Cambridge OCR Level 3 Advanced Subsidiary GCE in Biology A

H020/02 Depth in Biology

Sample Question Paper

Date – Morning/Afternoon

Version 3.0

Time allowed: 1 hour 30 minutes

You can use:

- a scientific or graphical calculator
- a ruler (cm/mm)

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name (s) _____

Last name _____

INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

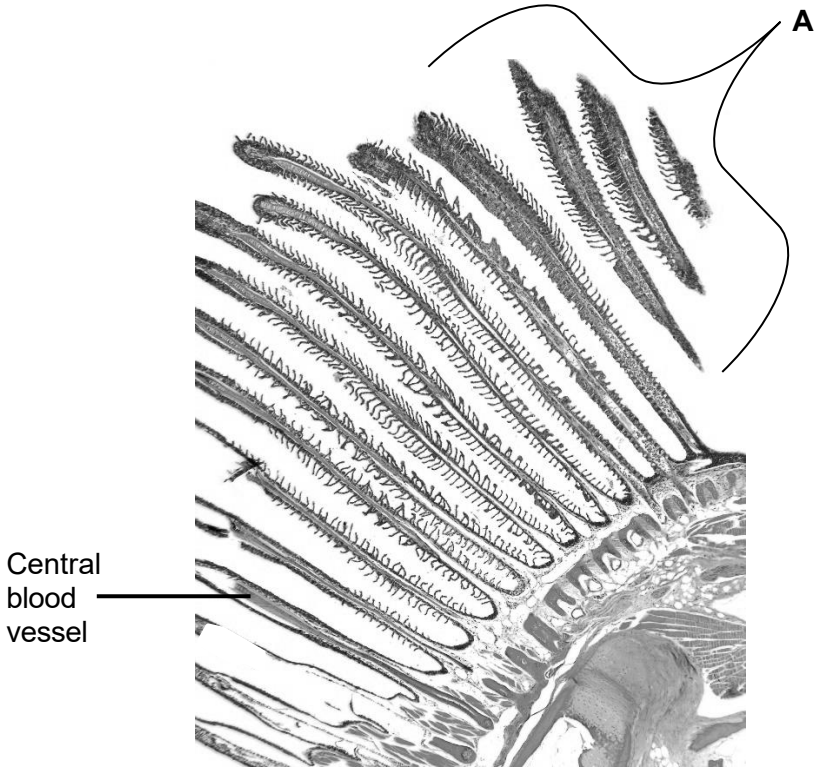
INFORMATION

- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **24** pages.

ADVICE

- Read each question carefully before your start your answer.

1 The microscopic image shows part of a fish gill.



(a) Name structure **A**.

…… **[1]**

(b) Explain how the image shows that gills are adapted for efficient gas exchange.

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…… **[4]**

(c) Each gill is supported by a gill arch made of bone. Bone tissue is made of living cells, collagen and an inorganic component.

Explain why bone is described as a tissue **and** gills are described as organs.

