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| Candidate surname | Other names |
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Centre Number | Candidate Number

# Pearson Edexcel International GCSE (9–1)

## Thursday 18 May 2023

Afternoon (Time: 1 hour 45 minutes)

**Paper reference** **4HB1/01**

# Human Biology
**UNIT: 4HB1**
**PAPER: 01**

**You must have:**
Ruler
Candidates may use a 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** Use information from the box to complete the sentences about the movement of molecules.

**(6)**

| | | | | | |
|---|---|---|---|---|---|
| ADP | ATP | against | along | down | fully |
| gases | selectively | volume | water | | |

Molecules can move in and out of cells by osmosis, diffusion and active transport.

Osmosis is the movement of ..... across a .....

permeable membrane.

Diffusion allows the passage of molecules ..... a concentration

gradient. The speed of movement is affected by the surface area to

..... ratio of the cell.

Active transport requires the use of energy stored in the form

of ..... and allows molecules to move

..... a concentration gradient.

**(Total for Question 1 = 6 marks)**

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**2** The photograph shows alveoli in the lungs. Alveoli are the site of exchange of gass between the air and the blood.



(Source: © Ed Reschke/Getty Images)

(a) (i) State, in the correct order, the structures that air must pass through from the atmosphere to the alveoli.

**(2)**

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(ii) State two features, shown in the diagram, that allow the efficient exchange of gases.

**(2)**

1 .....

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2 .....

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(b) (i) Which is the percentage of carbon dioxide in the atmosphere?

- ☒ **A** 0.01
- ☒ **B** 0.04
- ☒ **C** 0.10
- ☒ **D** 0.50

(ii) The table shows the results obtained when a person at rest breathes in air that contains different percentages of carbon dioxide.

| **Percentage (%) carbon dioxide in air** | 0.02 | 1.60 | 3.00 | 6.00 |
|---|---|---|---|---|
| **Tidal volume in $cm^3$** | 500 | 700 | 1200 | 2100 |
| **Rate of breathing in breaths per minute** | 14 | 15 | 16 | 28 |

Calculate the volume of air in $dm^3$ breathed in per minute when the person breathes air containing 3.00% carbon dioxide.

[1 $dm^3$ = 1000 $cm^3$]

**(2)**

volume of air = ..... $dm^3$

(iii) The air a person breathes in contains 20% oxygen. The body uses 20% of this oxygen.

Calculate the volume of oxygen used per minute when the person breathes air containing 1.60% carbon dioxide.

**(3)**

volume of oxygen = ..... $cm^3$

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(iv) Explain the effect of increasing the percentage of carbon dioxide in the air person breathes in on the tidal volume and rate of breathing.

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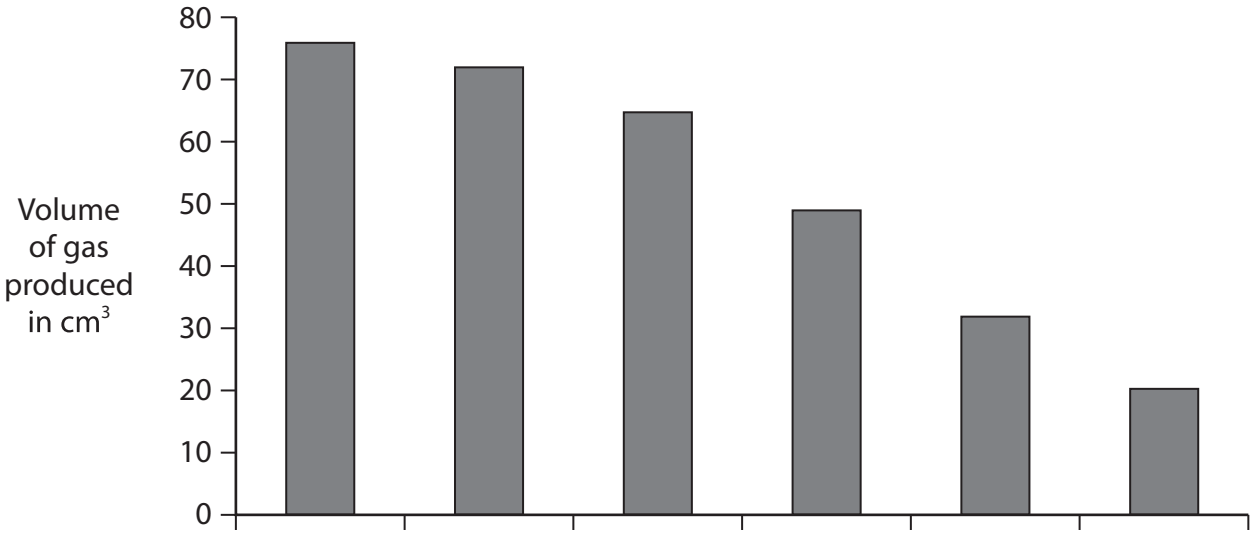
**(Total for Question 2 = 14 marks)**

