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

Time 1 hour 45 minutes

Paper reference **4HB1/02**

Human Biology

UNIT: 4HB1
PAPER: 02

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.
- Try to answer every question.
- Check your answers if you have time at the end.
- Good luck with your examination.

Turn over ▶

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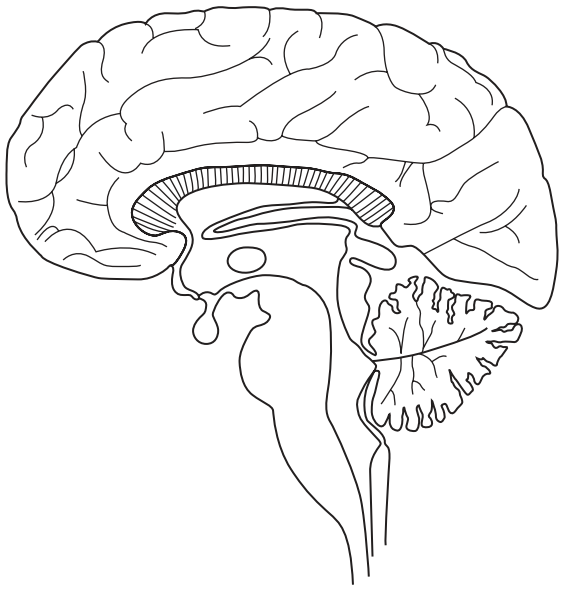
Answer ALL questions.

1 The diagram shows a section through a human brain.



(a) Using lines, label these structures on the diagram.

- cerebral hemisphere
- cerebellum
- pituitary gland
- hypothalamus

(4)

(b) State which structure in part (a) is responsible for each of these functions.

(4)

Function	Structure
control of muscle tone and posture	
intelligence and thought	
monitoring of body temperature	
release of ADH	

(Total for Question 1 = 8 marks)

2 Aerobic respiration is the process that releases energy for use in the body.

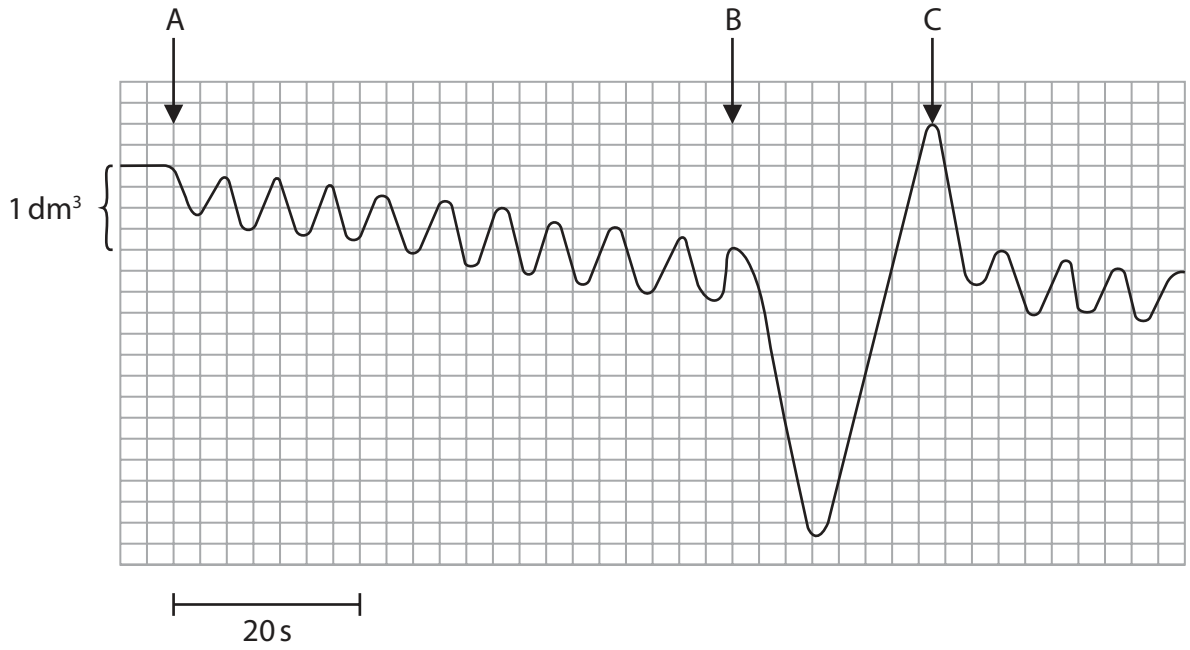
(a) Give the word equation for the process of aerobic respiration.

