

Carbohydrates and lipids

What is a covalent bond?

Carbohydrates and lipids

Why can carbon form such diverse compounds?

Carbohydrates and lipids

Give the SI prefixes milli, micro and nano as powers of ten.

Carbohydrates and lipids

What is a condensation reaction?

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What happens to water in hydrolysis?

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Name the bond formed in polysaccharides, polypeptides and nucleic acids.

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Pentose or hexose: how do you tell from a ring diagram?

Carbohydrates and lipids

Alpha-glucose versus beta-glucose

It forms up to four covalent bonds, single or double, with other carbons and non-metals, building chains, branches and rings.

A bond in which two atoms share a pair of electrons.

A reaction that links two monomers by a covalent bond, releasing a water molecule.

milli = 10^{-3} , micro = 10^{-6} , nano = 10^{-9} .

Glycosidic, peptide and phosphodiester bonds respectively.

A water molecule is split; its -H and -OH are added to the monomers as the bond breaks.

The -OH on carbon 1 is below the ring in alpha and above the ring in beta.

Count all carbon atoms, including those outside the ring: five = pentose (ribose), six = hexose (glucose).

Carbohydrates and lipids

Four properties of glucose that suit its use

Carbohydrates and lipids

Why are starch and glycogen compact?

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Why is glycogen's branching useful?

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How does cellulose's structure give strength?

Carbohydrates and lipids

What is a glycoprotein?

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How do the A, B and O antigens differ?

Carbohydrates and lipids

Define lipids.

Carbohydrates and lipids

What is a triglyceride made from?

Coiling and branching during polymerisation pack many alpha-glucose units into a small space.

Soluble, easily transported, chemically stable, and yields energy when oxidised in respiration.

Beta-glucose in alternating orientation gives straight chains, bundled and cross-linked by hydrogen bonds into microfibrils.

Many chain ends, so glucose can be added or removed quickly by condensation or hydrolysis.

All share the same basic carbohydrate chain. The A and B antigens each add a different extra sugar to it; group O has neither.

A protein with carbohydrate chains attached, facing out from the plasma membrane; used in cell-cell recognition.

One glycerol and three fatty acids, joined by condensation (ester bonds), releasing three water molecules.

Substances in living organisms that dissolve in non-polar solvents but are only sparingly soluble in aqueous solvents.

Carbohydrates and lipids

What is a phospholipid made from?

Carbohydrates and lipids

**Saturated, monounsaturated,
polyunsaturated**

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**Why do unsaturated fatty acids have
lower melting points?**

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**Why are triglycerides good long-term
energy stores?**

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**How does adipose tissue help
endotherms in cold habitats?**

Carbohydrates and lipids

Why do phospholipids form bilayers?

Carbohydrates and lipids

**How do you identify a steroid from a
diagram?**

Carbohydrates and lipids

**Why can oestradiol and testosterone
enter cells directly?**

No C=C double bonds; one C=C; two or more C=C.

One glycerol linked to two fatty acids and one phosphate group.

About twice the energy per gram of carbohydrate, insoluble, stored without water and chemically stable.

C=C double bonds bend the chain, so chains pack less closely and less energy is needed to melt them.

They are amphipathic: hydrophilic heads face water on both sides, hydrophobic tails face inwards.

Fat conducts heat poorly, so a thick layer (e.g. blubber in seals) insulates and reduces heat loss.

They are non-polar steroids, so they diffuse through the hydrophobic core of the phospholipid bilayer.

Four fused carbon rings: three with six carbons and one with five.

Proteins

Generalised structure of an amino acid

Proteins

Word equation for forming a dipeptide

Proteins

What is a peptide bond?

Proteins

Essential versus non-essential amino acids

Proteins

Why do vegan diets need attention to protein?

Proteins

Three reasons for the infinite variety of peptide chains

Proteins

Define denaturation.

Proteins

How does high temperature denature a protein?

amino acid + amino acid $\rightarrow$ dipeptide + water

An alpha carbon bonded to an amine group ($-\text{NH}_2$), a carboxyl group ($-\text{COOH}$), a hydrogen atom and an R-group.

Essential cannot be synthesised and must come from food; non-essential can be made from other amino acids.

The $-\text{CO}-\text{NH}-$ bond formed by condensation between the carboxyl group of one amino acid and the amine group of the next.

20 amino acids in the genetic code; chains of any length from a few to thousands; amino acids in any order.

Some plant proteins are low in certain essential amino acids, so a variety of plant sources is needed.

Increased vibration breaks hydrogen bonds and other weak interactions, so the protein unfolds; peptide bonds stay intact.

A usually permanent change in a protein's three-dimensional structure, so it can no longer carry out its function.

Proteins

How does pH denature a protein?

Proteins **HL only**

Classify the types of R-group.

Proteins **HL only**

What determines a protein's conformation?

Proteins **HL only**

What is primary structure?

Proteins **HL only**

What stabilises secondary structure?

Proteins **HL only**

Alpha helix versus beta-pleated sheet

Proteins **HL only**

Four interactions in tertiary structure

Proteins **HL only**

What forms a disulfide bond?

Hydrophobic (non-polar) or hydrophilic; hydrophilic are polar or charged; charged are acidic (negative) or basic (positive).

It changes the charges on R-groups, breaking ionic bonds and altering hydrogen bonds that hold the shape.

The sequence of amino acids in a polypeptide.

Its primary structure: the sequence and precise position of each amino acid, giving a precise, repeatable 3D shape.

Helix: chain coils, H bonds four amino acids apart. Sheet: stretches of chain side by side, H bonds between them.

Hydrogen bonds in regular positions between C=O and N-H groups of the backbone.

A covalent -S-S- bond between the R-groups of a pair of cysteines.

Hydrogen bonds, ionic bonds, disulfide covalent bonds and hydrophobic interactions, all between R-groups.

Proteins **HL only**

Where are hydrophobic amino acids in a water-soluble globular protein?

Proteins **HL only**

How do integral proteins embed in membranes?

Proteins **HL only**

Non-conjugated versus conjugated protein

Proteins **HL only**

Quaternary structure of haemoglobin

Proteins **HL only**

What has cryogenic electron microscopy allowed?

Proteins **HL only**

Globular versus fibrous proteins

Proteins **HL only**

How does collagen's form suit its function?

Proteins **HL only**

How does insulin's form suit its function?

They have regions of hydrophobic amino acids that sit in the hydrophobic core of the bilayer.

Clustered in the core, away from water; polar ones are on the surface.

Four polypeptides (two alpha, two beta), each with a haem group containing iron that binds O_2 .

Non-conjugated: polypeptides only (insulin, collagen). Conjugated: also has a non-polypeptide part (haemoglobin with haem).

Globular: rounded, compact, usually soluble (insulin). Fibrous: long, narrow, insoluble, structural (collagen).

Imaging of single protein molecules and their interactions with other molecules.

Soluble globular hormone carried in plasma; its precise shape binds a specific receptor on target cells.

Triple helix cross-linked into fibrils gives high tensile strength, resisting pulling in tendons, ligaments and skin.