

# Biological Molecules

## Question Paper 2

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Foundations in Biology
Topic	Biological Molecules
Booklet	Question Paper 2

**Time allowed:** 73 minutes

**Score:** /54

**Percentage:** /100

### Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

## Question 1

Proteins are important biological molecules.

- (a) Protein structure can be represented at four levels: primary, secondary, tertiary and quaternary.

Below is a set of features that may be used when describing the structure of a protein such as haemoglobin.

Features	Letter
hydrogen bonds	A
peptide bonds	B
$\alpha$ and $\beta$ subunits	C
the sequence of amino acids	D
the initial folding of the polypeptide chain	E
the overall 3D shape	F
ionic bonds	G

- (i) Select the letters of the features that describe the primary level of protein structure. [1]
- (ii) Select the letter or letters of the feature(s) found in the secondary level of protein structure that are **not** present in the primary structure. [1]
- (iii) Select the letter or letters of the feature(s) that are found in the tertiary level of protein structure that are **not** present in the primary and secondary structures. [1]
- (iv) Select the letter or letters of the feature(s) found only in the quaternary level of protein structure. [1]

**(b)** Hydrogen bonds also form between water molecules.

- (i)** Describe the formation of a hydrogen bond between two molecules of water and explain why water can form these bonds. **[3]**

**(ii)** Hydrogen bonds allow water to act as a solvent.

Why is the ability of water to act as a solvent important for the survival of organisms? **[3]**

**[Total: 10]**

## Question 2

(a) Amino acids form part of the structure of proteins.

(i) State the name given to the sequence of amino acids in a protein molecule. **[1]**

(ii) Draw the **general structure** of an amino acid molecule in the space below. **[3]**

(b) Collagen is an important fibrous protein which forms part of the wall of blood vessels.

(i) State **one** property of collagen that makes it a useful component of blood vessel walls. **[1]**

(ii) Describe the **structure** of the collagen molecule. [6]

(c) Another protein that is important in mammals is haemoglobin.

(i) State **one** function of haemoglobin. [1]

(ii) Haemoglobin contains a prosthetic group known as haem.

Collagen does not contain a prosthetic group.

Describe **three** other ways in which the structure of haemoglobin differs from that of collagen. [3]

[Total: 15]

### Question 3

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

Name the precise group of carbohydrate molecules of which glucose is an example. [1]

(b) Fig. 6.1 represents the structure of a  $\beta$ -glucose molecule.

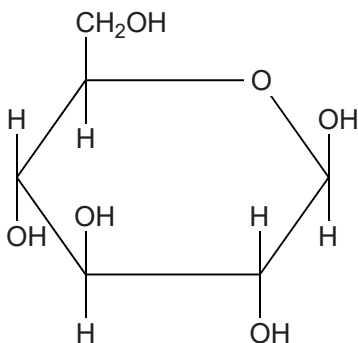


Fig. 6.1

(i) Use Fig. 6.1 to draw a similar representation of an  $\alpha$ -glucose molecule in the space provided below. [2]

(ii) 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]

(c) Deoxyribose is a pentose sugar that is a component of the double-stranded DNA molecule.

Describe the structural relationship between deoxyribose and the other components of the DNA molecule.

[3]

(d) Cellulose is a carbohydrate.

A student described the structure of cellulose as follows:

The cellulose molecule is insoluble.  
It contains only the elements carbon, hydrogen and oxygen.  
It is made up of  $\alpha$ -glucose subunits.  
The glucose subunits are linked by 1-4 glycosidic bonds formed by hydrolysis reactions.  
It also has some 1-6 glycosidic bonds.  
It is made of many long chains.  
The chains have branches.

(i) Identify **three** mistakes made by the student when describing the structure of cellulose. [3]

(ii) Suggest the name of a molecule that closely matches the student's description. [1]

[Total: 12]

## Question 4

Biological molecules are held together by a variety of bonds.

(a) The diagram in Fig. 1.1 represents an amino acid.

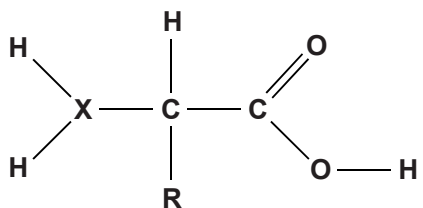


Fig. 1.1

(i) One of the atoms that make up an amino acid has been replaced with the letter **X**.

State the chemical symbol of the atom represented by the letter **X** in Fig. 1.1. [1]

(ii) Name the polymer formed from a chain of amino acids. [1]

(iii) Name the bond that is formed when two amino acids are joined together. Describe the formation of this bond.



(b) Fig. 1.2 shows a hydrogen bond between two water molecules.

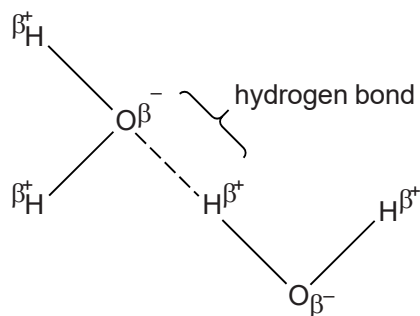


Fig. 1.2

(i) Many of the physical properties of water arise as a result of these hydrogen bonds.

Describe ways in which the physical properties of water allow organisms to survive over a range of temperatures.



*In your answer you should make clear links between the properties of water and the survival of organisms.* [9]

(ii) List **three other** examples of where hydrogen bonds are found in biological molecules. [3]

[Total: 17]