OCR
Oxford Cambridge and RSA

Friday 15 October 2021 – Morning

AS Level Biology A

H020/02 Depth in biology

Time allowed: 1 hour 30 minutes

You can use:
- a ruler (cm/mm)
- a scientific or graphical calculator

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H020002

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 answer 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 you start your answer.

Answer **all** the questions.

1 The information below is about carbohydrates.

- Glucose is a monomer of polysaccharides such as glycogen and starch.
- Glucose is an important source of energy in animals and is transported in the circulatory system.
- Glycogen is an energy storage molecule found in many animals.
- Starch is an energy storage molecule found in many plants.
- Amylopectin is one of the two polysaccharides that constitute the molecular structure of starch.

(a) **(i)** State **one** property of glucose that allows it to be easily transported in animals.

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(ii) Explain how the structure of glycogen differs from that of amylopectin to make it better suited as an energy store in animals.

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

(iii) **Fig. 1.1** shows the molecular structure of beta glucose.

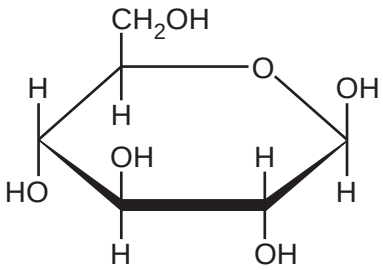

Fig. 1.1

Describe how the structure of alpha glucose would be different from the molecule shown in **Fig. 1.1**.

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..... **[1]**

(b) **Fig. 1.2** shows the start of the ring structure of ribose.

Complete the diagram to show the position of the carbon atoms. There is no need to include the –H and –OH groups. **[1]**

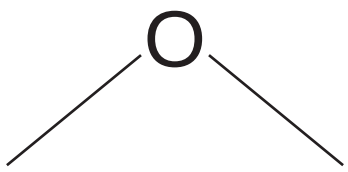

Fig. 1.2

2 **(a)** The immortal jellyfish, *Turritopsis dohrnii*, and the sea bass, *Dicentrarchus labrax*, are both found in the Mediterranean Sea.

(i) The table below shows some data on these two organisms.

Organism	Surface area (cm^2)	Volume (cm^3)
Immortal jellyfish	10.5	1.5
Sea bass	270.0	810.0

A student made the following statement:

'The immortal jellyfish does not need a transport system to transport oxygen as it has a very large surface area. The sea bass does need a transport system as it is a larger organism.'

Use the data in the table to evaluate the statement made by the student.

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(ii) **Fig. 2.1** shows the circulatory system of the sea bass.