(4)

..... + ... → ..... + ... + energy

(b) A spirometer is used to measure the volumes of air breathed in and the volumes of air breathed out.

The spirometer trace shows the readings taken of a person at rest.



(i) Calculate the rate of breathing between points A and B shown on the trace.

(2)

rate = ... breaths per minute

(ii) Calculate the difference in the volume of air breathed in and the volume of air breathed out between points B and C.

(3)

difference in volume = ... dm^3

(c) Describe the differences that would be seen in the trace between points A and B if the person had been exercising vigorously before the readings were taken.

(2)

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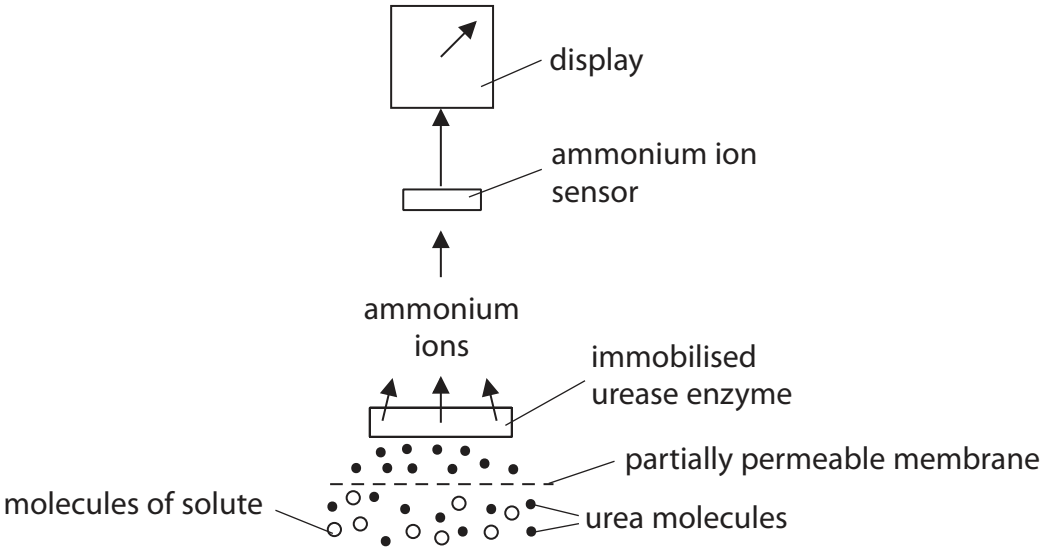
(Total for Question 2 = 11 marks)

3 The diagram shows a biosensor that can be used to measure the concentration of urea in urine.



(a) (i) The urea molecules are in solution.

State the name of the solvent.

(1)

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(ii) Explain the function of the partially-permeable membrane.

(2)

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(iii) Suggest the function of the urease enzyme.

(3)

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(b) A scientist wants to use the biosensor to compare the urea concentration of two urine samples.

Explain why it is important to do the tests at the same temperature.

(4)

(c) Immobilised enzymes are also used in industry to produce useful molecules.

Give two advantages of using immobilised enzymes instead of enzymes that are free to move in solution.

(2)

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2 .....

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(Total for Question 3 = 12 marks)

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4 Read the passage below.

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

Obesity and diabetes have been linked to a 20% increase in the number of leg and foot amputations.