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**3** A student investigates a reaction. The reaction is catalysed by an enzyme and produces a gas. The student collects the gas for 10 minutes and measures the volum of the gas. The student repeats this every 10 minutes for one hour.

The bar chart shows the student's results.




(a) (i) Add a suitable labelled scale to the *x*-axis.

**(2)**

(ii) Estimate the total volume of gas produced after 30 minutes.

**(2)**

volume of gas = ..... $cm^3$

(iii) Describe the trend shown by the results.

**(3)**

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(iv) Explain the student's results obtained in the investigation.

(b) Explain the effect on the results if the student had added a competitive inhibitor at the start of the investigation.

**(2)**

**(Total for Question 3 = 12 marks)**

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**4** The eye contains receptors that can detect light.

(a) Name two other senses.

**(2)**

1 .....

2 .....

(b) The table shows how the focal length of the eye lens changes as the thickness of the lens changes.

| Thickness of lens in mm | Focal length in mm |
|---|---|
| 10 | 12.5 |
| 9 | 14.0 |
| 8 | 15.5 |
| 7 | 18.0 |
| 6 | 21.0 |
| 5 | 25.0 |

(i) Describe the relationship between the thickness of the lens and its focal length.

**(2)**

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(ii) Give the effect on the diameter of the lens as its thickness increases.

**(1)**

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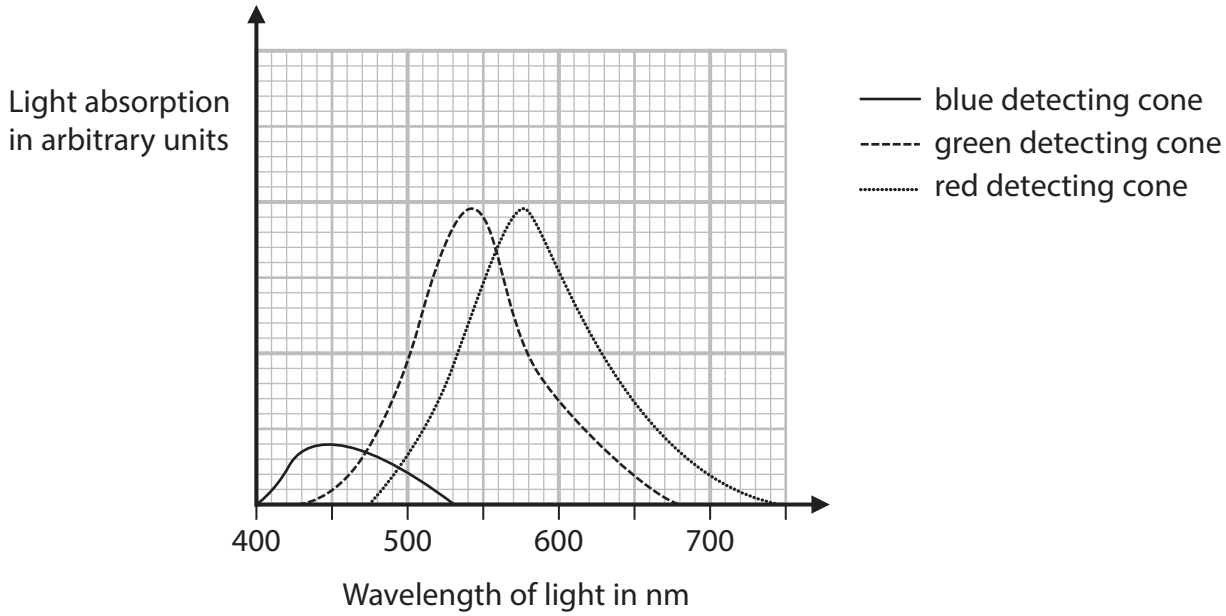
(iii) A person is looking at a distant object and then looks at a near object.