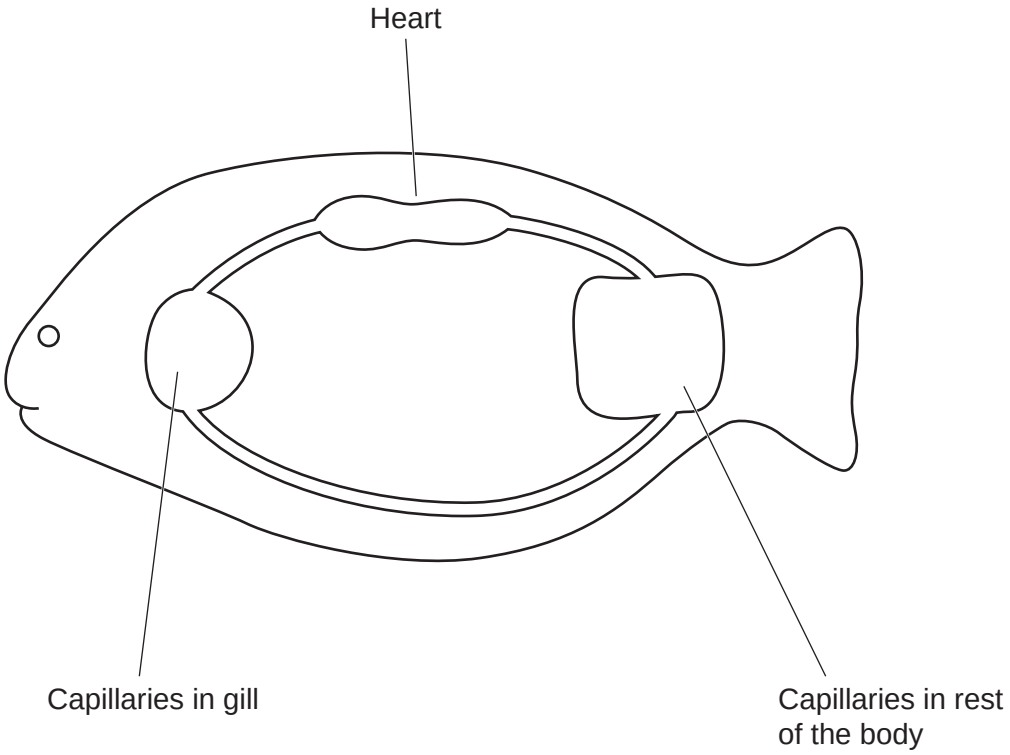

Fig. 2.1

Name the type of circulatory system shown in **Fig. 2.1**.

..... **[1]**

(iii) The circulatory systems of the sea bass and mammals are described as closed circulatory systems.

Define the term **closed circulatory system**.

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..... **[1]**

(iv) State **two** differences between the closed circulatory system of the sea bass and the closed circulatory system of a mammal.

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2 .....

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[2]

(b) A group of students were examining a mammalian heart prior to dissection. The atria and ventricles were clearly visible.

(i) Name **two** arteries that could be seen by the students.

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2 .....

[2]

(ii) The students then carried out a dissection of the heart. **Fig. 2.2** is an example of a drawing from one of the students.

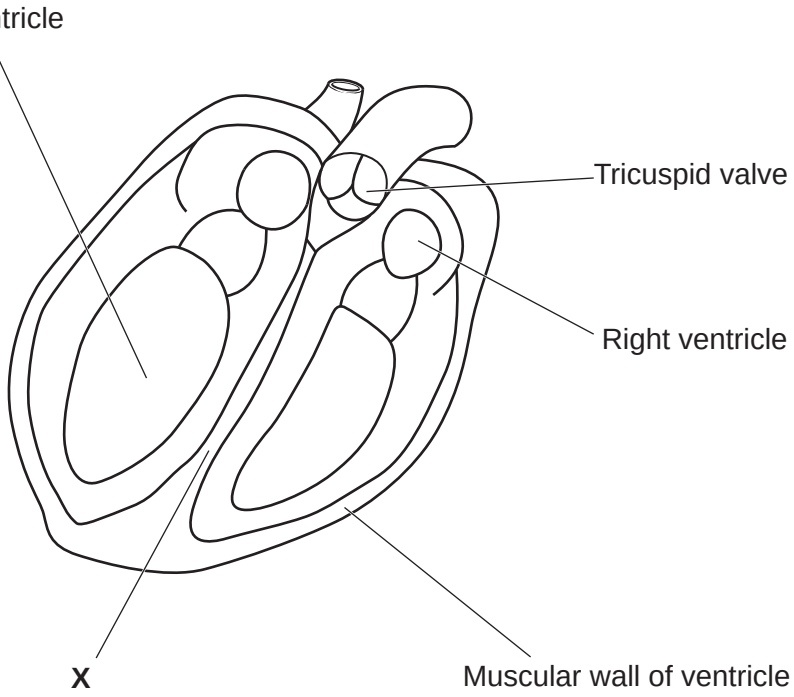

Fig. 2.2

Name the structure labelled **X** on **Fig. 2.2**.

..... **[1]**

(iii) Another student pointed out that there were structural and labelling errors in the drawing in **Fig. 2.2**.

In the space below, list **three** of these errors **and** the correction you would make.

Biological drawing errors are not required.