Data from Diabetes UK shows that there were 26 378 lower limb amputations related to diabetes from the period 2014 to 2017. This is an increase from the period 2010 to 2013 when there were 22 092 amputations related to diabetes.

Minor lower limb amputations are below the ankle and major lower limb amputations are below the knee. Minor lower limb amputations increased by 26.5% and major lower limb amputations increased by 4.0%.

In 2019 in the United Kingdom 3.8 million people had been diagnosed with diabetes and 90% of these people had Type 2 diabetes.

(a) (i) Describe the causes of obesity.

(3)

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(ii) Give two health risks, other than diabetes, associated with obesity.

(2)

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2 .....

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(b) Diabetes is caused as a result of insulin not being secreted or not working correctly.

(i) Which organ secretes insulin?

(1)

- ☒ **A** kidney
- ☒ **B** liver
- ☒ **C** pancreas
- ☒ **D** thyroid

(ii) Insulin stimulates the conversion of glucose into glycogen.

In which organ does this occur?

(1)

- ☒ **A** kidney
- ☒ **B** liver
- ☒ **C** pancreas
- ☒ **D** thyroid

(c) (i) Calculate the percentage increase in the number of lower limb amputations between the period 2010 to 2013 and the period 2014 to 2017.

(3)

percentage increase = ... %

(ii) Calculate the number of people in 2019 who had been diagnosed with Type 2 diabetes in the United Kingdom.

(1)

number of people = ... million

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(d) Diabetes causes a narrowing of the arteries supplying blood to the lower limbs.

Suggest why this can lead to the need to amputate the lower limbs.

(3)

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(Total for Question 4 = 14 marks)

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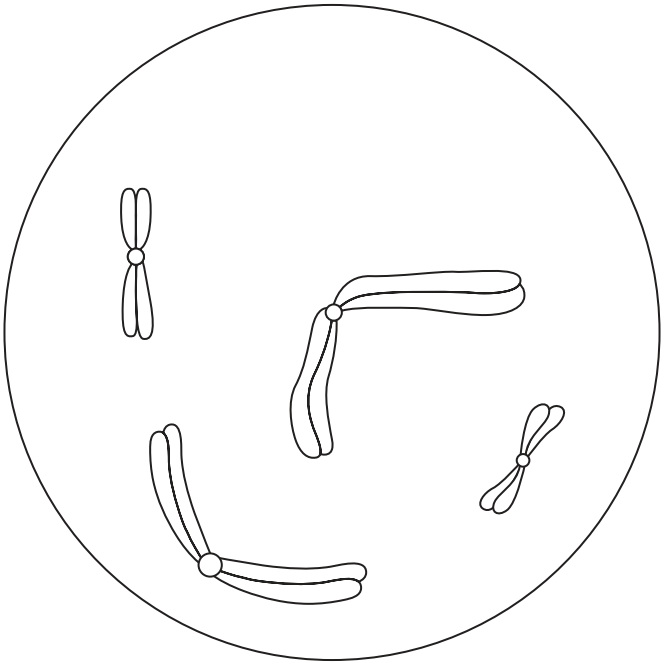
5 The diagram shows a cell in the early stages of mitosis.



(a) (i) Which molecule is found in the chromosomes?

(1)

- ☒ **A** DNA
- ☒ **B** glucose
- ☒ **C** glycogen
- ☒ **D** mRNA

(ii) Draw a circle around two homologous chromosomes on the diagram.

(1)

(iii) State how the diagram shows that this is not a human cell.

(1)

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(b) Describe what happens to the chromosomes during the four stages of mitosis.

(5)

(Total for Question 5 = 8 marks)

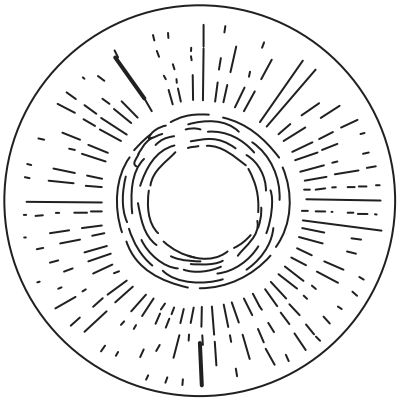
6 The human eye consists of many parts.

