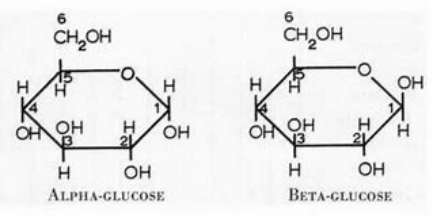
Carbohydrates

Most carbohydrates (and proteins/ nucleic acids) are polymers- large, complex molecules composed of long chains of monomers joined together. Monomers are small, basic molecular units, e.g. monosaccharides, amino acids and nucleotides

Carbohydrates are made from monosaccharides. The monomers that they're made from are monosaccharides, e.g. glucose, fructose and galactose

Glucose is a hexose sugar, a monosaccharide with six carbon atoms in each molecules. There are two types of **alpha** and **beta**- they're **isomers**.

alpha vs beta glucose



joined by condensation, has glycosidic bonds

Glucogen

Glycogen is the main **energy storage material in animals**

Animals store excess glucose as glycogen, a polysaccharide of alpha-glucose. It has a similar structure to amylopectin, but with more side branches so that stored glucose can be released quickly, important for energy release in animals.

Also very compact so it is good for storage

Condensation Reactions

Hydrolysis reactions

Polymers can be broken down into monomers by hydrolysis reactions. It breaks the chemical bind between monomers using a water molecule. Opposite of condensation. E.g. carbohydrates can be broken down into their constituent monosaccharides by hydrolysis

Starch

The Main **energy storage material in plants**

Cells get energy from glucose. Plants store excess glucose as starch. Starch is a mixture of two polysaccharides, **amylopectin** and **amylose**

Amylose- a long,**unbranched** chain of a-glucose. The angles of the glycosidic bonds give it a **coiled structure**, making it **compact**, good for storage because more can be fitted in a small space

Amylopectin- a long, **branched** chain of a-glucose. Its **side branches** allow enzymes that break down the molecule to get at the glycosidic bond easily, so glucose can be released quickly.

Starch is **insoluble** in water and doesn't affect **water potential**, so it doesn't cause water to enter by osmosis., which would make them swell, this makes them good for storage.

Iodine test for Starch- Add iodine dissolved in potassium iodide solution to test sample. If starch is present the sample changes from browny-orange to a dark blue black colour

Benedict's test for sugars

Sugar is a general term for **monosaccharides** and **disaccharides**. All sugars are either **reducing** or **non-reducing**

Reducing Sugars- all monosaccharides and **some** disaccharides	Non-reducing sugar e.g. sucrose, has to be broken down first to be tested.

Benedict's test for sugars (cont)

Add Benedict's reagent (which is blue) to a sample and heat it in a water bath that's been bought to boil. If it's positive, it will form a coloured precipitate	Add dilute hydrochloric acid to solution and gently heating in a water bath that's been bought to a boil. You then neutralise with **sodium hydrogen carbonate**.
blue-> green -> yellow -> orange ->brick red	Then carry out reducing sugar test

The higher the concentration the further the colour change goes. Can use to copare, but better if filter the solution and weigh the precipitate

Cellulose

Made of **long, unbranched** chains of **beta-glucose**

When beta-glucose molecules bind, they form straight cellulose chains. These are linked together by **hydrogen bonds** to form strong fibres called **microfibrils**. The strong fibres means cellulose provides **structural support** for cells

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A condensation reaction is when two molecules join together with the formation of a new **chemical bond** and a **water** molecule is released when the bond is formed. Monosaccharides join together by condensation reactions, where a glycosidic bond forms as the water molecule is released.

2 monosaccharides = **disaccharides** 2+ monosaccharides = **polysaccharide**

sucrose= glucose and fructose, lactose= glucose and galactose, maltose= 2x alpha glucose

By **AnitaAtina**
cheatography.com/anitaatina/

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