Error and correction 1

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Error and correction 2

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Error and correction 3

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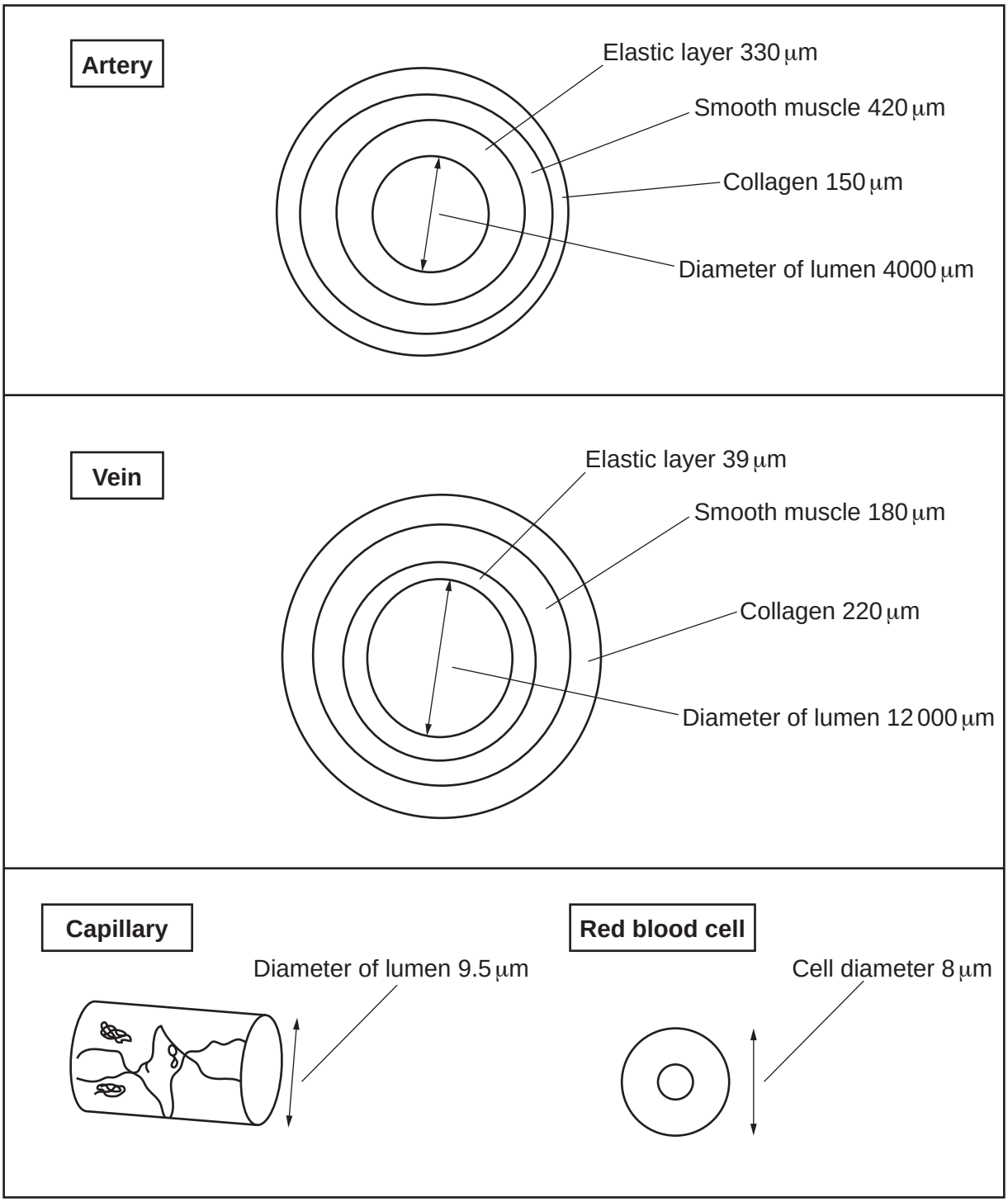
[3]

(c)* Three types of blood vessels found in mammals are arteries, veins and capillaries.

Fig. 2.3 shows data on these blood vessels.



Not to scale

Fig. 2.3

9

With reference to **Fig. 2.3** describe how the structure of each type of blood vessel is adapted to its function.

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Additional answer space if required.

