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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number | Candidate Number

Wednesday 6 May 2020

Morning (Time: 1 hour 45 minutes) | Paper Reference **4HB1/02R**

Human Biology

Unit: 4HB1

Paper: 02R

You must have:
Ruler
Calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Answer ALL questions.

1 Food enters the alimentary canal through the mouth.

All undigested food leaves the body through the anus.

(a) Name three structures the food passes through between the mouth and the anus.

(3)

1 .....

2 .....

3 .....

(b) Some of the food is digested by enzymes as it passes through the alimentary canal.

(i) Name an enzyme that digests protein.

(1)

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(ii) Describe the processes that occur in the mouth to digest food.

(4)

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(c) Fibre in food cannot be digested.

Explain the importance of fibre in the diet.

(3)

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(Total for Question 1 = 11 marks)

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2 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Treatment of Ebola

Ebola is caused by an RNA virus. There is no proven treatment available for Ebola. However, whole blood collected from someone who has recovered from infection has been used as a treatment. The results have been promising in a small group of Ebola patients.

Guidance for national health authorities and blood transfusion services describes the stages needed to collect whole blood (CWB) or plasma (CP) from Ebola-recovered patients. This can be used for transfusion to patients as a treatment for early Ebola.

The guidance states how to

- identify people who have recovered from Ebola as potential blood donors
- screen donors' blood for A, B, O and Rhesus groupings
- screen donors' blood for transfusion-transmissible infections
- collect blood and care for donors
- obtain agreement of Ebola patients for the treatment
- identify patient's blood grouping
- store and transport CWB and CP to the places where transfusions are to be given
- select Ebola patients for transfusion
- transfuse the blood into the patient

Donated CWB should never be frozen and should be stored between 2 °C and 6 °C.

CWB and CP donations should be transfused to the Ebola patients using standard transfusion procedures.

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(a) (i) Explain what is meant by an RNA virus (line 1).

(2)

(ii) The table lists five diseases. Put a tick (✓) next to the diseases that should be tested for in the donors' blood.

(2)

Disease	Blood tested (✓)
anaemia	
cystic fibrosis	
gonorrhoea	
HIV	
scurvy	

(iii) Explain why it is necessary to identify the blood group of the blood collected from donors who have recovered from Ebola (line 9).

(3)

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(iv) Suggest why donated CWB should never be frozen (line 17).

(2)

(v) Explain how the blood of people who have recovered from Ebola is likely to be effective in treating the disease.

(2)

(b) The nitrogenous base composition of another virus was found to be adenine 13%, guanine 26%, uracil 20% and cytosine 41%.

Explain how these figures prove that this is a virus with a single strand of RNA.

(3)

(Total for Question 2 = 14 marks)

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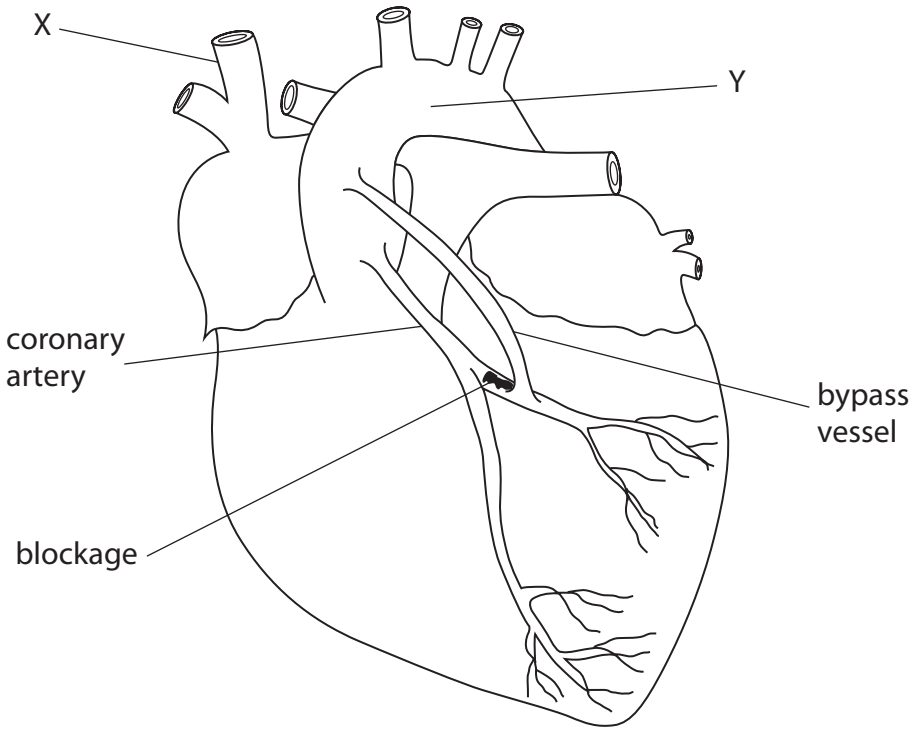
3 The diagram shows a person's heart. The person has had a heart bypass operation because a coronary artery had become partly blocked.



