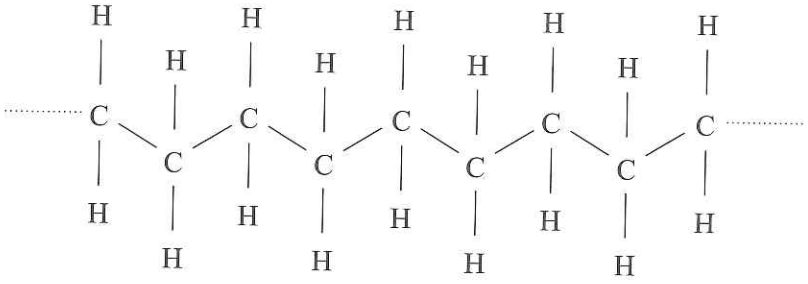
Biological Molecules — 1

There's a huge variety of life on Earth, but all organisms share the same few groups of carbon-based compounds. There might only be a few of these groups, but I've still managed to put plenty of exam-style questions together for you to have a go at. Best get to it — you can thank me later.

1 **Figure 1** shows a polymer.

Figure 1



1.1 What is a polymer?

.....

(1 mark)

1.2 Draw a circle around a single monomer in **Figure 1**.

(1 mark)

1.3 Give **three** types of monomer found in biological molecules.

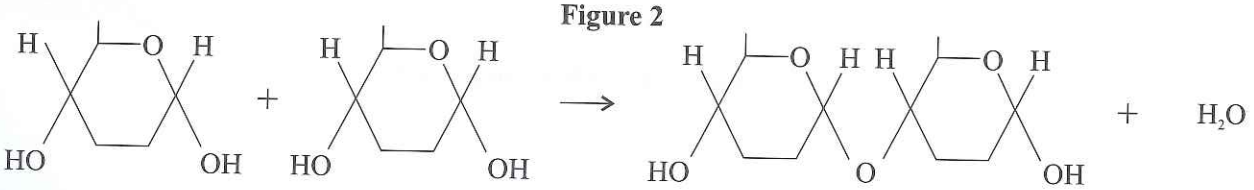
.....

.....

(1 mark)

2 **Figure 2** shows a reaction between two monomers that produces a disaccharide.

Figure 2



2.1 Name the monomers shown in **Figure 2**.

.....

(1 mark)

2.2 Name the disaccharide produced in **Figure 2**.

.....

(1 mark)

2.3 Disaccharides can be broken down.
Describe this reaction.

.....

.....

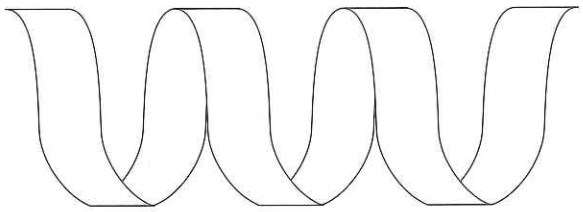
.....

(3 marks)

3 Proteins have four levels of structure.

Figure 3 shows part of the secondary structure of a protein.

Figure 3



3.1 State which secondary structure is shown in **Figure 3**.

.....

(1 m

3.2 Compare and contrast the bonding in the secondary and tertiary structures of a protein.

.....

.....

.....

(2 m

3.3 Explain why the tertiary structure of proteins is important for metabolic reactions.

.....

.....

.....

.....

(3 m

3.4 Haemoglobin is a quaternary protein.
What does this information tell you about haemoglobin's structure?

.....

.....

(2 m

Haemoglobin is the oxygen-carrying molecule in red blood cells.
At low pH, haemoglobin's ability to bind to oxygen is reduced.

3.5 Suggest why a low pH affects haemoglobin in this way.

.....

.....

(2 m

EXAM TIP

Take your time to really read the question — every word is carefully chosen. You need to look out for command words. The phrase "compare and contrast" means the examiner wants you to talk about the similarities and differences. It'd be really easy to forget to mention the differences here and just talk about the similarities, but you'd lose yourself marks that way.