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3 Students carried out a practical investigation into the effect of enzyme concentration on the rate of reaction.

They were provided with:

- a 1% solution of the enzyme trypsin
- a supply of distilled water
- test tubes labelled 1–4
- 10 cm^3 syringes.

(a) (i) Describe how they would create **four** different enzyme concentrations using **tenfold serial dilutions**. They started by using a syringe to transfer 1 cm^3 of the 1% trypsin solution into tube 1. With a clean syringe, they then added 9 cm^3 of distilled water to tube 1.

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..... **[2]**

(ii) State the concentration of trypsin in tube 4 once the **tenfold serial dilutions** had been completed.

Concentration = ... % **[1]**

(b) Trypsin is an example of a protease enzyme found in the small intestine of mammals. Explain why trypsin is described as an extracellular enzyme.

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..... **[1]**

(c) **Fig. 3.1** shows how the rate of reaction of trypsin changes with pH.

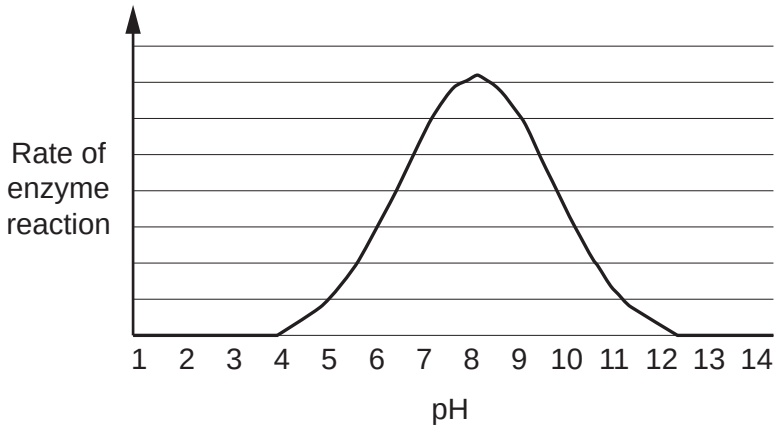

Fig. 3.1

With reference to **Fig. 3.1**, explain the change in the rate of reaction between pH 8 and pH 11.

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..... **[2]**

(d) Catalase is an enzyme found in a wide range of tissues. It catalyses the breakdown of hydrogen peroxide into water and oxygen. A group of students used liver tissue to investigate the effect of temperature on the rate of reaction of catalase.

A diagram of the apparatus is shown in **Fig. 3.2**.

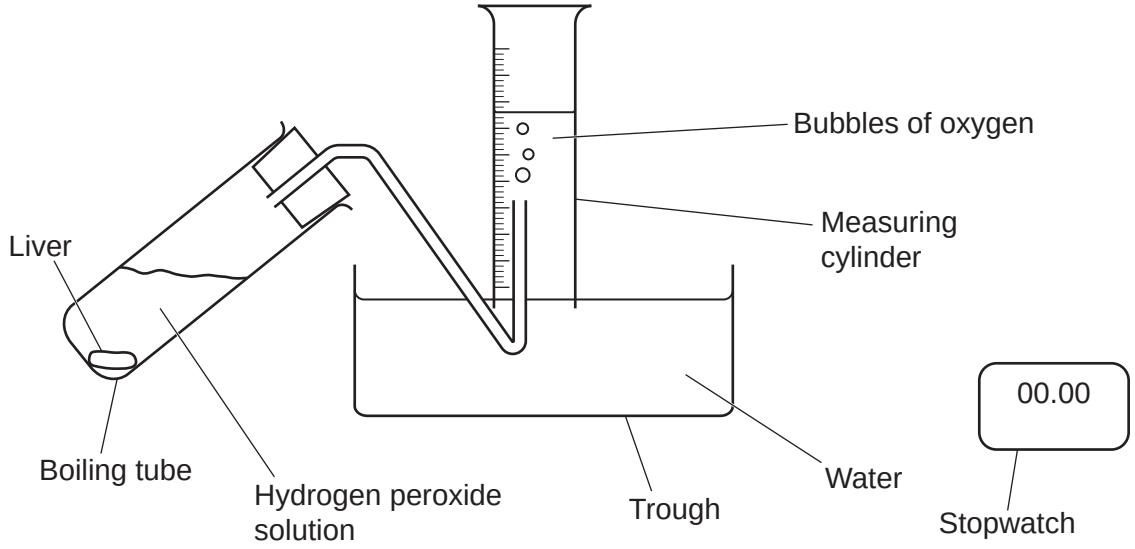

Fig. 3.2

Table 3 shows the results from the experiment carried out at 20 °C.