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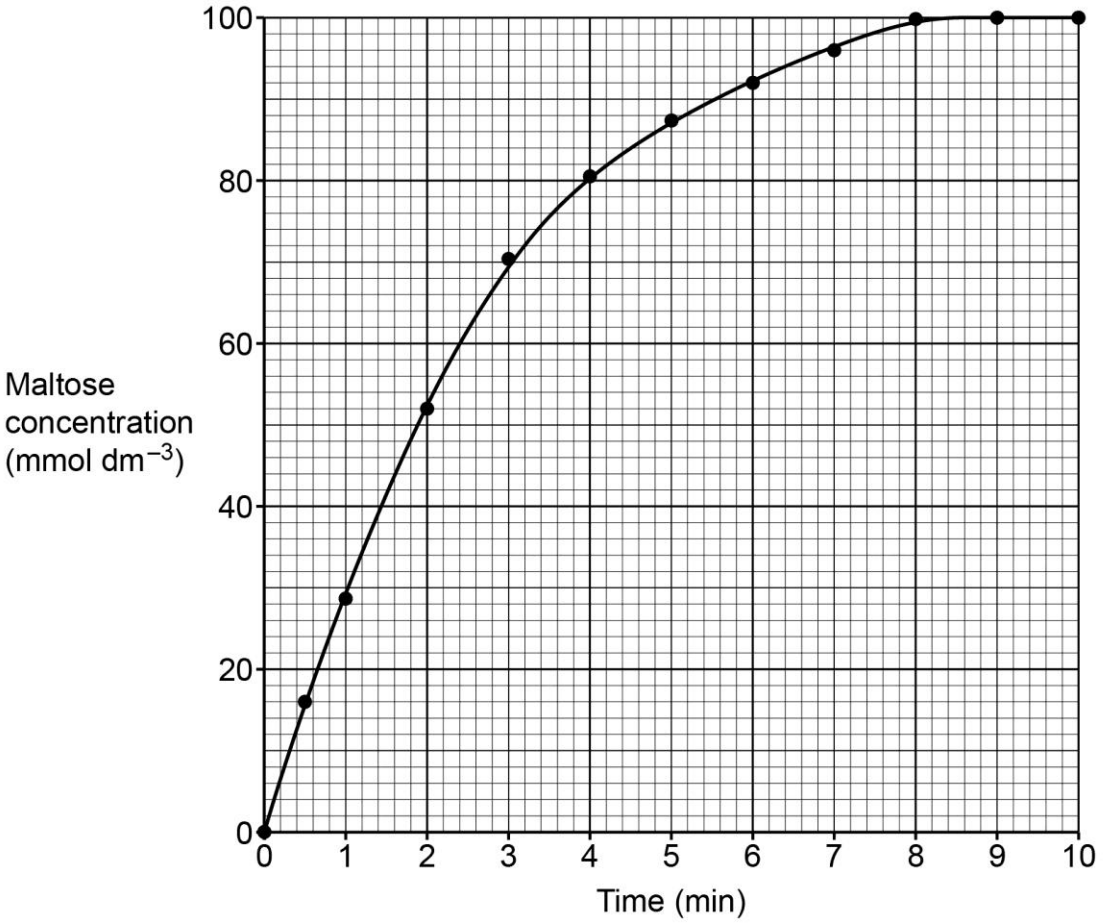
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..... **[3]**

2 Amylase is an enzyme that breaks down starch into maltose.

(a) A student investigates the breakdown of starch into maltose using amylase.

The results are shown in the graph.



(i) Calculate the rate of maltose production over the first 30 s.

Use appropriate units.

Rate = ……..…….. Units = …… **[2]**

(ii) State **and** explain how the rate you calculated in **(a)(i)** would differ from the actual initial rate of reaction.

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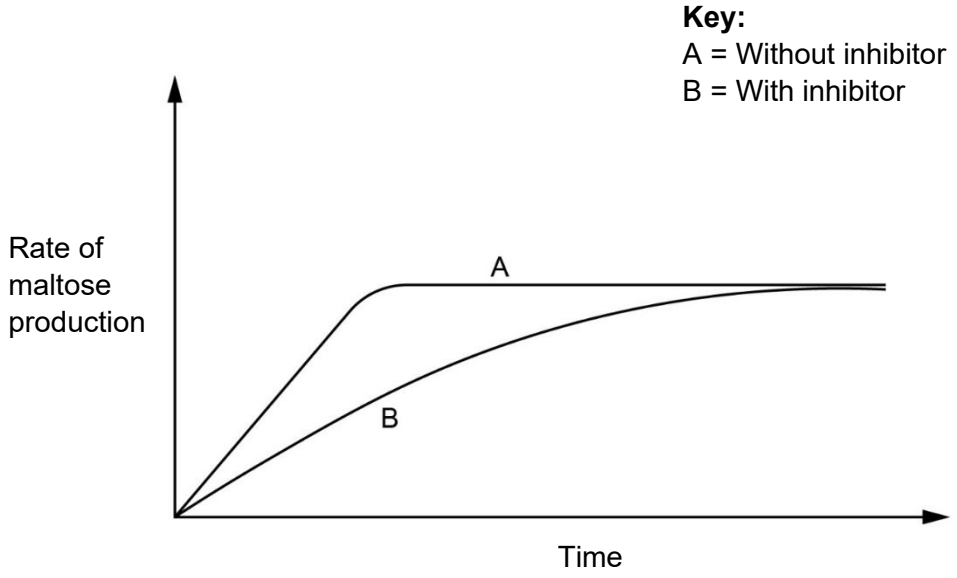
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…… **[3]**

