

AQA AS BIOLOGY

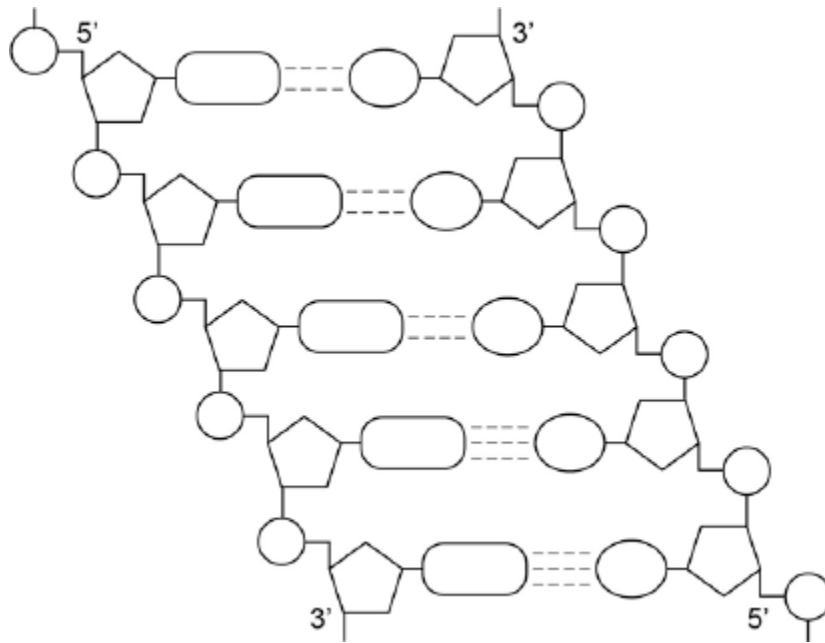
TOPIC 1

BIOLOGICAL MOLECULES



1

The following figure represents part of a DNA molecule.



(a) Draw a box around a single nucleotide.

(1)

The table below shows the percentage of bases in each of the strands of a DNA molecule.

DNA strand	Percentage of each base			
	A	C	G	T
Strand 1	16			
Strand 2		21	34	

(b) Complete the table by adding the missing values.

(2)

- (c) During replication, the two DNA strands separate and each acts as a template for the production of a new strand. As new DNA strands are produced, nucleotides can only be added in the 5' to 3' direction.

Use the figure in part (a) and your knowledge of enzyme action and DNA replication to explain why new nucleotides can only be added in a 5' to 3' direction.

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(4)
(Total 7 marks)

2

(a) Messenger RNA (mRNA) is used during translation to form polypeptides. Describe how mRNA is produced in the nucleus of a cell.

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(6)

(b) Describe the structure of proteins.

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(5)

(c) Describe how proteins are digested in the human gut.

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(4)
(Total 15 marks)

4

A student investigated the effect of chewing on the digestion of starch in cooked wheat.

He devised a laboratory model of starch digestion in the human gut. This is the method he used.

- 1. Volunteers chewed cooked wheat for a set time. The wheat had been cooked in boiling water.
- 2. This chewed wheat was mixed with water, hydrochloric acid and a protein-digesting enzyme and left at 37 °C for 30 minutes.
- 3. A buffer was then added to bring the pH to 6.0 and pancreatic amylase was added. This mixture was then left at 37 °C for 120 minutes.
- 4. Samples of the mixture were removed at 0, 10, 20, 40, 60 and 120 minutes, and the concentration of reducing sugar in each sample was measured.
- 5. Control experiments were carried out using cooked wheat that had been chopped up in a blender, not chewed.

(a) What reducing sugar, or sugars, would you expect to be produced during chewing? Give a reason for your answer.

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(2)

(b) In this model of digestion in the human gut, what other enzyme is required for the complete digestion of starch?

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(1)

(c) What was the purpose of step 2, in which samples were mixed with water, hydrochloric acid and pepsin?