Also availa

ISBN 9 78

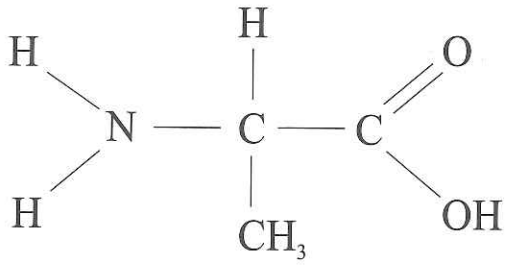
BAQ51

Biological Molecules — 2

1 Proteins are polymers of amino acids.

Figure 1 shows the amino acid alanine.

Figure 1



1.1 On **Figure 1**, circle and label the carboxyl group, the R group and the amino group.

(3 marks)

1.2 How is alanine different to the other 19 amino acids?

.....

(1 mark)

1.3 Draw a diagram of the dipeptide formed from the reaction between two molecules of alanine.
Label the peptide bond.

(2 marks)

1.4 Name the molecule required to break the peptide bond between two amino acids.

.....

(1 mark)

1.5 If this molecule alone is added to a dipeptide under neutral conditions in a laboratory, the peptide bond does not break down.
Explain why the bond is able to break down in the human body but not in the laboratory.

.....

.....

(2 marks)

2 Three food samples (**A**, **B** and **C**), each containing carbohydrates, were tested using different techniques.

The results of these tests are shown in **Table 1**.

Table 1

Sample	Test Results		
	Test with iodine dissolved in potassium iodide solution	Test with Benedict's solution	Test with Benedict's solution (after heating with dilute hydrochloric acid)
A	Negative	Negative	Positive
B	Positive	Negative	Negative
C	Negative	Positive	Negative

2.1 Describe how to carry out a Benedict's test and what would indicate a positive result.

.....

.....

.....

(2 marks)

The tests shown in **Table 1** allow the type of carbohydrate in each sample to be identified.

2.2 Using the information provided in **Table 1**, complete **Table 2** by placing a tick (✓) in the column that correctly identifies the type of carbohydrate present.

Table 2

Sample	Type of carbohydrate present		
	Reducing sugar	Non-reducing sugar	Starch
A			
B			
C			

(2 marks)

Two more samples were tested and found to contain reducing sugars.

2.3 Describe how the amounts of reducing sugar in the two samples could be compared.

.....

.....

(1 mark)

The reducing sugar present in one of the samples was identified as lactose.

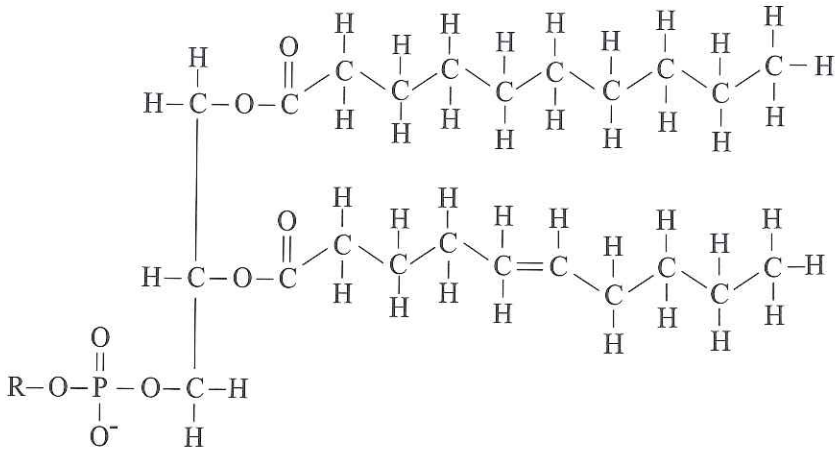
2.4 Name the **two** monomers that form a lactose disaccharide.

.....

(1 mark)

3 **Figure 2** shows a type of biological molecule.