(a) (i) What is the name of blood vessel Y?

(1)

- ☒ **A** aorta
- ☒ **B** pulmonary artery
- ☒ **C** pulmonary vein
- ☒ **D** vena cava

(ii) To which part of the heart is blood vessel X connected?

(1)

- ☒ **A** left atrium
- ☒ **B** left ventricle
- ☒ **C** right atrium
- ☒ **D** right ventricle

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(b) (i) Before the bypass operation, the coronary artery was becoming blocked at the point shown on the diagram.

Draw a circle on the diagram to show the area of the heart that was affected by the blockage before the bypass operation.

(1)

(ii) Describe what effect this blockage would have on the heart tissue if the bypass vessel was not inserted.

(3)

(iii) Suggest how the bypass vessel allows the heart to work more effectively.

(2)

(Total for Question 3 = 8 marks)

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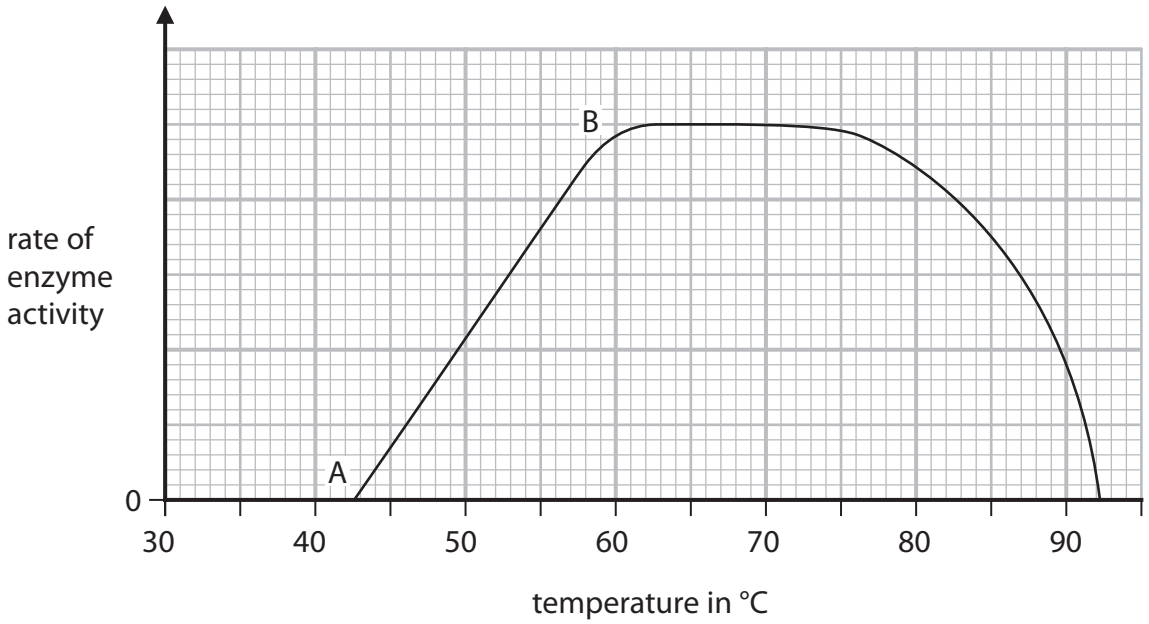
4 The graph shows the effect of temperature on the activity of a bacterial enzyme.



(a) Draw a curve on the grid to show the rate of enzyme activity for an enzyme from the human alimentary canal.

(2)

(b) Explain what is causing the change in enzyme activity from A to B.

(5)

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(c) Deduce which type of environment the bacterium lives in.

