopectin.
- Cellulose: β-glucose.
- Glycogen: animal starch.

PROTEINS

- Peptide bond –CO–NH–.
- 1°, 2° (helix/sheet), 3°, 4°.
- Denaturation: 1° bachti.

BAAKI

- Fat-soluble: A, D, E, K.
- DNA: A=T, G≡C, deoxyribose.
- RNA: U, ribose.

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.