Helicate

HELICATE · AS AND A-LEVEL BIOLOGY · TOPIC BANK

3.1.1 Monomers and polymers

Topic question bank

Version 1 · 2 October 2026

Name

Date

QUESTIONS	TOTAL MARKS	TIME	YOUR SCORE
6	47	No time limit	/ 47

Contents

Subtopic	Questions	Marks
Monomers and polymers Specification 3.1.1	01–02	15
Condensation and hydrolysis reactions Specification 3.1.1	03–05	21
Investigating hydrolysis Specification 3.1.1	06	11
Total		**47**

Instructions

- Answer the questions in the spaces provided. Show all your working.
- The marks for each question are shown in brackets. Use them to judge how much detail to give.
- Work through a subtopic at a time, then mark your answers with the matching mark scheme.

Original questions by Helicate for AQA AS and A-level Biology (7401/7402), specification section 3.1.1. Not affiliated with or endorsed by AQA.

Do not write outside the box

Monomers and polymers 3.1.1

Scientists completely hydrolysed one molecule of each of five biological molecules, **P** to **T**. Table 1 shows the products.

Table 1

Molecule	Products of complete hydrolysis of one molecule
P	3000 glucose molecules
Q	412 amino acids, of 19 different types
R	One glycerol molecule and three fatty acid molecules
S	One glucose molecule and one fructose molecule
T	2100 nucleotides, of 4 different types

0 1 . 1 Which statement about monomers and polymers is correct?
Tick (✓) one box.

[1 mark]

A polymer is always made from only one type of monomer. ☐

Monomers are joined together to form a polymer by hydrolysis reactions. ☐

A polymer is a molecule made from a large number of monomers joined together. ☐

Monosaccharides and amino acids are monomers, but nucleotides are polymers. ☐

Question 1 continues on the next page

Do not write outside the box

0 1 . 2 Which of the molecules in Table 1 are polymers?
Tick (✓) one box.

[1 mark]

P and **T** only ☐

P, **Q** and **T** only ☐

P, **Q**, **R** and **T** only ☐

P, **Q**, **R**, **S** and **T** ☐

0 1 . 3 Molecule **S** is formed by a condensation reaction. A student concluded that this means **S** is a polymer.
Explain why the student's conclusion is **not** correct.

[2 marks]

.....

.....

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.....

.....

0 1 . 4 Molecule **P** is branched. One molecule of **P** contains 3000 glucose monomers and 150 branch points.
How many water molecules are used when one molecule of **P** is completely hydrolysed to glucose? Explain your answer.

[2 marks]

.....

.....

.....

.....

Number of water molecules .....

6

Turn over for the next question

Do not write outside the box

The relative molecular mass (M_r) of a molecule is the total of the relative masses of all the atoms in the molecule.

- M_r of glucose = 180
- M_r of water = 18

0 2 . 1 Starch is a polymer of glucose. One starch molecule has an M_r of 1.62×10^6
Calculate the number of glucose monomers in this starch molecule. Give your answer in standard form.

[2 marks]

Answer .....

A student hydrolysed 8.10 g of dry starch, using a mixture of enzymes that hydrolyse starch to glucose. The student then separated the glucose from the reaction mixture, dried it and weighed it.

0 2 . 2 The mass of glucose the student obtained was greater than 8.10 g.
Explain why.

[2 marks]

Question 2 continues on the next page

Do not write outside the box

0 2 . 3 Calculate the maximum mass of glucose that the student could obtain from 8.10 g of starch. Use the M_r values given.

[2 marks]

Answer ..... **g**

0 2 . 4 The student obtained 8.55 g of glucose.
Calculate the percentage yield.
Percentage yield = (mass obtained ÷ maximum possible mass) × 100

[1 mark]

Answer ..... **%**

0 2 . 5 Suggest **two** reasons why the percentage yield was less than 100%.

[2 marks]

1 .....

2 .....

9

Turn over for the next question

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Condensation and hydrolysis reactions 3.1.1

0 3 . 1 Complete the table to compare condensation reactions with hydrolysis reactions.

[4 marks]

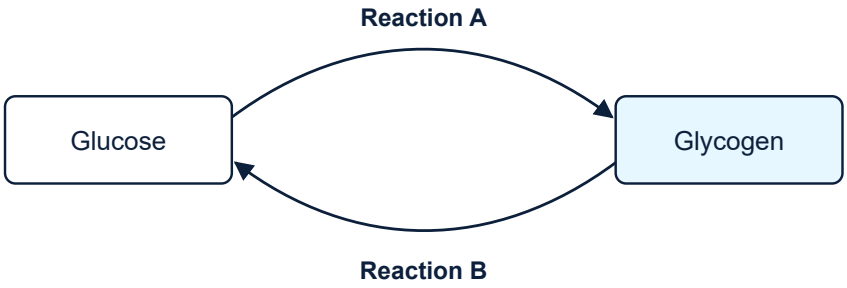
	Condensation reaction	**Hydrolysis reaction**
Effect on the chemical bond between two molecules		
Role of water		
One example in a living organism (name the molecules)		

Question 3 continues on the next page

Do not write outside the box

Figure 1 shows how a liver cell stores glucose as glycogen and releases glucose from glycogen.

Figure 1



0 3 . 2 In reaction A, a liver cell adds 500 glucose molecules, one at a time, to a glycogen molecule that is already in the cell.
How many water molecules are released?
Tick (✓) one box.

[1 mark]

250 ☐

499 ☐

500 ☐

501 ☐

0 3 . 3 A student wrote this description of reaction B:
'In reaction B, glucose molecules are hydrolysed, and one molecule of water is released for each glucose molecule removed from the glycogen.'
Identify **two** errors in the student's description. For each error, give the correct version.