Use the data in the table to explain the changes that occur in the eye so the person is able to form an image of the near object on the retina.

**(4)**

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(c) Cone cells are found in the retina of the eye. They detect colour. The graph sho the absorption of different wavelengths of light by three types of cone cell.




(i) Determine the wavelength of light at which a red detecting cone absorbs most light.

**(1)**

wavelength of light = ..... nm

(ii) Determine the maximum difference in the wavelengths of the light that can be absorbed by blue detecting cones.

**(2)**

difference in wavelengths = ..... nm

(iii) Suggest why it is better to have three types of cone rather than just one type of cone.

**(2)**

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**(Total for Question 4 = 14 marks)**

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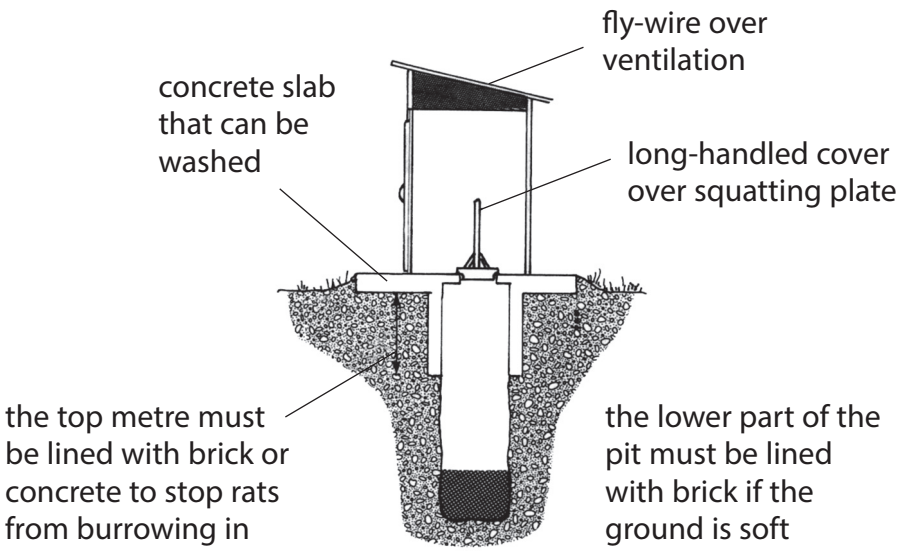
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**5** Pit latrines can be used to get rid of urine and faeces. They can be used where the is permeable to water and are always placed downhill from wells.

The diagram shows a pit latrine.




(a) (i) Explain why a pit latrine should be placed downhill from a well.

**(2)**

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(ii) Give the reason why pit latrines must be placed in soil that is permeable to water.

**(1)**

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(iii) Explain why, when a pit latrine is not in use, the latrine should have a cover and why the cover should have a long handle.

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(b) The concrete slab shown in the diagram is washed regularly with an antibacterial solution.

A scientist wants to investigate two antibacterial solutions to see which solution is more effective.

Design an investigation the scientist could use to find out which of the two antibacterial solutions is more effective.

Include experimental details in your answer and write in full sentences.

