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Please check the examination details below before entering your candidate infor on

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Wednesday 14 June 2023

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.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **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.

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.

Turn over ▶

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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind a an answer, put a line through the box ☒ and then mark your new answer with a cross ☒

1 (a) The table shows some cell structures and their functions.

(i) Place one tick (✓) in each row to show the function of each cell structure.

(3)

Cell structure	Function		
	makes proteins	contains DNA	allows substances in and out of cells
nucleus			
ribosomes			
cell membrane			

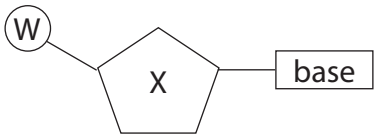
(ii) Give a structure found in bacterial cells.

(1)

.....

(b) (i) DNA is made of two chains of nucleotides.

The diagram shows one nucleotide.



Name part W and part X.

(2)

W .....

X .....

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(ii) Describe how bases hold the two chains of nucleotides together.

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(c) The gene for the hormone insulin contains 153 bases.

Determine the number of amino acids in insulin.

(2)

number of amino acids = ...

(Total for Question 1 = 11 marks)

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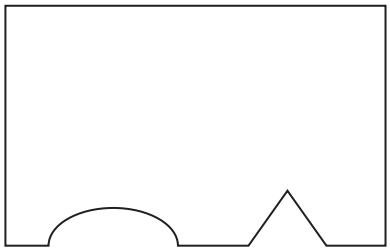
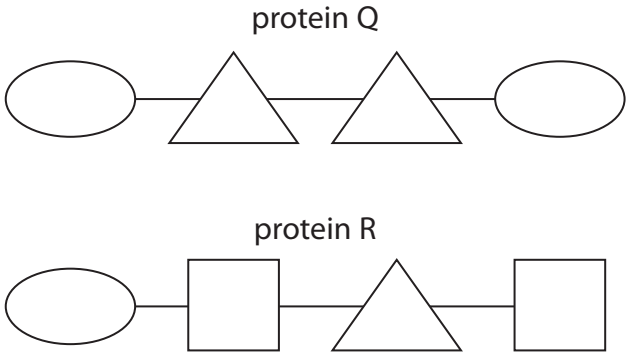
2 (a) The diagram represents an enzyme, known as enzyme P, and two named substrates.



Enzyme P



Substrates

(i) Use the diagram and words from the box to complete the passage about enzyme P.

(3)

amino acids	amylases	fatty acids	proteases
protein Q	protein R	starch	sugar

Enzyme P belongs to a group of enzymes called ..... .

This enzyme breaks down ..... in food

to ..... .

(ii) Give one location where enzyme P is found in the digestive system.

(1)

.....

(iii) Name the molecule that codes for the production of enzyme P.

(1)

.....

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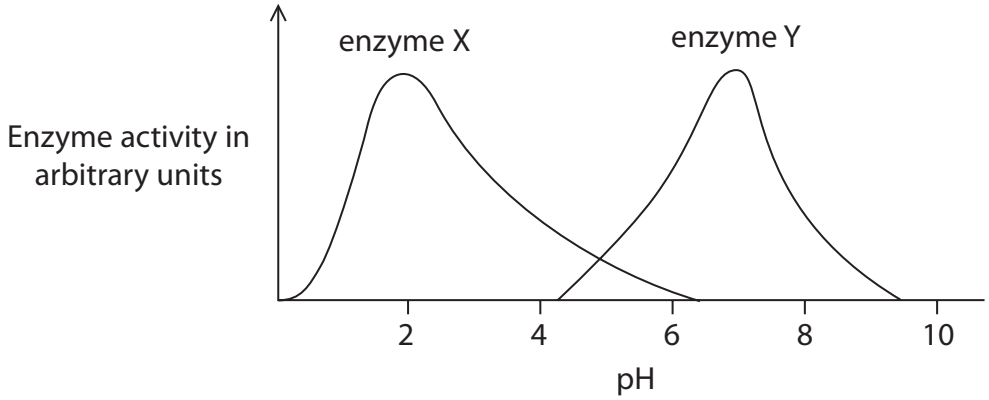
(b) A student investigates the effect of pH on the activity of two enzymes, X and Y.

The student measures the activity of each enzyme once, using different pH values.

The graph shows the results of their investigation.