[2 marks]

Error 1 .....

.....

Error 2 .....

.....

7

Turn over for the next question

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Some stitches used in surgery dissolve in the body, so they do not have to be removed. One type of dissolving stitch is made of polymer L.

- Polymer L is made from two types of monomer, lactic acid and glycolic acid, joined by condensation reactions.
- Both monomers are soluble in water.
- Long molecules of polymer L are insoluble in water.

Scientists placed stitches made of polymer L in a buffer solution at pH 7.4 and 37 °C. Every 14 days, they removed some stitches, dried them and found:

- the mass of the stitches
- the mean number of monomers in each molecule of polymer L in the stitches.

Table 2 shows their results.

Table 2

Time / days	Mass of stitches as a percentage of the starting mass	Mean number of monomers in each molecule of polymer L
0	100	1800
14	99	950
28	94	430
42	72	160
56	39	55
70	11	20

The scientists also kept some stitches in dry air at 37 °C. The mass of these stitches and the mean number of monomers in each molecule did **not** change over 70 days.

Question 4 continues on the next page

Do not write outside the box

0 4 . 1 Explain why the stitches kept in dry air did **not** change.

[2 marks]

0 4 . 2 Use Table 2 to describe **and** explain the changes in the mass of the stitches **and** in the mean number of monomers in each molecule of polymer L in the buffer solution.

[5 marks]

0 4 . 3 Suggest why the scientists kept the stitches at pH 7.4 and 37 °C.

[1 mark]

8

Turn over for the next question

Do not write outside the box

0 5 Beans contain protein. When a person eats beans, amino acids from the bean protein can later become part of amylase molecules made in the person's salivary glands.

The biochemical basis of life is similar for all living things. Use this idea, and your knowledge of condensation and hydrolysis reactions, to explain how bean protein can be used to make amylase in the person's salivary glands.

[6 marks]

6

Turn over for the next question

Investigating hydrolysis 3.1.1

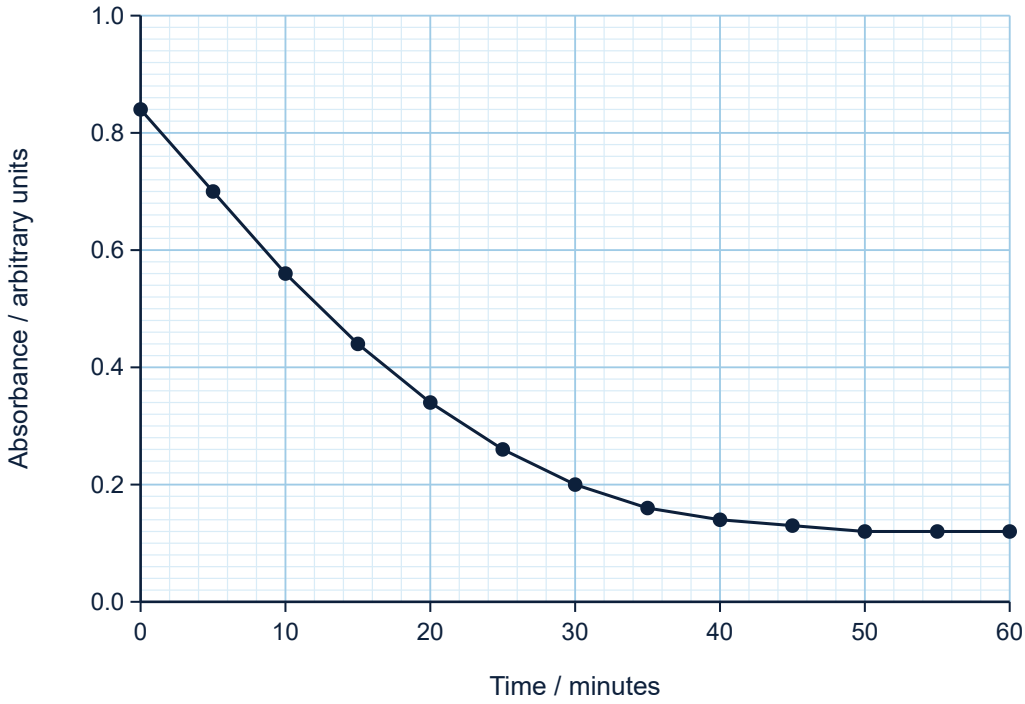
Biuret reagent turns purple when it reacts with molecules that contain two or more peptide bonds. The more of these peptide bonds there are, the darker the purple colour. Amino acids and dipeptides do **not** give a purple colour.

A scientist mixed a protein solution with a protease solution at 37 °C. Every 5 minutes she:

- removed a 1 cm^3 sample of the mixture
- immediately added the sample to 2 cm^3 of biuret reagent, which is strongly alkaline
- measured the absorbance of the purple solution, using a colorimeter.

The darker the purple colour, the higher the absorbance. Figure 2 shows her results.

Figure 2



Question 6 continues on the next page

Do not write outside the box

0 6 . 1 Explain the change in absorbance during the first 30 minutes.

[3 marks]

0 6 . 2 Suggest why each sample was added to the biuret reagent immediately.

[1 mark]

0 6 . 3 Use Figure 2 to calculate the rate of decrease in absorbance during the first 10 minutes. Give your answer in standard form.

[2 marks]

Answer _____ **arbitrary units min^{-1}**

Question 6 continues on the next page

Do not write outside the box

0 6 . 4 After 50 minutes the absorbance stayed at 0.12
Suggest explanations for why the absorbance did **not** fall to zero.

[3 marks]

0 6 . 5 Describe a suitable control for this investigation **and** explain why it is needed.

[2 marks]

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END OF QUESTIONS

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