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(1)

(d) In the control experiments, cooked wheat was chopped up to copy the effect of chewing. Suggest a more appropriate control experiment. Explain your suggestion.

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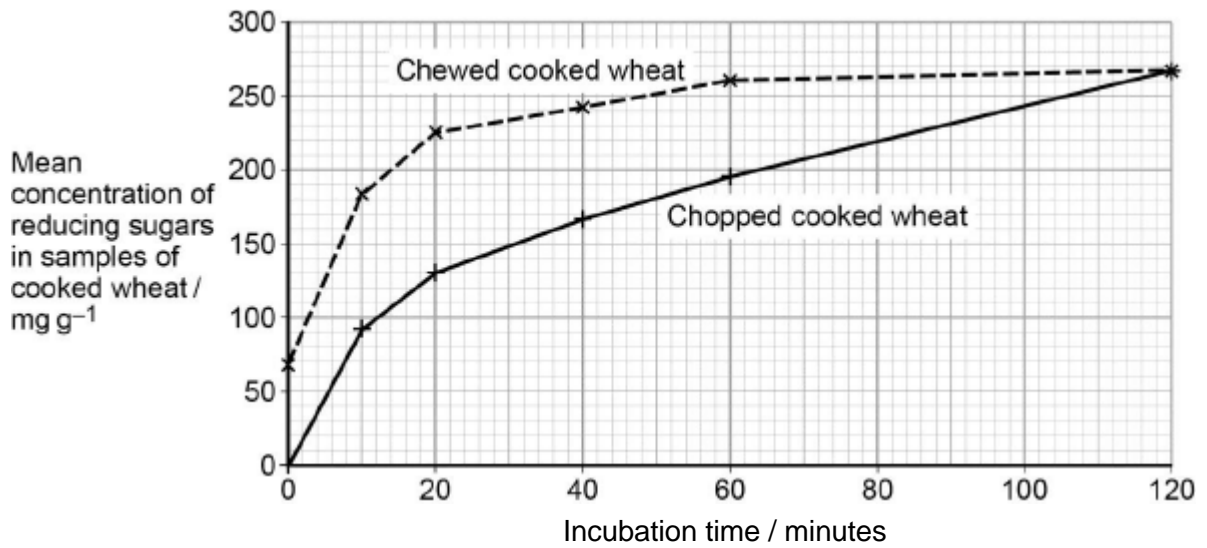
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(2)

(e) The figure below shows the student's results.



Explain what these results suggest about the effect of chewing on the digestion of starch in wheat.

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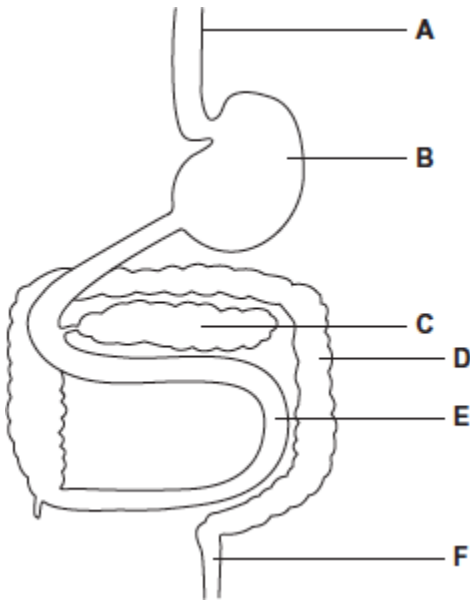
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(3)
(Total 9 marks)

5

The diagram represents part of the human digestive system. The organs are labelled **A-F**.



(a) Give the letter of the organ that produces amylase.

(1)

(b) Give the letter of the organ that produces maltase.

(1)

(c) Maltose is hydrolysed by the enzyme maltase.

Explain why maltase catalyses only this reaction.