(2)

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(Total for Question 4 = 9 marks)

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5 A scientist investigates how the drug, atropine, affects the heart rate in humans.

Atropine paralyses the vagus nerve which carries impulses from the brain to the heart.

The heart rates of ten people are measured at intervals of two minutes for eight minutes, after which, atropine is injected.

The scientist continues to measure the heart rates.

The scientist's results are shown in the table.

Time in minutes	Heart rate in beats per minute
0	90
2	81
4	78
6	80
8	82
9	100
10	120
11	148
12	160
13	138
15	128
17	120
19	116
21	109
23	100

atropine injected →

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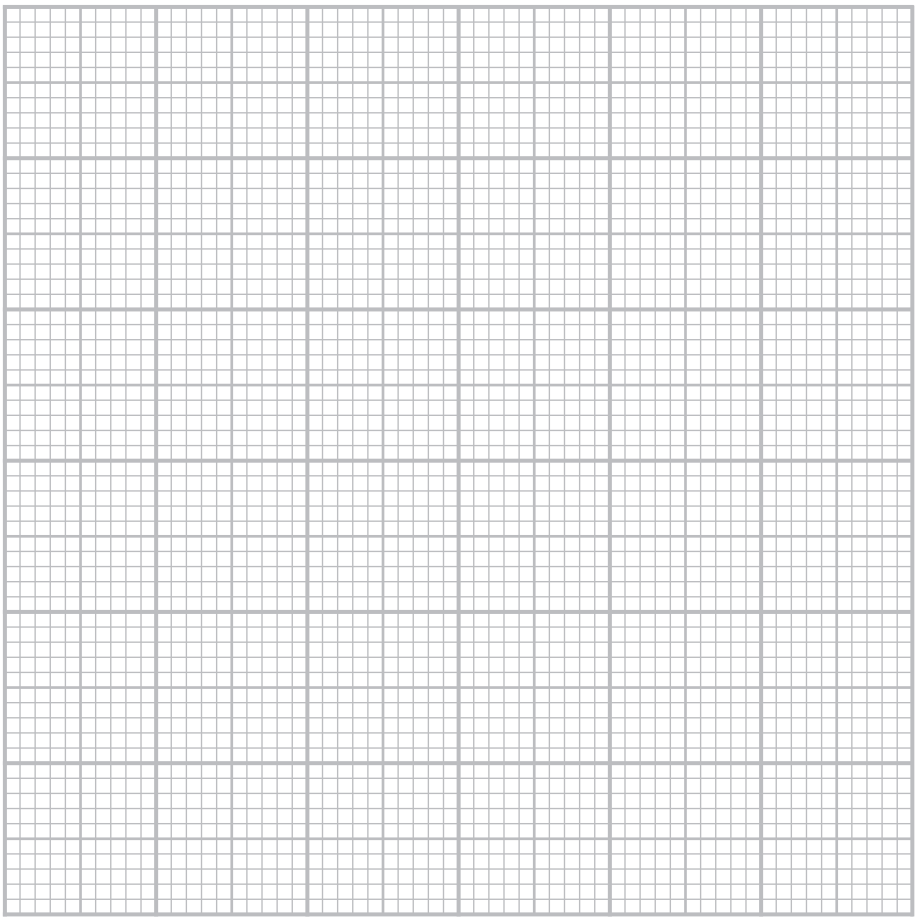
(a) (i) Plot the scientist's results on the grid. Draw a curve of best fit.

(6)



(ii) Explain why ten people are injected with atropine rather than just one person.

(2)

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(b) (i) Calculate the percentage change in the heart rate at 12 minutes compared to the heart rate at the start of the investigation.

(2)

percentage change = ...%

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(ii) Explain why this percentage change is not achieved as soon as atropine is injected.

(2)

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(c) Suggest the function of the vagus nerve.

(2)

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(Total for Question 5 = 14 marks)

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6 Haemophilia is a condition in which blood does not clot. It is caused by a sex-linked allele.

