

carbohydrates, proteins and nucleic acids are all polymers of a small, repeating chemical unit

Classification of carbohydrates *

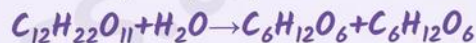
- carbohydrates: polyhydroxy aldehydes or ketones, or units that hydrolyse to give them
- name comes from $C_x(H_2O)_y$, hydrates of carbon
- monosaccharide: does NOT hydrolyse further, e.g. glucose, fructose, ribose
- oligosaccharide: hydrolyses to 2-10 monosaccharide units
- disaccharide (2 units): sucrose, maltose, lactose; trisaccharide (3): raffinose; tetrasaccharide (4): stachyose
- polysaccharide: hydrolyses to many monosaccharide units, e.g. starch, cellulose, glycogen

Glucose: proof of its aldohexose structure

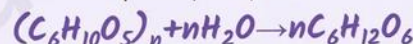
- formula $C_6H_{12}O_6$, from elemental analysis and colligative properties
- SIX carbons, ONE straight chain: gives n-hexane on prolonged heating with HI
- ONE carbonyl: forms an oxime with NH_2OH , a cyanohydrin with HCN
- carbonyl is an ALDEHYDE: bromine water oxidises it to gluconic acid, so it was terminal
- FIVE -OH groups: reacts with 5 mol acetic anhydride to give glucose pentaacetate
- ONE primary alcohol $-CH_2OH$ at C6: glucose and gluconic acid both give saccharic acid with dilute HNO_3

Glucose from sucrose and from starch

acid-catalysed hydrolysis of sucrose



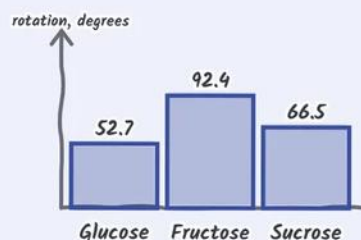
acid-catalysed hydrolysis of starch, 393 K, 2-3 atm



glucose from sucrose separates on adding ethanol: it is nearly insoluble in alcohol and crystallises out first

Fischer projection and D/L configuration

- an aldohexose has 4 chiral carbons (C2-C5), so $2^4 = 16$ optical isomers are possible
- Fischer (Nobel 1902) fixed glucose's configuration at all four by chemical correlation
- glucose is dextrorotatory, $[\alpha]_D^{20} = +52.7^\circ$, hence dextrose; D-(+)-glucose names configuration, not just sign
- glyceraldehyde has ONE chiral carbon: -OH on the RIGHT defines D-, on the LEFT defines L-
- a sugar's D/L label is read off its LOWEST (highest-numbered) chiral carbon



size of the specific rotation, sign set aside: fructose's is the largest of the three, and fructose alone is laevorotatory