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AS Level Biology A
H020/02 Depth in biology
Sample Question Paper

Date – Morning/Afternoon
Time allowed: 1 hour 30 minutes

You may use:
- a scientific or graphical calculator

First name	
Last name	
Centre number	**Candidate number**

SPECIMEN

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **16** pages.

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Answer **all** the questions.

1 **Fig. 1.1** shows a microscopic image of part of a fish gill.

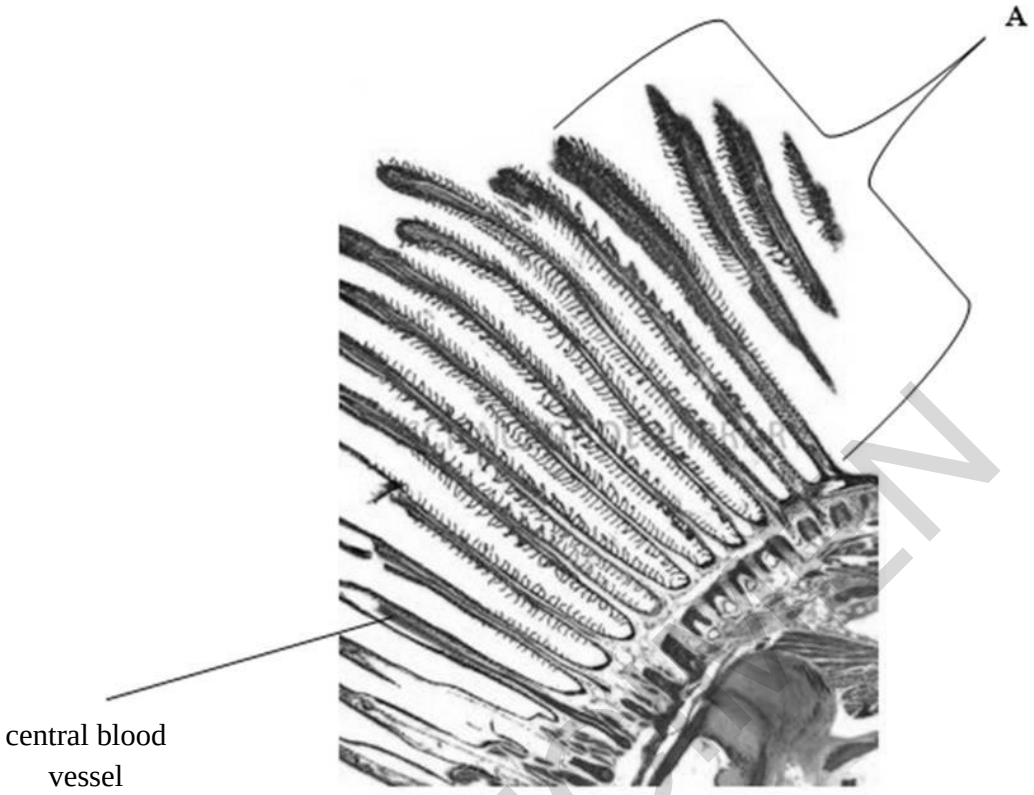


Fig. 1.1

(a) Name structure **A**.

……..…… **[1]**

(b) Explain how **Fig. 1.1** shows that gills are adapted for efficient gas exchange.

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…… **[4]**

SPECIMEN

(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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…… **[3]**

SPECIMEN

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

(a) A student investigated the breakdown of starch into maltose. The results are shown in **Fig. 2.1**.