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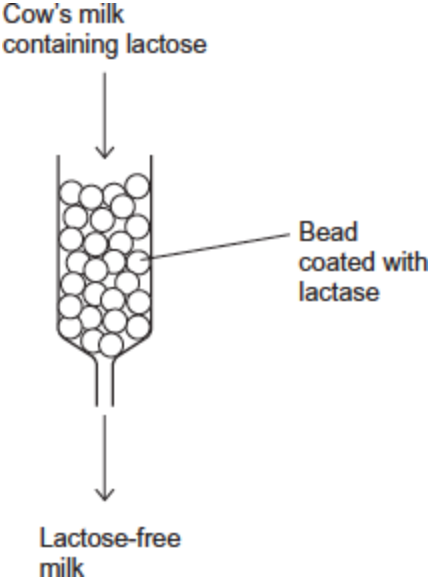
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(3)
(Total 5 marks)

6

Cow's milk contains the sugar lactose. Many cats are unable to digest cow's milk because they are lactose intolerant.

Cow's milk can be made suitable for these cats by treating it with the enzyme lactase to hydrolyse lactose. This makes the cow's milk lactose-free. Beads are coated with lactase and placed in a tube, as shown in the diagram below. Cow's milk flows over the beads and the lactose is hydrolysed.



(a) Attaching lactase to the beads is a more efficient use of lactase than adding the lactase directly to cow's milk.

Suggest **three** reasons why it is more efficient to attach lactase to the beads.

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- 2
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- 3
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(3)

- (b) Monosaccharides and disaccharides taste sweet.
The lactose-free milk made after hydrolysis with lactase tastes sweeter than the cow's milk containing lactose.
Suggest why.

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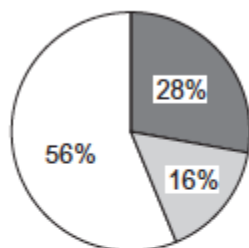
(2)
(Total 5 marks)

7

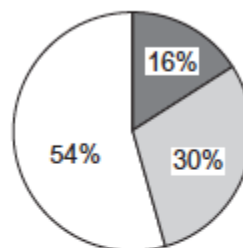
Nutritionists investigated the relationship between eating oily and non-oily fish and the incidence of asthma. They analysed the diets of children with asthma and the diets of children without asthma.

The pie charts show the results.

Children with asthma



Children without asthma



Key

- Children who ate no fish
- Children who ate oily fish
- Children who ate non-oily fish

(a) What conclusions can you make from the data?

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(3)

(b) Describe how you could use the emulsion test to show the presence of oil in a sample of fish.

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(3)
(Total 6 marks)

8

(a) (i) Give **two** ways in which the structure of starch is **similar** to cellulose.

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2

(2)

(ii) Give **two** ways in which the structure of starch is **different** from cellulose.

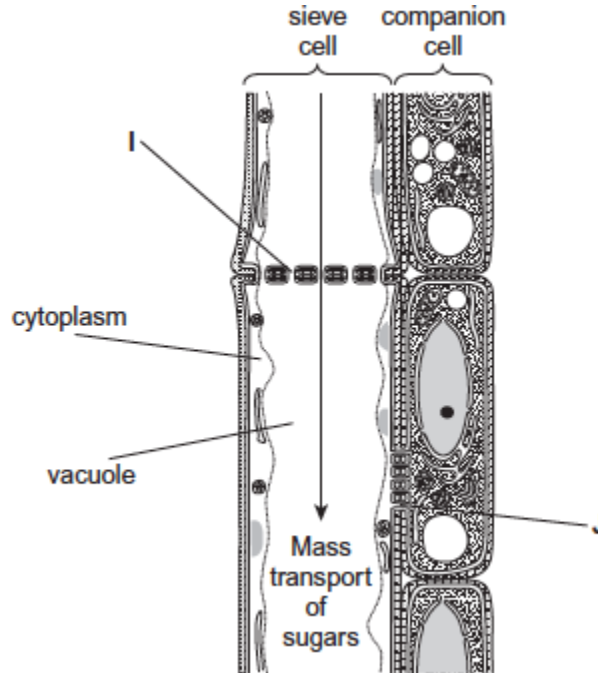
1

2

(2)

(b) In plants, mass transport of sugars takes place through columns of sieve cells in the phloem. Other cells, called companion cells, transport sugars into, and out of, the sieve cells.

