

Biomolecules: one-page cheat sheet

NEET Chemistry · Unit 19 · Organic Chemistry

1 · Carbohydrates

Mono-	no further hydrolysis: glucose, fructose, galactose, ribose
Oligo-	2 to 10 units: sucrose, maltose, lactose
Poly-	starch, cellulose, glycogen
Reducing	all monosaccharides, maltose, lactose; sucrose is non-reducing
Fructose	ketohexose, laevorotatory (-92.4°), furanose; in honey

2 · Glucose structure proofs

Reagent	Shows
HI / red P	n-hexane: straight C_6 chain
NH_2OH , HCN	oxime, cyanohydrin: $C=O$
Br_2 water	gluconic acid: $-CHO$
Ac_2O	pentaacetate: five $-OH$
conc. HNO_3	saccharic acid: $-CH_2OH$ at C-6

No Schiff's test, no $NaHSO_3$ adduct, pentaacetate does not react with hydroxylamine: the ring is a cyclic hemiacetal.

3 · Rings & mutarotation

Pyranose	$-OH$ at C-5 attacks C-1: six-membered ring
Anomers	α : C-1 OH down; β : up (Haworth)
Rotation	$\alpha + 112^\circ$, $\beta + 19^\circ$ both go to $+52.5^\circ$
Mix	about 36% α , 64% β , under 0.02% open chain

4 · Di- & polysaccharides

Sugar	Units and link	Reducing
Sucrose	α -Glc C1 - β -Fru C2	no
Maltose	two α -Glc, C1-C4	yes
Lactose	β -Gal + β -Glc, C1-C4	yes

Invert sugar sucrose $+66.5^\circ$ gives glucose $+52.5^\circ$ + fructose -92.4° : net -20°

Amylose 15-20%, linear α -1,4, soluble

Amylopectin 80-85%, branched (α -1,6)

Cellulose β -glucose, β -1,4, unbranched

Glycogen like amylopectin, branches every 8-12 units

5 · Amino acids

Natural	L-configuration; glycine is achiral
Acidic	Asp, Glu
Basic	Lys, Arg, His
	$RCH(NH_2)COOH \rightleftharpoons RCH(NH_3^+)COO^-$ (zwitterion)
pI	net charge zero; least soluble; no migration

6 · Proteins

Peptide bond	$-CO-NH-$, planar and rigid (partial double bond)
1°	amino acid sequence
2°	α -helix ($N-H$ of n to $C=O$ of $n+4$); β -sheet
3°	folding; H-bonds, S-S, ionic, van der Waals
4°	subunits: haemoglobin $2\alpha + 2\beta$
Fibrous	keratin, myosin; Globular : insulin, albumin
Denaturation	2°, 3°, 4° lost; primary stays intact

7 · Enzymes & vitamins

Enzymes are globular proteins that lower activation energy, not polysaccharides.

Vitamin	Deficiency
A (retinol)	night blindness, xerophthalmia
B ₁ (thiamine)	beri-beri
B ₂ (riboflavin)	cheilosis
B ₆	convulsions
B ₁₂	pernicious anaemia
C	scurvy
D	rickets, osteomalacia
E	increased RBC fragility
K	slow blood clotting

Fat-soluble: A, D, E, K. Water-soluble: B and C (B₁₂ is stored in the liver).

8 · Nucleic acids

Sugar	DNA 2-deoxyribose; RNA ribose
Bases	purines A, G; pyrimidines C, T (DNA), C, U (RNA)
Nucleoside	base at C-1' of sugar
Nucleotide	nucleoside + H_3PO_4 at C-5'
Linkage	3'-5' phosphodiester $A=T$ (2 H-bonds), $G\equiv C$ (3 H-bonds)
RNA	single strand: mRNA, rRNA, tRNA

9 · Biomolecule tests

Molisch	carbohydrates: violet ring
Benedict / Fehling	reducing sugars: red Cu_2O
Iodine	starch: blue-black
Ninhydrin	amino acids, proteins: purple
Biuret	peptide bonds: violet

Seen in NEET 2024, 2020

Glucose does **not** give Schiff's test or the $NaHSO_3$ adduct.

Sucrose hydrolysis gives α -D-glucose + β -D-fructose.

Denaturation leaves the **primary** structure intact. Lysine is a basic amino acid.

Seen in NEET 2021, 2022, 2025

Starch gives the Tyndall effect (colloid); glucose, urea and NaCl do not.

Enzymes are not polysaccharides.

Keto sugar in honey, laevorotatory: **D-fructose**.

Six traps to remember

- Sucrose is non-reducing; maltose and lactose are reducing.
- Glucose gives no Schiff's test and no $NaHSO_3$ adduct, so it exists as a cyclic hemiacetal.
- Invert sugar rotates to the left because fructose (-92.4°) outweighs glucose ($+52.5^\circ$).
- Glycine is the only achiral natural amino acid.
- Denaturation destroys 2°, 3° and 4° structure but not the primary.
- A nucleotide is a nucleoside plus **phosphoric** acid, not phosphorous acid.