Figure 2



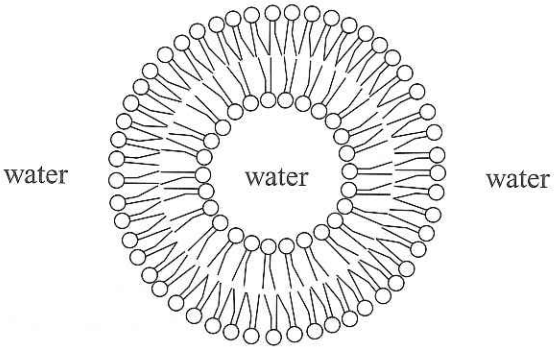
3.1 Name the type of molecule shown in **Figure 2**.

.....

(1 mark)

A droplet of these molecules was placed in water.
The molecules took the arrangement shown in **Figure 3**.

Figure 3



3.2 Explain why the molecules arranged themselves in this way.

.....

.....

.....

.....

(3 marks)

3.3 Describe **one** role that the molecules shown in **Figure 3** have in a cell.

.....

.....

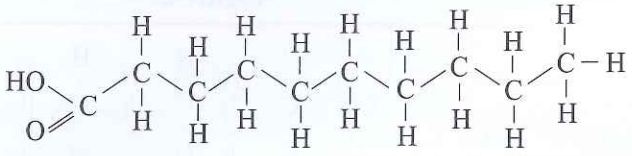
.....

(2 marks)

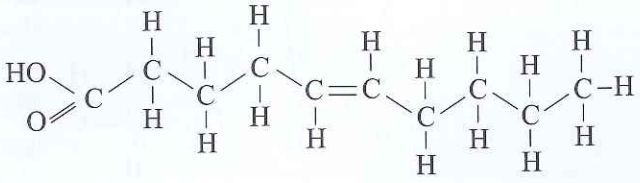
4 **Figure 4** shows two different fatty acids.

Figure 4

Fatty Acid 1



Fatty Acid 2



4.1 Explain the difference between these two fatty acids.

.....

.....

.....

(2 marks)

Triglycerides contain fatty acids.

4.2 Describe how triglycerides are formed.

.....

.....

.....

(3 marks)

4.3 Give **one** function of triglycerides and relate this to **one** of their properties.

.....

.....

(2 marks)

The emulsion test can be used to test for lipids.

4.4 Describe the emulsion test, including a positive result.

.....

.....

(2 marks)

4.5 An emulsion is droplets of one liquid suspended in another liquid.
Using this information, explain why lipids give a positive result in the emulsion test.

.....

.....

(1 mark)

EXAM TIP

You need to be really familiar with the structure of proteins, lipids and carbohydrates. You might get asked to identify a type of molecule or one of its groups from a diagram. Practise drawing these molecules out at home to help you visualise them — and don't be afraid to take a minute to quickly sketch out a molecule in your exam if it helps you to answer the question.

Score

Biological Molecules — 3

1 Glycogen, starch and cellulose are all polymers of glucose.

1.1 Explain how the structure of glycogen makes it well-suited to its function.

.....

.....

.....

(2 marks)

Starch is made of alpha-glucose molecules and cellulose is made of beta-glucose molecules.

1.2 Draw the structure of beta-glucose below and explain how it is different from that of alpha-glucose.

.....

.....

(2 marks)

1.3 The beta-glucose molecules allow cellulose to form long, straight chains with multiple hydrogen bonds between the chains. Explain how this makes cellulose well-suited to its function.

