

2.1.2 Biological molecules

- (a) how hydrogen bonding occurs between water molecules, and relate this, and other properties of water, to the roles of water for living organisms
- A range of roles that relate to the properties of water, including solvent, transport medium, coolant and as a habitat **AND** roles illustrated using examples of prokaryotes and eukaryotes.
- HSW2, HSW8
- (b) the concept of monomers and polymers and the importance of condensation and hydrolysis reactions in a range of biological molecules
- (c) the chemical elements that make up biological molecules
- To include:
C, H and O for carbohydrates
C, H and O for lipids
C, H, O, N and S for proteins
C, H, O, N and P for nucleic acids.
- (d) the ring structure and properties of glucose as an example of a hexose monosaccharide and the structure of ribose as an example of a pentose monosaccharide
- To include the structural difference between an α - and a β -glucose molecule **AND** the difference between a hexose and a pentose monosaccharide.
- (e) the synthesis and breakdown of a disaccharide and polysaccharide by the formation and breakage of glycosidic bonds
- To include the disaccharides sucrose, lactose and maltose.
- (f) the structure of starch (amylose and amylopectin), glycogen and cellulose molecules
- HSW8
- (g) how the structures and properties of glucose, starch, glycogen and cellulose molecules relate to their functions in living organisms
- HSW2, HSW8
- (h) the structure of a triglyceride and a phospholipid as examples of macromolecules
- To include an outline of saturated and unsaturated fatty acids.
- (i) the synthesis and breakdown of triglycerides by the formation (esterification) and breakage of ester bonds between fatty acids and glycerol
- (j) how the properties of triglyceride, phospholipid and cholesterol molecules relate to their functions in living organisms
- To include hydrophobic and hydrophilic regions and energy content **AND** illustrated using examples of prokaryotes and eukaryotes.
- HSW2, HSW8
- (k) the general structure of an amino acid
- (l) the synthesis and breakdown of dipeptides and polypeptides, by the formation and breakage of peptide bonds
- (m) the levels of protein structure
- To include primary, secondary, tertiary and quaternary structure **AND** hydrogen bonding, hydrophobic and hydrophilic interactions, disulfide bonds and ionic

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- (n)** the structure and function of globular proteins including a conjugated protein
- bonds.
HSW8
To include haemoglobin as an example of a conjugated protein (globular protein with a prosthetic group), a named enzyme and insulin.
An opportunity to use computer modelling to investigate the levels of protein structure within the molecule. **PAG10**
- (o)** the properties and functions of fibrous proteins
- To include collagen, keratin and elastin (no details of structure are required).
- (p)** the key inorganic ions that are involved in biological processes
- To include the correct chemical symbols for the following cations and anions:
cations: calcium ions (Ca^{2+}), sodium ions (Na^+), potassium ions (K^+), hydrogen ions (H^+), ammonium ions (NH_4^+)
anions: nitrate (NO_3^-), hydrogencarbonate (HCO_3^-), chloride (Cl^-), phosphate (PO_4^{3-}), hydroxide, (OH^-).
- (q)** how to carry out and interpret the results of the following chemical tests:
biuret test for proteins
Benedict's test for reducing and non-reducing sugars
reagent test strips for reducing sugars
iodine test for starch
emulsion test for lipids
- PAG9** HSW3, HSW4, HSW5
- (r)** quantitative methods to determine the concentration of a chemical substance in a solution
- To include colorimetry and the use of biosensors (an outline only of the mechanism is required). **PAG5** HSW3, HSW4, HSW5
- (s)** **(i)** the principles and uses of paper and thin layer chromatography to separate biological molecules / compounds
(ii) practical investigations to analyse biological solutions using paper or thin layer chromatography.
- To include calculation of retention (R_f) values.
For example the separation of proteins, carbohydrates, vitamins or nucleic acids.
M0.1, M0.2, M1.1, M1.3, M2.2, M2.3, M2.4
PAG6 HSW2, HSW3, HSW4