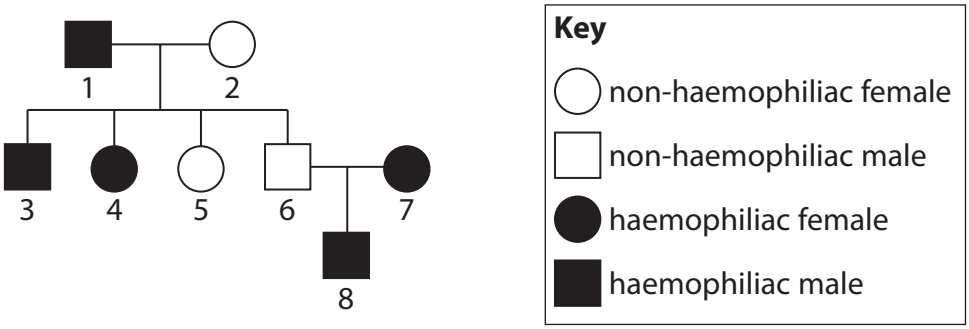
(a) (i) Explain why the process of blood clotting is important.

(3)

(ii) State what is meant by the term **sex-linked**.

(2)

(b) The pedigree shows the pattern of inheritance of haemophilia in a family.



X^h is the allele for haemophilia and X^H is the allele for clotting.

(i) What is the genotype of person 3?

(1)

☒ **A** $X^h X^h$

☒ **B** $X^H X^h$

☒ **C** $X^H Y$

☒ **D** $X^h Y$

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(ii) What is the genotype of person 5?

(1)

- ☒ **A** $X^h X^h$
- ☒ **B** $X^H X^h$
- ☒ **C** $X^H Y$
- ☒ **D** $X^h Y$

(iii) Parents 6 and 7 have another child.

Determine the probability that the child will be male with haemophilia.

(2)

probability = ...

(iv) Explain why people with genotypes shown by persons 4 and 7 are less likely to be present in a population.

(3)

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(Total for Question 6 = 12 marks)

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7 Chymosin is an enzyme found in young humans, but not in adults. It converts soluble proteins in milk into solid proteins.

(a) (i) Suggest the advantages to a young human of having chymosin in their alimentary canal.

(2)

(ii) Explain why chymosin is only needed in young humans.

(2)

(iii) Describe a test to show that the solid formed by the action of chymosin on milk is a protein.

(3)

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(b) A student investigates the effect of carbon dioxide on the activity of chymosin.

The student bubbles different volumes of carbon dioxide gas into five samples of milk.

He then adds chymosin to each sample and records the time taken for the milk protein to become solid.

The student repeats this method three times.

The table shows the student's results.

Number of bubbles of CO_2	Time taken for chymosin to turn milk protein solid, in seconds				
	Test 1	Test 2	Test 3	Test 4	Mean
100	253	257	250	260	255
150	238	232	241	229	
200	216	214	219	211	215
250	208	202	212	198	205
300	210	200	199	311	203

(i) State three factors that the student should control.

(3)

1 .....

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2 .....

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3 .....

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(ii) Calculate the missing mean (average) time taken for 150 bubbles.

(2)

mean time taken = ...

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(iii) In test 4 there is an anomalous result.

State how the student deals with this result.

(1)

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(iv) State why recording the number of bubbles may produce inaccurate results.

(1)

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(Total for Question 7 = 14 marks)

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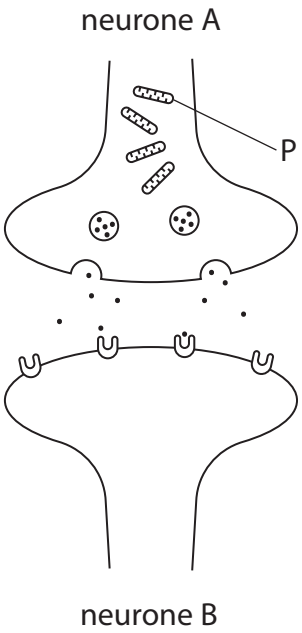
8 The diagram shows the gap between two neurones, A and B.



(a) (i) Draw an arrow on the diagram to show the direction of travel of an impulse.

(1)

(ii) Explain the function of structure P in the transmission of the impulse across the gap.

(3)

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(b) Curare is a poison used by South American Indians when hunting. Curare blocks receptors on the post synaptic membranes of neurones supplying skeletal muscles and prevents breathing.

(i) Explain how curare can stop the process of breathing.

(2)

(ii) Acetylcholinesterase is an enzyme found in the gap between two neurones.

Suggest why acetylcholinesterase inhibitors can be used to reverse the effects of curare poisoning.

(2)

(Total for Question 8 = 8 marks)

TOTAL FOR PAPER = 90 MARKS

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