Time (s)	Volume of oxygen collected (cm^3)
30	6.0
60	12.0
90	15.0
120	18.0
150	21.0
180	22.0
210	23.5
240	24.0
270	24.5
300	25.0

Table 3

(i) Other factors may affect the rate of the reaction.

Name **one** other factor they would need to control **and** describe how they would control this.

Factor

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How they would control this

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[2]

(ii) Describe how you would use the apparatus shown in **Fig. 3.2** to obtain the results shown in **Table 3**.

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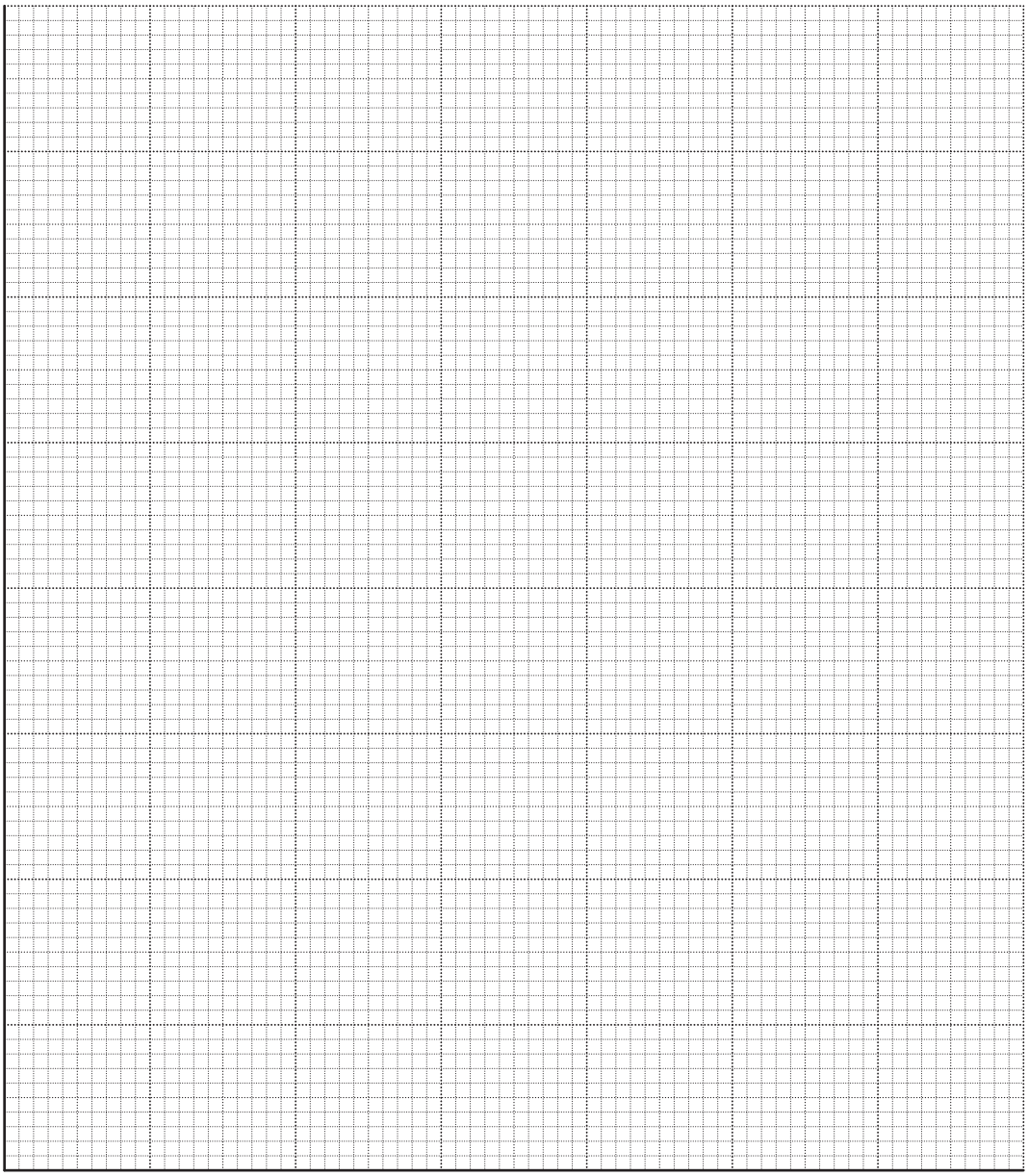
..... **[2]**