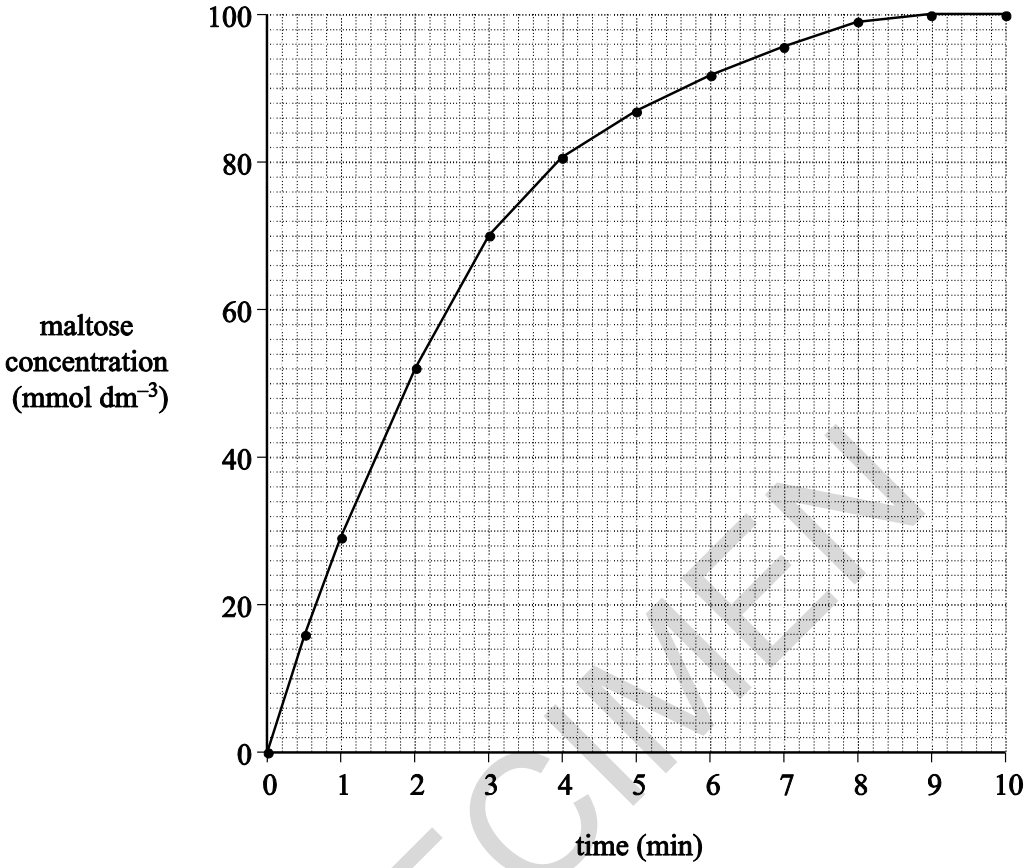


Fig. 2.1

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

Show your working and use appropriate units.

Answer…… **[2]**

(ii) How would this calculated rate differ from the 'true' initial rate of reaction?
Explain your answer.

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…… **[3]**

SPECIMEN

(b) The student conducted a further investigation using the same enzyme and substrate.

- A range of substrate concentrations was used.
- The investigation was repeated in the presence of an inhibitor of amylase activity extracted from kidney beans.

Fig. 2.2 shows a sketch of the student's results.

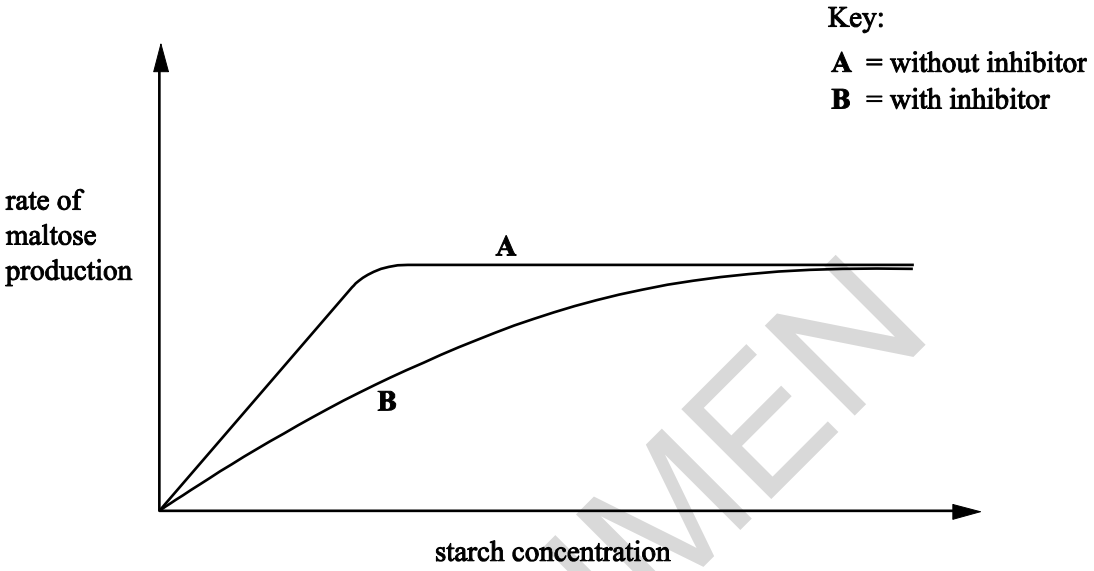


Fig. 2.2

(i) Explain the mechanism by which the extract from the kidney bean inhibited the amylase.

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…… **[3]**

(ii) What evidence from the graph supports your answer to part **(i)**?