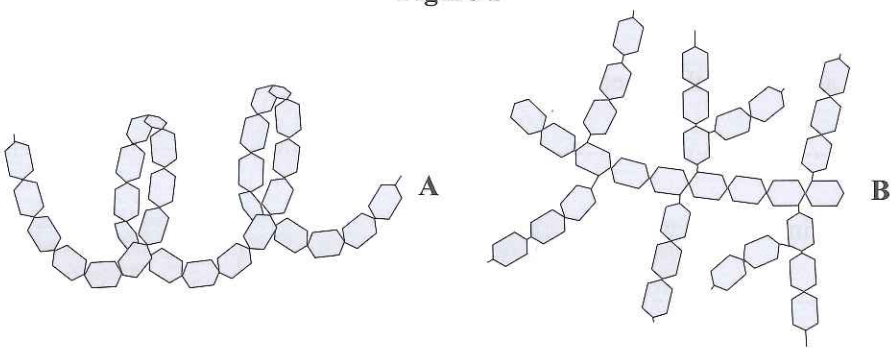
.....

.....

(2 marks)

Starch is a mixture of two polysaccharides of alpha-glucose, amylose and amylopectin.
The structures of amylose (**A**) and amylopectin (**B**) are shown in **Figure 1**.

Figure 1



1.4 Different starches are made up of different proportions of amylose and amylopectin.
Using **Figure 1**, suggest **one** advantage and **one** disadvantage of using amylose to store excess glucose, rather than amylopectin.

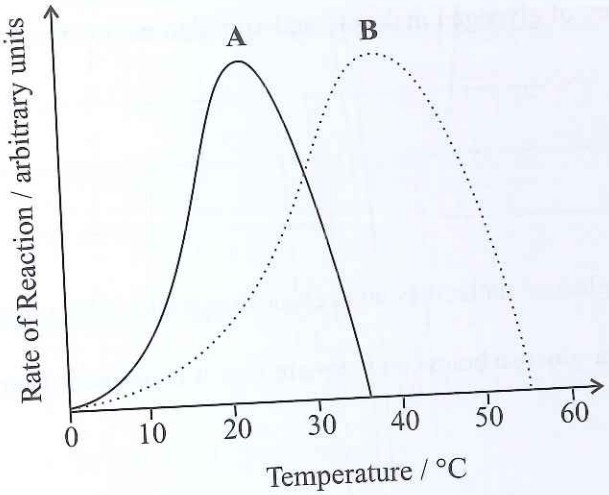
Advantage: .....

Disadvantage: .....

(2 marks)

2 **Figure 2** shows the activity of two different enzymes (**A** and **B**).
The enzymes are involved in respiration. One enzyme is from an insect that lives in the UK and one is from an insect that lives in a tropical climate.

Figure 2



2.1 Explain the shape of the curve for enzyme **A**.

.....

.....

.....

.....

(3 marks)

2.2 Suggest which enzyme (**A** or **B**) is from the tropical insect. Explain your answer.

.....

.....

.....

(2 marks)

Insecticides are chemicals that kill insects.
Scientists have developed an insecticide that works as a competitive inhibitor of enzyme **A**.

2.3 How would the addition of the insecticide affect the shape of the curve for enzyme **A**?

.....

(1 mark)

2.4 Describe how the insecticide works.

You need to use information from the introduction to question 2, as well as your knowledge of how competitive inhibitors work, to answer this question part.

.....

.....

.....

.....

(4 marks)

3 Four molecules were tested and found to be proteins.

A biuret test was used to test these molecules.

3.1 Describe how to carry out a biuret test and what a positive result would be.

.....

.....

.....

(3 marks)

Further analysis showed that each of the proteins had a slightly different structure.

Protein **A** was made of long polypeptide chains lying parallel to each other, with cross linkages between.
Protein **B** had tightly folded polypeptide chains and was roughly spherical in shape.
Protein **C** was made up of two light polypeptide chains and two heavy polypeptide chains.

3.2 Protein **A** is a structural protein. Explain why its structure makes it well-suited to this role.

.....

.....

(1 mark)

3.3 Suggest how proteins **B** and **C** are used by the body.

Protein **B**: .....

Protein **C**: .....

(2 marks)

The fourth protein was found to be a channel protein.
It had a hydrophobic region and a hydrophilic region.