(iii) Plot a graph of the results shown in **Table 3** on the grid below.



[3]

(iv) Use your graph to calculate the **initial** rate of reaction.

Give your answer to **2** significant figures.

Rate of reaction = ... $cm^3 s^{-1}$ **[3]**

(v) The students investigating 30 °C calculated the initial rate of reaction to be 0.48 $cm^3 s^{-1}$.

Calculate the temperature coefficient (Q_{10}) for this reaction.

Give your answer to **2** significant figures.

Q_{10} = ... **[1]**

(e)* Temperature and enzyme concentration are two factors that affect the activity of enzymes.

Describe how variations in these two factors affect enzyme activity.

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Additional answer space if required.

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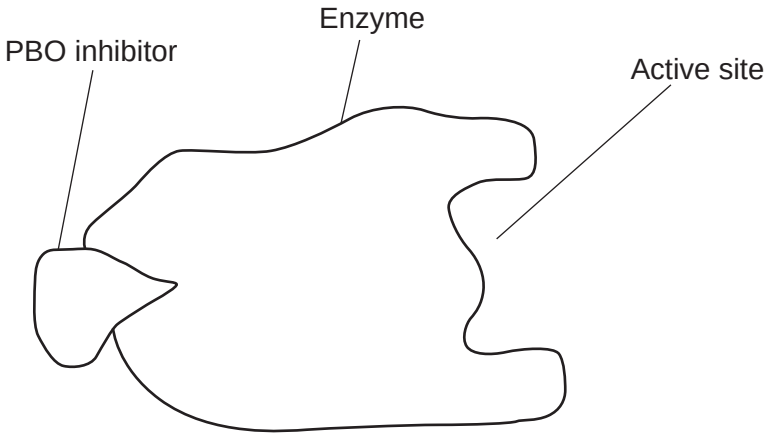
4 **(a)** Mosquito nets help to prevent the spread of malaria. They are often treated with an insecticide called permethrin. Some mosquitoes have developed resistance to the insecticide permethrin. Resistant mosquitoes produce an enzyme to detoxify the permethrin.

Scientists discovered that piperonyl butoxide (PBO) inhibits the activity of this enzyme in mosquitoes. The diagram shows how PBO acts on this enzyme.



With reference to the diagram, describe how PBO is acting as an enzyme inhibitor.

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(b) The malarial pathogen, *Plasmodium*, is a protoctist.

State **two** features of organisms that belong to the Kingdom Protoctista.

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2 .....

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[2]

5 **(a)** A group of students were studying invertebrate biodiversity in **two** areas of local woodland, **Area A** and **Area B**. They used pitfall traps to sample the two areas.

(i) Explain how a pitfall trap can be set up and used to sample invertebrate biodiversity.

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

(ii) The results for **Area A** are shown in the table below.

Species	***n* = Number of organisms**	$\frac{n}{N}$	$\left(\frac{n}{N}\right)^2$
Common woodlouse	9		
Black sexton beetle	6		
Spotted wolf spider	2		
Woodlouse spider	4	0.190	0.036
	***N* =**		$\sum\left(\frac{n}{N}\right)^2$ =
			$1 - \sum\left(\frac{n}{N}\right)^2$ =

Complete the above table **and** calculate the Simpson's Index of Diversity (*D*) for **Area A**.