(i) Describe how the activity of enzyme X changes with pH.

(3)

(ii) Explain why no activity is shown for enzyme Y at pH2.

(2)

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(iii) Describe how the student could make the results of this investigation more reliable.

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(iv) Name one control variable in the student's investigation.

(1)

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(Total for Question 2 = 13 marks)

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3 (a) Describe what is meant by a specialised cell.

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(b) The sperm cell is an example of a specialised cell.

The diagram shows a sperm cell.

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(i) The sperm cell in the diagram has an actual length of 0.0060 mm.

The length of the image of the sperm cell is 84 mm.

Calculate the magnification of the sperm cell.

(2)

magnification = × .....

(ii) The head of the sperm contains DNA.

Give the difference in the amount of DNA found in the head of the sperm and in a nucleus of a body cell.

(1)

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(iii) Explain why the sperm cell has many mitochondria.

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(iv) A sperm cell travels at a speed of 0.070 mm/s.

It travels a distance of 180 mm to fertilise an egg.

Use this equation to calculate the time it takes for the sperm to reach the egg.

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

Give your answer in minutes.

(3)

time taken = ... minutes

(c) An electron microscope can be used to view structures in specialised cells.

Explain why an electron microscope is more useful than a light microscope to view cell structure.

(2)

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(Total for Question 3 = 12 marks)

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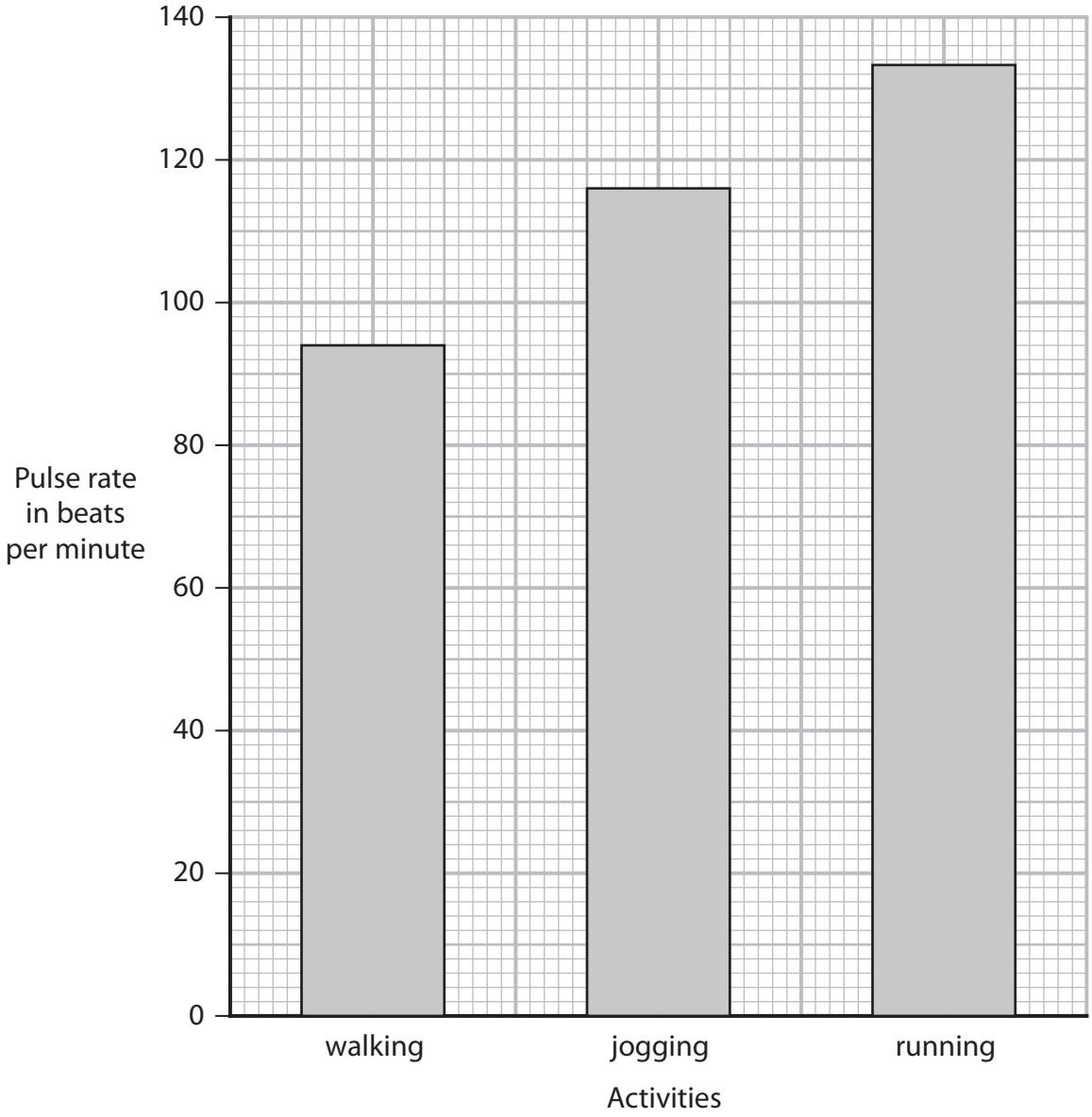
4 (a) The bar chart shows the pulse rate of a student at the end of three different activities.