3.4 Describe the function of a channel protein and explain how its structure allows it to carry out this function.

.....

.....

.....

.....

(3 marks)

4 A student investigated how an enzyme-controlled reaction is affected by changes in enzyme concentration. The student used the enzyme catalase to break hydrogen peroxide down into water and oxygen.

4.1 Identify the dependent and independent variables in this investigation.

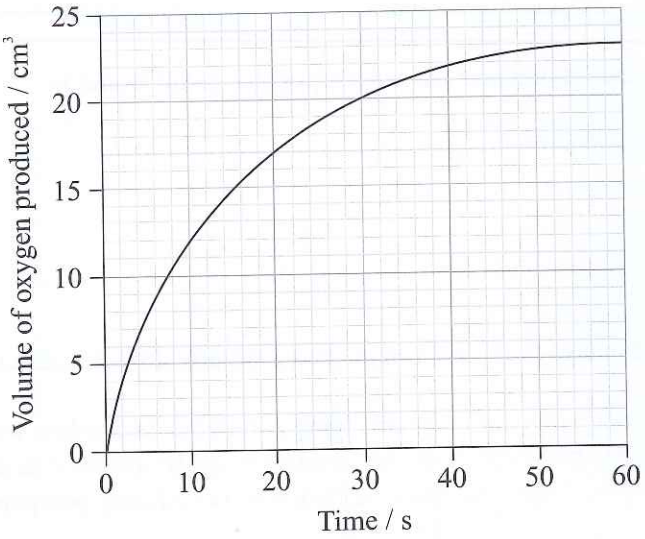
.....

.....

(1 mark)

The results of the student's first experiment are shown in **Figure 3**.

Figure 3



The student collected the oxygen in a measuring cylinder submerged in water.
The measuring cylinder measured to the nearest 1 cm^3.

4.2 Give the uncertainty of measurements associated with this measuring cylinder.

uncertainty = ... cm^3

(1 mark)

4.3 Suggest **one** way that the student could have obtained more accurate results.

.....

(1 mark)

4.4 Calculate the average rate of the reaction shown in **Figure 3** for the first 20 seconds.

rate = ...

(2 marks)

4.5 Calculate the initial rate of the reaction shown in **Figure 3**.

To calculate the initial rate, you need to draw a tangent.

rate = ...

(1 mark)

4.6 Sketch on the same axes the curve you would expect if the experiment were carried out with a higher enzyme concentration.

(1 mark)

EXAM TIP

Pen, pencil, ruler, calculator... Oh, that's just my shopping list for my exam. Sometimes examiners will ask you to draw, measure or calculate, so you need to make sure you've got all this stationery — a ruler that can measure in millimetres, a calculator, a pencil (for drawing graphs) and a pen with black ink. In fact, make sure you've got a couple of spare pens too.

Score

34

More Biological Molecules

DNA, water and ions are essential for cell function in living organisms, and being able to answer questions about them is essential for your exams. This one might only be a short section, but make sure you give it a go.

1 Inorganic ions play many important roles in organisms.

1.1 Give **one** role that sodium ions (Na^+) play in living cells.

.....

(1 mark)

1.2 Explain how the concentration of hydrogen ions (H^+) affects the internal environment of an organism.

.....

.....

(2 marks)

1.3 Suggest why nitrate ions (NO_3^-) are needed to make DNA.

.....

.....

(2 marks)

2 Animals living in hot, dry climates have developed behaviours that help them keep cool.

Kangaroos have been observed licking saliva onto their forearms in hot weather.

2.1 Using your knowledge of the properties of water, explain why this behaviour helps the kangaroos to keep cool.

.....

.....

.....

.....

(3 marks)

Koalas have been observed to hug trees in hot weather.
This is thought to be because the trunks of trees are usually cooler than the surrounding air.

2.2 Tree trunks contain a lot of water.
Explain how this could contribute to the tree trunks being cooler than the surrounding air.

.....

.....