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…… **[1]**

SPECIMEN

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

This was the method used,

- Tubes containing starch and amylase were set up in a range of pH buffer solutions.
- The same concentration of starch and amylase were used each time.
- A small sample of the solution was removed and tested for the presence of starch at 20 s intervals.
- The procedure was repeated three times and a mean was calculated for each pH.

The student presented the results in **Table 2.1**.

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

Table 2.1

(i) Another student wanted to replicate the investigation.

Refine the method, by giving additional information, so that reproducible results would 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]**

SPECIMEN

(iii) The student concluded that the optimum pH for amylase was pH 7.

A teacher made the following statement:

*'The results in **Table 2.1** provide only weak support for the conclusion that the optimum pH for amylase is pH 7.0'*

Evaluate the statement **and** suggest an improvement to the student's procedure that would support the conclusion more strongly.

Evaluation

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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]**

SPECIMEN

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 potentially fatal disease.

- Since 1988 children in the UK have been vaccinated against measles using the MMR vaccine.
- In 1998 a study was published which linked the MMR vaccine to the development of a condition known as autism. Some parents refused to have their children vaccinated with MMR.
- The study linking MMR to autism has since been discredited.

Table 3.1 shows some data about the percentage of children vaccinated with MMR and the incidence of measles in England and Wales.

Year	Proportion 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

Table 3.1

SPECIMEN

(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.

Give your answer to one decimal place.

Answer…… **[1]**

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

Use your answer to part **(i)** to calculate the percentage change in the number of confirmed cases of measles from the mean value of 1997–1999 to 2005.

Give your answer to one decimal place.

Answer…… **[2]**

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

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

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…… **[3]**

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

It 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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SPECIMEN

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

Fig. 4.1 shows a llama, a relative of the camel.



Fig. 4.1

- 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.

Fig. 4.2 shows dissociation curves for llama haemoglobin and camel haemoglobin.

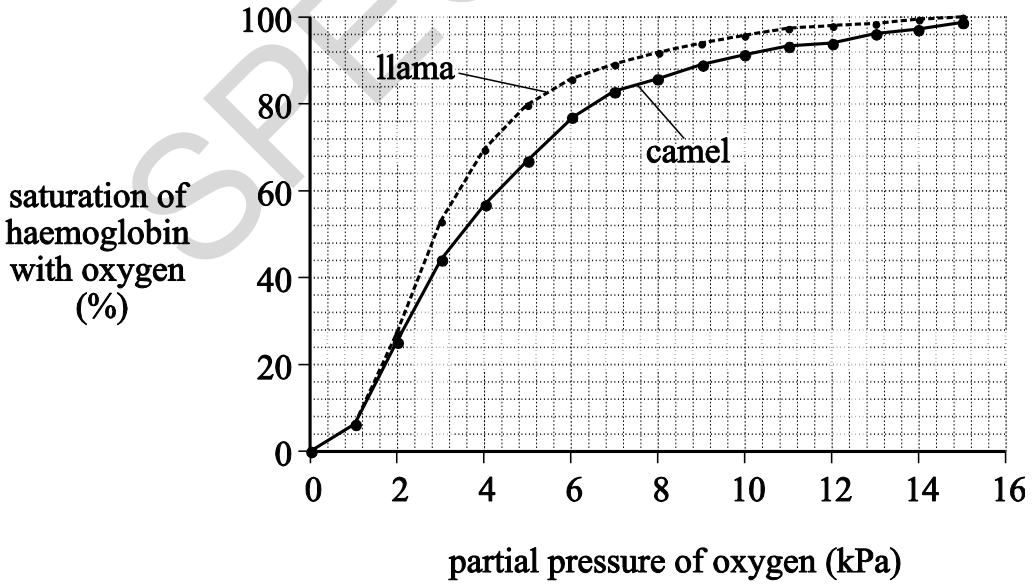


Fig. 4.2

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

Answer…… **[1]**

SPECIMEN

(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 hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

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…… **[6]**

(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]

SPECIMEN

(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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SPECIMEN

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 vast majority of bird species have not evolved the ability to echolocate.

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…… **[1]**

SPECIMEN

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

Table 5.1 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	5.5	0.22	52 – 60	medium to dark brown	woodland, hedgerows, grassland, farmland, suburban and urban
Soprano pipistrelle	5.5	0.21	42 – 47	medium to dark brown	wetland, woodland edge, tree lines, hedgerows, suburban gardens and parks

Table 5.1

A researcher made the following claim:

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

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

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SPECIMEN

6 DNA is arguably the most important molecule in the whole of biology.

When a cell divides an identical copy of its 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, following the pairing of nitrogenous bases.

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…… **[3]**

(ii) Why is DNA replication described as semi-conservative?

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…… **[1]**

END OF QUESTION PAPER

SPECIMEN

SPECIMEN

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