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(i) Draw a table that the student could use to record these results.

(ii) Complete the table by adding the student's results.

(2)

(iii) Describe a method that the student could use to obtain the results shown in the bar chart.

(4)

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(b) The pulse rates at the end of walking and running are different.

Explain this difference.

(4)

(Total for Question 4 = 13 marks)

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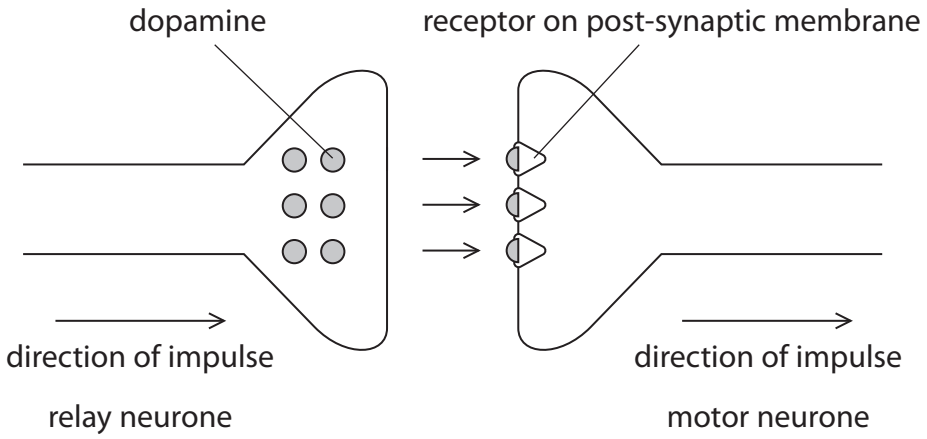
5 (a) Dopamine is a neurotransmitter produced by nerve cells in the brain.

The nerve cells that produce dopamine are involved in stimulating movement and increasing heart rate.

The diagram shows how dopamine travels from a relay neurone to a motor neurone in the brain.



(i) Describe what is meant by a neurotransmitter.

(2)

(ii) Describe how information is transmitted from the relay neurone to the motor neurone.

(2)

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(iii) Suggest how an excess of dopamine will affect bodily functions.

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(b) In 2017 in the United Kingdom, 145 000 people were diagnosed with Parkinson's disease.

This figure is expected to have an 18% increase by 2025.

(i) Give two symptoms of Parkinson's disease.

(2)

1 .....

.....

2 .....

.....

(ii) Calculate the number of people expected to be diagnosed with Parkinson's disease in 2025.

(2)

number of people = ...

(Total for Question 5 = 10 marks)

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6 Read the passage below.

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

Pregnancy begins with the formation of a zygote. This stage is known as conception. The zygote develops into an embryo. By day five the embryo is transformed into a blastocyst, a hollow ball of about 100 genetically identical cells. These cells have not yet differentiated and they can provide a source of embryonic stem cells for use in medical research. Embryos produced following IVF treatment can be used as a source of embryonic stem cells.

In the second week following conception, the blastocyst begins the process of implantation and releases a hormone, called hCG. This hormone maintains the corpus luteum, a structure formed in the ovary following ovulation. After implantation the amniotic sac forms, which is where the blastocyst and later the fetus develop.