(b) The student conducts a further investigation using the same enzyme, amylase, and the same substrate, starch.

- The student uses a range of starch concentrations.
- The investigation is repeated using an amylase activity inhibitor extracted from kidney beans.

The graph shows a sketch of the student's results.



(i) Explain how the extract from the kidney bean inhibited the amylase.

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…… **[3]**

(ii) State the evidence from the graph that supports your answer to part **(i)**.

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…… **[1]**

(c) The student then investigates the effect of pH on the activity of the amylase.

This is the method they use:

- Set up tubes containing starch and amylase in a range of pH buffer solutions.
- Use the same concentration of starch and amylase each time.
- Remove a small sample of the solution and test for the presence of starch at 20 s intervals.
- Repeat the process three times and calculate a mean for each pH.

The table shows the student's results.

pH	4	5	6	7	8	9
Mean amylase activity (% of maximum)	27	68	96	100	50	29

(i) Another student wants to replicate the investigation.

Refine the original student's method, by giving additional information, so that reproducible results can be obtained.

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(ii) Explain, with reference to bonding, why amylase activity is low at pH 4.

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…… **[4]**

(iii) The student concludes that the optimum pH for amylase is pH 7.

A teacher states:

'The results in the table provide only weak support for the conclusion that the optimum pH for amylase is pH 7'.

Describe the evidence that supports the teacher's statement **and** suggest an improvement to the student's method that would support the conclusion more strongly.

Evidence ……

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Improvement ……

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[3]

(d) Amylase activity is increased in the presence of chloride ions.

State the name given to any inorganic ion that increases the activity of an enzyme.

…… **[1]**

3 Vaccinations are effective in preventing the spread of a range of diseases.

(a) Explain why vaccinations are an example of **active immunity**.

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…… **[2]**

(b) Measles is a disease that can cause serious illness.

Since 1988, children in the UK have been vaccinated against measles using the MMR vaccine.

The table shows the percentage of children vaccinated with MMR and the incidence of measles in England and Wales.

Year	Percentage of children vaccinated with MMR	Confirmed cases of measles
1997	92	177
1998	91	56
1999	88	92
2000	88	110
2001	87	70
2002	84	319
2003	82	437
2004	80	188
2005	81	78
2006	84	740
2007	85	990
2008	85	1370
2009	85	1144
2010	88	380

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(i) Between 1997 and 1999 the mean percentage of children vaccinated with MMR was 90.3%.

Calculate the mean number of confirmed cases of measles between 1997 and 1999.

Mean number of cases = …… **[1]**

(ii) In 2005, despite relatively low vaccination rates, the number of confirmed cases of measles was only 78.

Use your answer from **(b)(i)** to calculate the percentage change in the mean number of confirmed cases between 1997 and 1999, and 2005.

Percentage change = …… **[2]**

(iii) In 2006, a newspaper claimed that a drop in MMR vaccination rates had **not** led to an increase in measles cases.

Evaluate the validity of the newspaper's claim. Use data from the table to support your argument.

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…… **[3]**

(c) The MMR vaccine is a combination of three different vaccines.

The MMR vaccine protects children against measles, mumps and rubella pathogens.

Explain why it is **not** possible to protect against the different pathogens using only one vaccine.