Use the formula: $D = 1 - \left(\sum\left(\frac{n}{N}\right)^2\right)$

Where: *n* = number of organisms of this species

N = total number of organisms

Give your answer to **2** significant figures.

D = ... **[3]**

(iii) The students found the Simpson's Index of Diversity for **Area B** to be 0.84.

Compare the stability of the community living in **Area B** with that of the community living in **Area A** based on their Simpson's Index of Diversity.

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..... **[1]**

(b) A study was carried out on moorland vegetation in the North of England. A number of 10-metre interrupted belt transects were carried out in this area.

Here are some instructions for carrying out an interrupted belt transect:

1. Mark a line with a string.
2. Make an observation at varying points along the string.
3. Count how many different species of plants are found at each point.
4. Note down what you think the names of each of these species are.
5. Record your results as a table.

(i) Suggest **two** improvements you could make to these instructions.

Improvement 1

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Improvement 2

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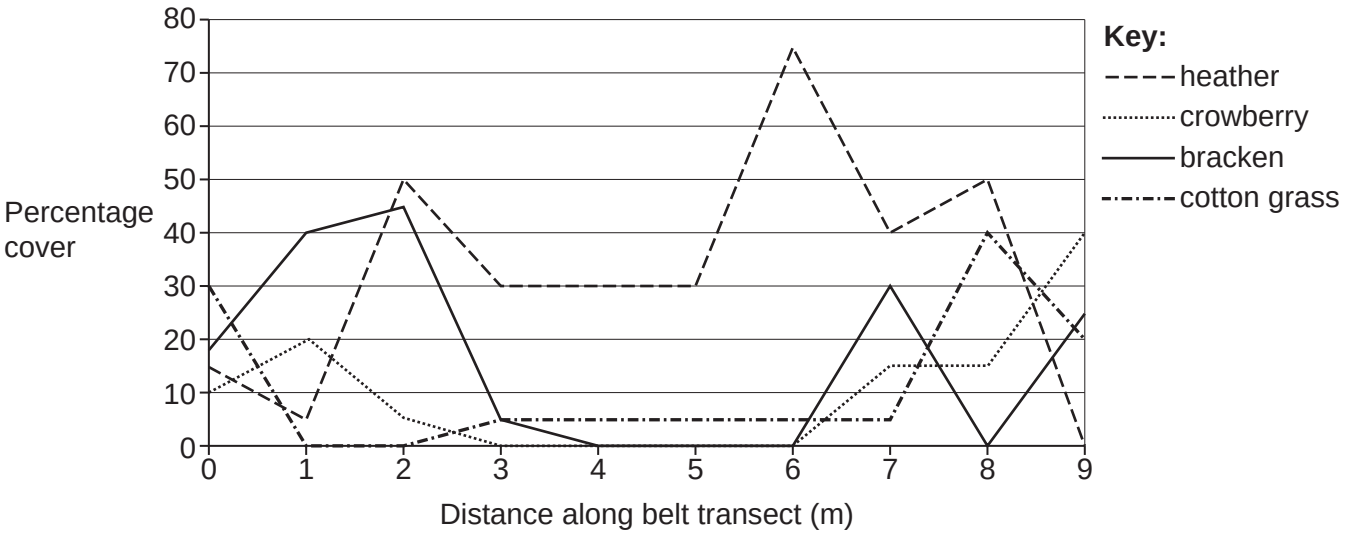
[2]

(ii) Results of the four most abundant species from the study are shown in the graph below.



When presented with an aerial photograph of the moorland community being studied, a student stated that bracken and heather are not found growing in the same area.

Using the data in the graph, evaluate the student's statement.

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(c) Many birds found in moorland habitats, including the lapwing and curlew, are 'red listed' as species of high conservation concern. It is for this reason that many moorland habitats are considered to be areas of international significance to birdlife.

Suggest measures that could be implemented to protect the biodiversity of moorland habitats.

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END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).