

A-LEVEL BIOLOGY BRIDGING WORK

Bonding in Biological Molecules - Summary Booklet

Learners should be able to demonstrate and apply their knowledge and understanding of:

- ⇒ The concept of monomers and polymers and the importance of condensation and hydrolysis reactions in a range of biological molecules
- ⇒ 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
- ⇒ The ring structure and properties of glucose as an example of a hexose monosaccharide to include the structural difference between an α - and a β -glucose molecule and the difference between a hexose and a pentose monosaccharide
- ⇒ The synthesis and breakdown of a disaccharide by the formation and breakage of glycosidic bonds, to include the disaccharide maltose

Task: Define these terms and name **three** biological examples for each:

Monomer

Polymer

Task: List the elements found in each of these classes of biological molecule:

- Carbohydrates
- Proteins
- Lipids (fats)
- Nucleic acids (DNA and RNA)

Forming bonds in polymers

Monomers are joined together through _____ reactions. A molecule of water is _____ (removed) as the bond is formed

Task: Draw a diagram to show two monomers being joined together in a condensation reaction (use a simple box to represent the monomers, as in the PowerPoint). Remember to show the water molecule being added

Breaking bonds in polymers

Polymers are broken down into monomers through _____ reactions - the opposite of condensation reactions

A molecule of water must be _____ to break the bond (*hydro = water and lysis = to break/split*)

Task: Draw a diagram to show a bond being broken in a hydrolysis reaction (use a simple box to represent the monomers, as in the PowerPoint). Remember to show the water molecule being removed

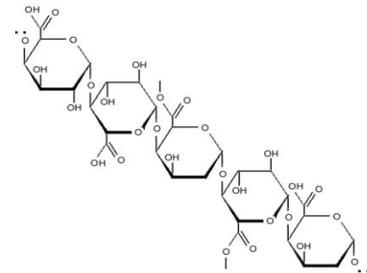
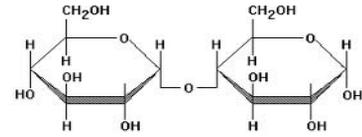
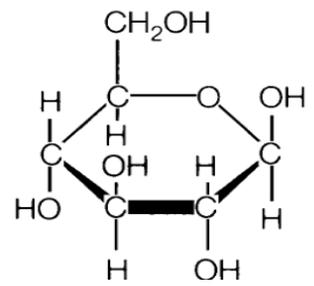
Carbohydrates

Task: Define these terms and name **three** examples for each:

Monosaccharide

Disaccharide

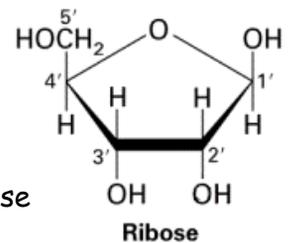
Polysaccharide



Monosaccharides

Ribose is a monosaccharide formed of five carbon atoms - it is therefore called a _____ sugar. Ribose is one of the monomers that make up the polymer RNA (a nucleic acid)

Glucose is a hexose sugar (6 carbons) with two isomers - alpha and beta glucose



Task: Draw the molecular structure of **alpha-glucose** and number the carbon atoms

Task: Describe in words how the structure of **beta-glucose** is different to that of alpha-glucose

Glucose is adapted to its function as an energy source in the following ways:

- ⇒ _____ - easily transported around organisms (e.g. in the blood of animals)
- ⇒ **Small molecule** - can enter cells easily by _____ across the cell surface membrane
- ⇒ Readily _____ to release energy
- ⇒ Molecules can be **joined together** (_____) through condensation reactions to form starch or glycogen for storage

Disaccharides

To produce a disaccharide, a _____ reaction takes place to form a covalent bond between the two alpha-glucose molecules (at carbon 1 and carbon 4). A _____ molecule is removed in the process. In carbohydrates, the bond formed is called a _____ bond.

To split a disaccharide back into two monosaccharide molecules, a water molecule must be added (reverse of condensation reaction). The addition of water breaks the glycosidic bond. This is called a _____ reaction

Maltose is a disaccharide formed of two molecules of alpha-glucose bonded together. Other examples of a disaccharide include _____ and _____.

Task: Draw an annotated diagram to show how maltose is formed from two alpha-glucose molecules through a condensation reaction

Extension: Draw the molecular structures of sucrose and fructose (both are disaccharides)

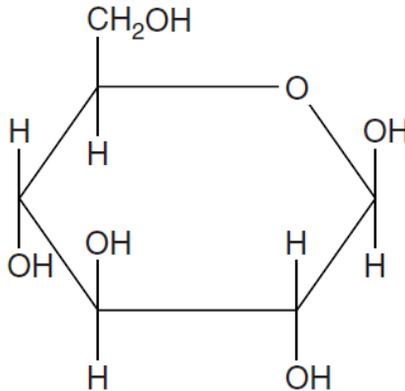
Exam-Style Questions

1) Glucose is a hexose sugar and is a monomer in many carbohydrates.

a) Name the **precise** group of carbohydrate molecules of which glucose is an example.

..... (1 mark)

The diagram below represents the structure of a β -glucose molecule.



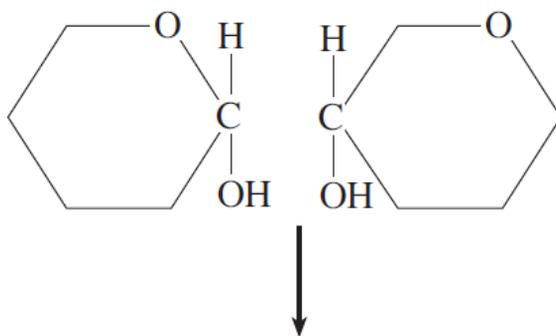
b) Using the diagram above as a guide, draw a similar representation of an **α -glucose** molecule in the space below. (2 marks)

c) The cells of living organisms require glucose. State and explain **two** ways in which the glucose molecule is well suited to its function in living organisms. (2 marks)

1.
.....

2.
.....

- 2) a) Complete the diagram below to show the reaction between two molecules of glucose and the products formed. (3 marks)



b) Name the organic molecule formed.

..... (1 mark)

c) Name the inorganic molecule released during the reaction.

..... (1 mark)

d) Name the type of reaction. .

..... (1 mark)