In the fourth and fifth week after conception, the umbilical cord forms. This connects the embryo to the placenta by week eight. The placenta is not fully developed until week ten when it begins to produce progesterone and oestrogen. All organ systems are present at this time in pregnancy.

Fetal development begins at about month four and it is possible to distinguish males from females at this time. In males the testes, which develop in the abdominal cavity, release testosterone. Female characteristics are produced in the fetus if testosterone is not released at the stage.

Hormones are important in starting labour and the birth process, about nine months after conception. The cervix dilates, with the head of the baby pushing against the cervix to help the process of dilation. Once the child is born and breathing normally, the umbilical cord is tied and cut, separating the child from the placenta.

(a) Describe the process that occurs at conception. (lines 1 and 2)

(2)

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(b) Describe the process that forms a blastocyst. (lines 2 to 4)

(c) Which is a reason why cells taken from a blastocyst can be useful in scientific research?

(1)

- ☒ **A** the cells are already differentiated
- ☒ **B** the cells are able to differentiate into both sex cells and body cells
- ☒ **C** the cells are able to differentiate into any type of sex cell
- ☒ **D** the cells are able to differentiate into any type of body cell

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(d) Explain why it is important that hCG maintains the corpus luteum. (lines 7 to 9)

(e) Explain the importance of the development that takes place in the fourth and fifth week after conception. (lines 12 and 13)

(2)

(f) Suggest the role of testosterone in the development of the fetus. (lines 17 to 19)

(1)

(g) Which change occurs during the birth process? (line 20)

(1)

- ☒ **A** oestrogen levels decrease
- ☒ **B** progesterone levels increase
- ☒ **C** release of oxytocin from the pituitary gland
- ☒ **D** release of hCG from the placenta

(Total for Question 6 = 13 marks)

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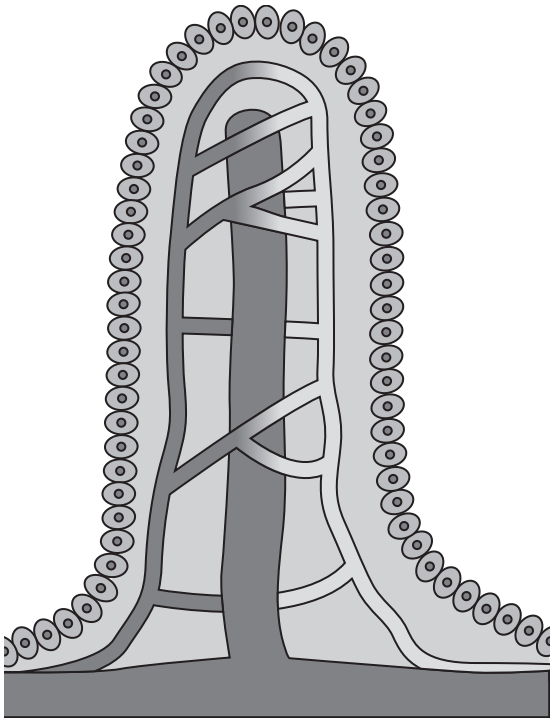
7 The diagram shows a villus in the small intestine of the digestive system.



(a) Explain how the villus is adapted to its function in the digestive system.

(3)

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(b) (i) Coeliac disease is an autoimmune disease.

The immune system of people with coeliac disease attacks the body's own tissue and damages the lining of the small intestine.

Describe how the immune system of people with coeliac disease damages the lining of the small intestine.

(2)

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(ii) Explain how coeliac disease affects the absorption of nutrients in the small intestine.

(3)

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(Total for Question 7 = 8 marks)

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8 (a) (i) Describe the structure of a virus.

(ii) Viruses attach to cells of various body tissues.

The virus uses the host cell's genetic material to produce new viral proteins.

Describe how the host cell carries out protein synthesis to produce new viral proteins.

(5)

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(b) In 2010, AIDS-related illnesses caused the death of 1.4 million people.

In 2021, AIDS-related illnesses caused the death of 650 000 people.

(i) Name the microorganism that causes AIDS.

(1)

.....

(ii) Calculate the percentage decrease in the number of people dying from AIDS-related illnesses between 2010 and 2020.

(2)

percentage decrease = ...%

(Total for Question 8 = 10 marks)

TOTAL FOR PAPER = 90 MARKS

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