Biomolecules Class 12 Key Points

CBSE Class 12 Chemistry · NCERT · for boards, NEET and JEE revision

ChapterNotes

Carbohydrates: Classification

$C_x(H_2O)_y$ · aldose (–CHO) vs ketose (C=O)

The $C_x(H_2O)_y$ rule is loose - sugars like rhamnose break it.

- Mono- (glucose), oligo-/di- (sucrose), poly- (starch) by hydrolysis
- Sugars = sweet, soluble; non-sugars = polysaccharides, insoluble
- Glucose = aldohexose, fructose = ketohexose

Glucose & Fructose Structure

Br_2 water → gluconic acid (mono) · HNO_3 → saccharic acid (di)

Pentaacetate ⇒ 5 –OH; HI → n-hexane ⇒ straight 6-C chain; 1 HCN ⇒ one –CHO.

- Fructose = ketohexose at C-2 but still a reducing sugar
- Glucose closes to a 6-ring pyranose; fructose to a 5-ring furanose
- C-1 –OH (anomeric C) α (down) or β (up) → two anomers

Mutarotation

α +111° ⇌ open chain ⇌ β +19.2° → settles +52.7°

Rotation changes, molecular formula does not; equilibrium ≈ 36% α, 64% β.

- Anomers differ only at the anomeric C-1, not at C-4 (that's an epimer)
- 0.36(111) + 0.64(19.2) ≈ 52° matches observed +52.7°
- Caused by ring repeatedly opening and re-closing

Di- & Polysaccharides

Sucrose = α-glucose + β-fructose (C1–C2) → non-reducing

Sucrose hydrolysis → invert sugar; rotation flips +66.5° → –39.7°.

- Maltose (2 α-glucose, C1–C4) & lactose (β-gal + glucose) are reducing
- Starch = amylose (linear α-1,4) + amylopectin (branched α-1,4 & α-1,6)
- α-links = digestible storage; β-1,4 = tough structural cellulose

Amino Acids & the Zwitterion

H_3N^+–CHR–COO^- (zwitterion) · net charge = 0 at pI

Essential ones (valine, leucine, lysine) come from diet; rest are non-essential.

- Zwitterion ⇒ high melting, water-soluble, salt-like
- All except glycine are optically active (chiral α-carbon)
- Peptide bond = amide link –CO–NH– between two amino acids

Four Levels of Protein Structure

Primary → Secondary (α-helix / β-sheet) → Tertiary → Quaternary

Denaturation breaks secondary/tertiary structure; primary sequence stays intact.

- Secondary held by H-bonds; tertiary adds –S–S– disulphide bridges
- Quaternary = ≥2 subunits, e.g. haemoglobin (4 chains)
- Egg white / curdled milk = denaturation in action

Enzymes & Vitamins

Fat-soluble = A, D, E, K (stored) · Water-soluble = B-complex, C

B_{12} is the water-soluble vitamin that IS stored (in the liver).

- Enzymes = globular proteins, lock-and-key, names end in -ase
- Maltase→maltose, invertase→sucrose, zymase→glucose to ethanol
- C→scurvy, A→night blindness, D→rickets, K→poor clotting

Nucleic Acids (DNA & RNA)

Nucleoside = sugar + base · Nucleotide = sugar + base + phosphate

Backbone = 3′–5′ phosphodiester bonds; strands held by H-bonds.

- DNA: deoxyribose + thymine; RNA: ribose + uracil
- Purines A, G (2 rings); pyrimidines C, T, U (1 ring)
- Pairing A=T (2 H-bonds), G≡C (3 H-bonds); strands antiparallel

Chargaff's Rule

%A = %T , %G = %C → %G = (100 − (%A + %T)) / 2

Use only for double-stranded DNA, not single-stranded RNA.

- If %A = 30, then %T = 30, so %G = %C = 20
- G≡C-rich DNA is more stable (3 H-bonds, needs more heat)
- Know one strand ⇒ you can write the complementary strand

Hormones, Lipids & Metabolism

Insulin ↓ glucose (glucose→glycogen) · glucagon/adrenaline ↑ glucose

Thyroxine = the iodine-containing hormone; Co in B_{12}, Fe in haemoglobin, Mg in chlorophyll.

- Steroid (testosterone), peptide (insulin), amine (adrenaline, thyroxine)
- Phospholipid = glycerol + 2 fatty acids + 1 phosphate → cell membranes
- Glycolysis: glucose → 2 pyruvate (+ATP); digestion = hydrolysis

Quick revision

- Carbohydrates: mono (glucose, fructose), di (sucrose, maltose, lactose), poly (starch, cellulose)
- Glucose: aldohexose, exists as cyclic hemiacetal (α and β anomers)
- Sucrose = only common non-reducing disaccharide (both anomeric C involved)
- Starch: amylose (linear α-1,4) + amylopectin (branched α-1,4 + α-1,6)
- Cellulose: β-1,4 linked (humans can't digest - no enzyme for β-linkage)
- Amino acids: zwitterionic, all optically active except glycine
- Protein structure: 1° (sequence) → 2° (helix/sheet) → 3° (3D fold) → 4° (multi-chain)
- Fat-soluble vitamins: A, D, E, K; Water-soluble: B, C
- DNA: double helix, A=T (2 H-bonds), G≡C (3 H-bonds)
- Chargaff's rule: [A]=[T], [G]=[C]

Full chapter notes with solved examples and practice questions: https://chapternotes.in/cbse/class-12-chemistry/biomolecules-class-12-notes/