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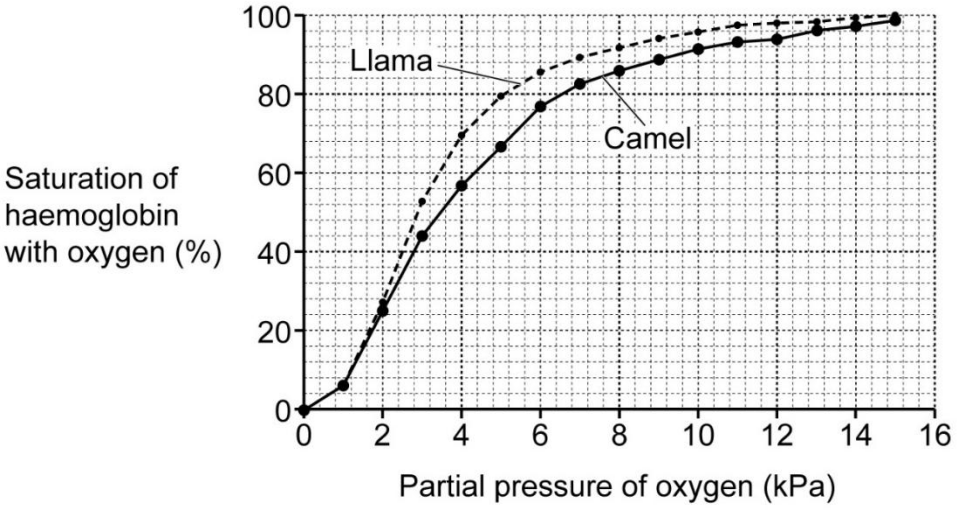
…… **[3]**

4 Haemoglobin is a protein that carries oxygen in the blood of all mammals. The structure of haemoglobin can vary slightly between species.

The llama, *Lama glama*, is a relative of the camel.

- Llamas live at high altitudes and camels live at low altitudes.
- At high altitudes the partial pressure of oxygen is low.
- Llama and camel haemoglobin consists of 2 α subunits and 2 β subunits.
- Each subunit contains a haem group and is able to bind to one molecule of oxygen.
- In the β subunits, one amino acid present in camel haemoglobin has been replaced by a different amino acid in llama haemoglobin.

The graph shows dissociation curves for llama haemoglobin and camel haemoglobin.



(a)

(i) State the partial pressure of oxygen that results in a saturation of 50% in llama haemoglobin.

Partial pressure of oxygen = …… **[1]**

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

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…… **[2]**

(b)* Describe how the structure of llama haemoglobin is likely to be different from that of camel haemoglobin.

Your answer should refer to the four levels of protein structure.

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…… **[6]**

Extra answer space if required.

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(c) Collagen is a fibrous protein.

State **three** properties of a fibrous protein that are different from those of a globular protein.

1 ……

2 ……

3 ……

[3]

(d) A vet is concerned that a llama is unwell. The vet suspects there may be haemoglobin in the urine of the llama.

Explain how the vet could confirm this suspicion.

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5 Bats are the only mammals that have wings. Many species of bat hunt flying insects at night. Bats are able to use echolocation (sound waves) in order to help them find their prey in the dark.

(a)

(i) Explain why bats and birds, despite not being closely related, have both evolved wings.

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…… **[3]**

(ii) Suggest why the majority of bird species have **not** evolved the ability to echolocate.

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…… **[1]**

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Turn over for the next question

(b)* The pipistrelle is the most common species of bat in Europe.

The table shows information about two distinct populations of pipistrelle.

Population	Mean Body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
Common pipistrelle	5.50	0.22	52 – 60	medium to dark brown	woodland, hedgerows, grassland, farmland, suburban and urban
Soprano pipistrelle	5.50	0.21	42 – 47	medium to dark brown	wetland, woodland edge, tree lines, hedgerows, suburban gardens and parks

A researcher claims:

'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in the table.

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6 DNA is an important biological molecule.

When a cell divides, an identical copy of DNA is made in a process called DNA replication.

(a) Explain how pairing of nitrogenous bases allows identical copies of DNA to be made.

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(b)

(i) Outline how the process of DNA replication is completed, after the pairing of nitrogenous bases.

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(ii) Explain why DNA replication is described as **semi-conservative**.

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…… **[1]**

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.

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