(a) Which part has the highest concentration of light sensitive cells?

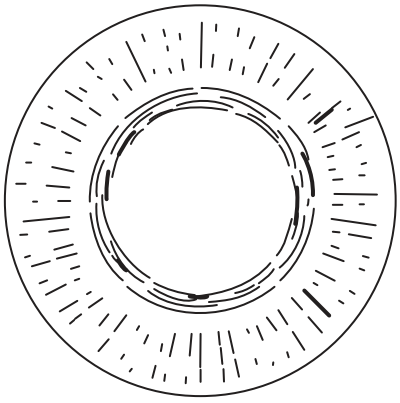
(1)

- ☒ **A** blind spot
- ☒ **B** choroid
- ☒ **C** fovea
- ☒ **D** optic nerve

(b) The diagram shows the iris of an eye in two different light conditions, A and B.



light condition A



light condition B

(i) Describe what happens in the eye when the light condition changes from A to B.

(5)

(ii) Explain why it is important that the changes in the eye occur quickly when the light condition changes from B to A.

(3)

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(Total for Question 6 = 9 marks)

7 Garlic plants contain a substance called allicin. This substance is thought to have antibacterial properties.

A student investigates the antibacterial effect of garlic.

This is the student's method.

- label three test tubes A, B and C
- add 10 cm^3 of milk into each of the tubes
- add a sample of the bacterium *E. coli* into tubes B and C using aseptic techniques
- crush the garlic in water to form garlic juice
- add 1 cm^3 of garlic juice to tube C
- shake all three tubes and leave to incubate for two hours
- place a sample from tube A into the centre of Petri dish A, from tube B into the centre of Petri dish B and from tube C into the centre of Petri dish C
- incubate the three Petri dishes for five days
- each day measure the diameter of any bacterial growth that has occurred

The table shows the student's results.

Petri dish	Diameter of bacterial growth in mm				
	day 1	day 2	day 3	day 4	day 5
A	0	1.7	3.0	4.6	7.1
B	0	4.2	8.4	15.1	36.5
C	0	0	0	0	0

(a) (i) State three control variables in the student's investigation.

(3)

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3 .....

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(ii) State the dependent variable in the student's investigation.

(1)

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(b) (i) Calculate the mean daily increase in the diameter of the bacterial growth for dish A and dish B.

(2)

mean daily increase for dish A ..... mm/day

mean daily increase for dish B ..... mm/day

(ii) Explain the difference between the mean daily increases in the diameter of the bacterial growth for dish A and dish B.

(4)

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(c) Explain what is meant by an aseptic techniques for the transfer of bacteria.

(2)

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(d) Suggest what further tests the student should do to show that garlic can be used as an effective general antibacterial agent.

(2)

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(Total for Question 7 = 14 marks)

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8 Skin and hair contain a pigment called melanin.

(a) (i) Describe the function of the pigment melanin in the skin.

(2)

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(ii) State one other place, apart from hair and skin, where pigment is found in the body.

(1)

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(b) A condition known as white forelock is caused by a dominant allele H.
People with this condition have a white patch in their hair.

The condition causes a deficiency of the skin pigment melanin.

A woman who is heterozygous for white forelock produces children with a father who does not have the condition.

(i) Draw a genetic diagram to show the possible offspring from this cross.

The condition is not sex-linked.

(4)

(ii) Calculate the probability that these parents will produce a boy with the condition.

(3)

probability = ...

(c) White forelock is a result of a mutation in a molecule of DNA.

Describe how this mutation causes the white forelock phenotype.

(4)

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(Total for Question 8 = 14 marks)

TOTAL FOR PAPER = 90 MARKS

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