(2 marks)

2.3 Explain how water is able to flow up a tree trunk, from the roots to the leaves.

.....

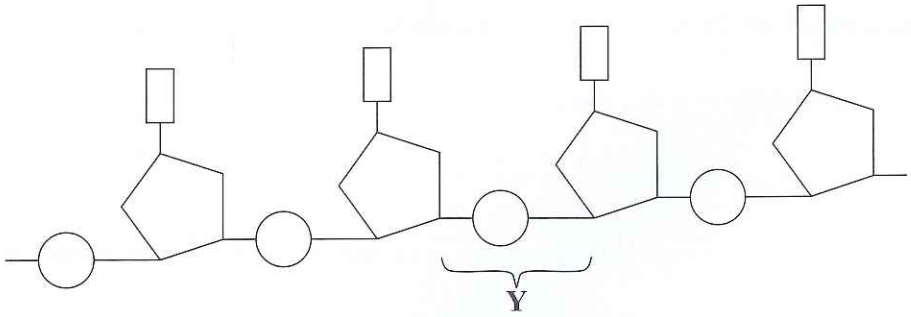
.....

(2 marks)

3 RNA carries genetic information from DNA to the ribosomes.

Figure 1 shows part of the structure of an RNA molecule.

Figure 1



3.1 Name the bond labelled **Y** in **Figure 1**.

.....

(1 mark)

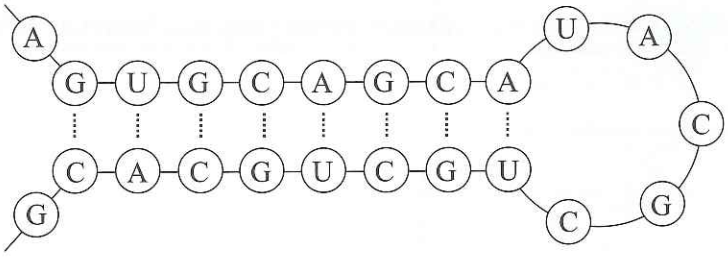
3.2 What type of reaction results in the formation of the bond labelled **Y**?

.....

(1 mark)

Some RNA molecules are capable of folding into structures known as stem-loops.
An example of a stem-loop structure is shown in **Figure 2**.

Figure 2



3.3 Looking at the sequence of the structure shown in **Figure 2**, explain how you can tell that this is part of an RNA molecule and not a DNA molecule.

.....

.....

(1 mark)

3.4 Using your knowledge of how DNA molecules can form a double helix, explain how the stem-loop structure shown in **Figure 2** is formed.

.....

.....

.....

.....

(3 marks)

4 A scientist is investigating the role of enzymes in DNA replication.

4.1 Describe the roles that the enzymes DNA helicase and DNA polymerase play in DNA replication.

.....

.....

.....

.....

(4 marks)

The scientist mixes a bacterial DNA sample with the enzymes and substrates required for DNA replication. He does this in both the presence and the absence of ATP, and using active and inactive ATP hydrolase. He then measures the amount of DNA produced to determine whether DNA replication has taken place.

Some of the results of the investigation are shown in **Table 1**.

Table 1

DNA replication enzymes	ATP hydrolase	ATP	Has DNA replication occurred?
Present	Active	Present	Yes
Present	Active	Absent	No
Present	Inactive	Present	No
Present	Inactive	Absent	No

4.2 With reference to the structure of an ATP molecule, explain why ATP is known as a nucleotide derivative.

.....

.....

.....

(2 marks)

4.3 Outline the reaction catalysed by ATP hydrolase.

.....

.....

(2 marks)

4.4 Describe and suggest an explanation for the results in **Table 1**.

.....

.....

.....

.....

.....

(3 marks)

EXAM TIP

If you have to interpret the results of an unfamiliar experiment in the exam, don't panic — just make sure you read the method carefully. There'll always be some important information there that will help you understand the results. If you can take a minute to piece it together with everything you already know about those molecules, then you're sure to come out on top.

Score

29