The diagram shows the structure of phloem.



Structures **I** and **J** allow the transport of sugars between cells.

(i) Using the diagram, suggest and explain **one** other way in which sieve cells are adapted for mass transport.

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(2)

- (ii) Using the diagram, suggest and explain **one** other way in which companion cells are adapted for the transport of sugars between cells.

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(2)
(Total 8 marks)

9

- (a) (i) Describe the role of DNA polymerase in DNA replication.

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(1)

- (ii) Other than being smaller, give **two** ways in which prokaryotic DNA is different from eukaryotic DNA.

1

2

(2)

(b) The table shows the percentage of each base in the DNA from three different organisms.

Organism	Percentage of each base in DNA			
	Adenine	Guanine	Thymine	Cytosine
Human	30.9	19.9	29.4	19.8
Grasshopper	29.4	20.5	29.4	20.7
Virus	24.0	23.3	21.5	31.2

(i) Humans and grasshoppers have very similar percentages of each base in their DNA but they are very different organisms.

Use your knowledge of DNA structure and function to explain how this is possible.

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(2)

(ii) The DNA of the virus is different from that of other organisms. Use the table above and your knowledge of DNA to suggest what this difference is. Explain your answer.

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(2)
(Total 7 marks)

10

(a) The events that take place during interphase and mitosis lead to the production of two genetically identical cells. Explain how.

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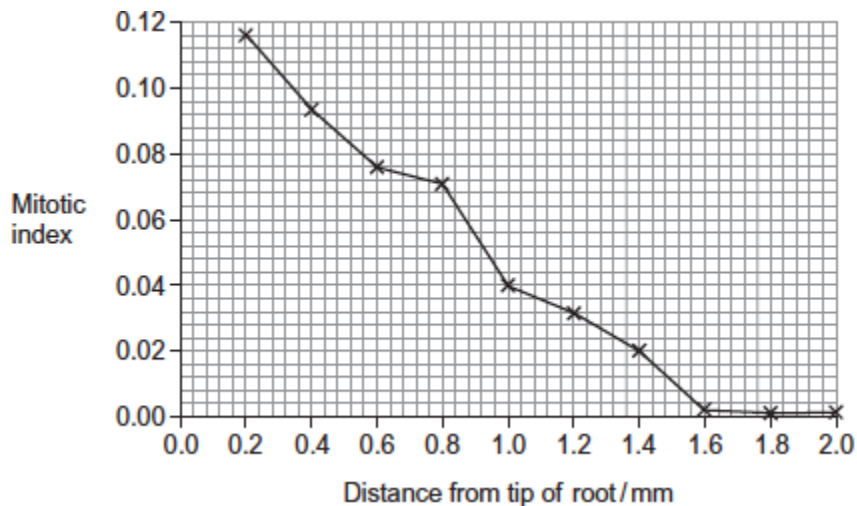
(4)

- (b) A student cut thin sections of tissue at different distances from the tip of a root. She stained the sections and viewed them with an optical microscope.

For each section, the student counted the number of cells in mitosis and the total number of cells in each field of view. She then calculated a **mitotic index** for each section using the equation:

$$\text{mitotic index} = \frac{\text{number of cells in mitosis}}{\text{total number of cells}}$$

The student's results are shown in the graph.



- (i) The student cut thin sections of tissue to view with an optical microscope. Explain why it was important that the sections were thin.

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(2)

- (ii) What does the graph show about the growth of roots?
Use the data to explain your answer.

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(2)
(Total 8 marks)