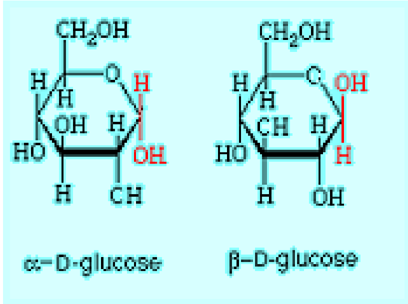
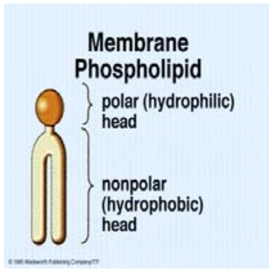
Biochemistry

Carbohydrates $C_n(H_2O_n)$



Sugars:
Uses – energy (respiration). Learn to draw diagram *(right)*
Monosaccharides: 3C = triose; 5C = pentose; 6C = hexose
5-carbon: deoxyribose (DNA), ribose (RNA, ATP)
6-carbon: *($C_6H_{12}O_6$)* – α-glucose (G); β-glucose; fructose (F)
Testing: Benedicts**; B**oil; **B**lue → **B**rick red;
Joined together with **glycosidic** bonds **(condensation** -H_2O)
Disaccharides: *($C_{12}H_{22}O_{11}$)* – maltose (2 x G); sucrose (G + F) – the only non-reducing sugar
Testing: – Boil HCl, add NaOH, then **B**enedicts**; B**oil; **B**lue → **B**rick red *(as above)*
Polysaccharides: Starch (**plants only)** = ⅓ amylose (1:4 **α** glucose **chain**);
⅔ amylopectin (1:4 **α and** 1:6 **α** bonds, so **branched)**
Testing: – add I_2/KI **solution**; yellow/orange → blue-black
Glycogen animals, fungi, bacteria: **(**1:4 α **and** 1:6 α bonds, so **branched**)
Uses: energy store – because: **not soluble,** so no effect on water potential(ψ); not washed away
Compact, lots of energy stored**, branched,** so easily broken down
Cellulose **(plants only)**1:4 **β-**glucose chain (X-linked by H-bonds)
Uses: plant cell wall (support) – because: strong in tension, not easily digested (roughage)

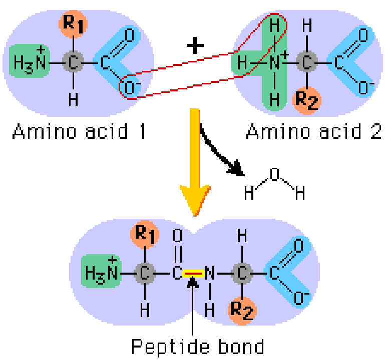
Triglycerides (Lipids) $C_nH_{2n}O_6$



Structure: 1 x glycerol + 3 x fatty acids, joined by **3x ester** bonds (-3x H_2O)
Uses – energy store, insulation, waterproofing, membranes
Contains little oxygen, so **rich in energy; hydrophobic; NOT a polymer**
Can be **saturated** (all C-C bonds e.g. animal fats)
Or **unsaturated** (includes some C=C bonds, e.g. olive oil, cholesterol)
Phospholipids (polar) - with PO_4 – form bilayers in **fluid mosaic** membranes
Phosphate head is **hydrophyllic**; 2 x fatty acid tails are **hydrophobic**
Testing: shake with warm ethanol; pour into **cold water** – forms WHITE emulsion

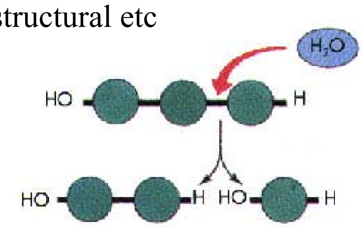
Proteins (CNON+S - in 2 amino-acids ONLY)

Proteins are polymers made of amino-acids (20 different e.g. alanine). Differ only in R-groups.



Joined by **peptide bonds** = CONH (-H_2O) on ribosomes *(70s Prokaryotes, 80s Eukaryotes).*
Forms **dipeptides**; **polypeptides**; active form = **proteins**
Primary (1^o) structure = sequence of amino-acids;
bonds = **peptide** (covalent -H_2O)
Secondary (2^o) structure = folding (α-helix, β-pleated sheet);
bonds = H-bonds (many)
Tertiary (3^o) structure = final folding to form active site;
bonds = H and disulphide bridges
Quaternary (4^o) structure – found only in haemoglobin;
bonds = weak ionic/Van der Waals forces
Denatured when H-bonds break - ↕ pH (reversible); temperatures >60^oC (irreversible).
Testing: add Biuret reagent to **solution** of protein; pale blue → lilac NB **no heat**!
Uses: enzymes; **buffers pH**; movement; transport; reproduction; hormones; structural etc

General



Joining molecules = anabolism = condensation reactions (-H_2O)
Breaking molecules = catabolism = hydrolysis reactions (+ H_2O)