**(7)**

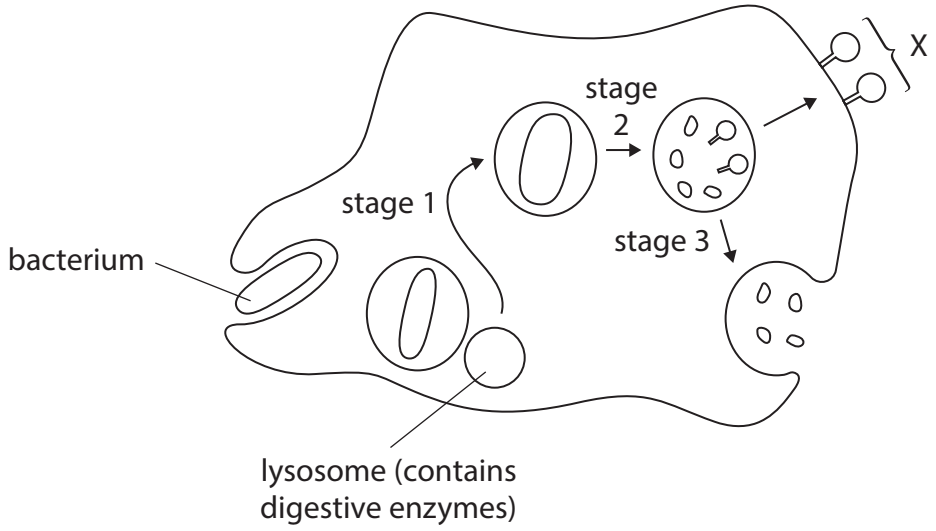
**(Total for Question 5 = 15 marks)**

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**6** The diagram shows a white blood cell engulfing a bacterium and the stages that follow.




(a) (i) State the name of the process used by white blood cells to engulf bacteria.

**(1)**

(ii) Describe what is happening at stages 1, 2 and 3 shown in the diagram.

**(3)**

stage 1

stage 2

stage 3

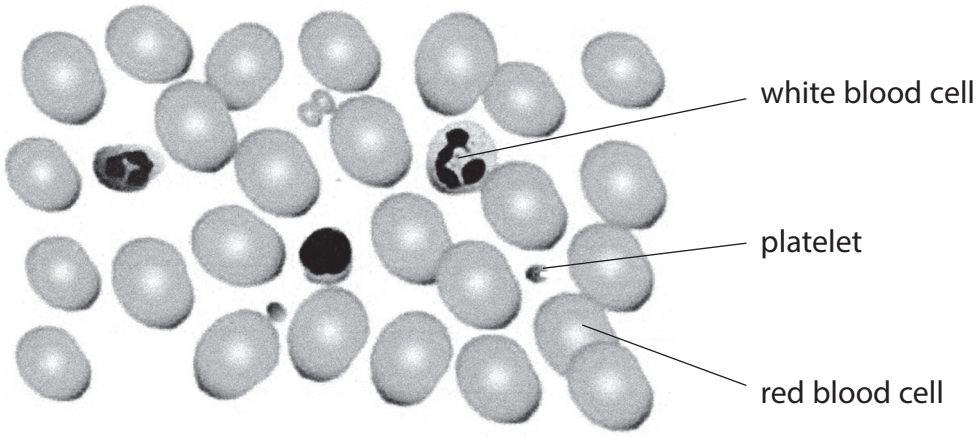
(iii) Suggest the function of the structures labelled X.

**(2)**

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(b) A student observes a prepared slide of blood under a light microscope.

The student draws this diagram of what could be seen.




(i) Describe how the slide of human blood could be prepared.

**(3)**

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(ii) Discuss the accuracy of the student's diagram.

(iii) Explain why the student would be advised to use a prepared slide rather than making one from their own blood.

**(2)**

**(Total for Question 6 = 15 marks)**

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**7** A method that shows whether a person's kidneys are working correctly is to meas the volume of filtrate produced by the kidneys in one minute. This is known as the glomerular filtration rate (GFR).

A person with healthy kidneys has a GFR of over 100 $cm^3$ per minute.

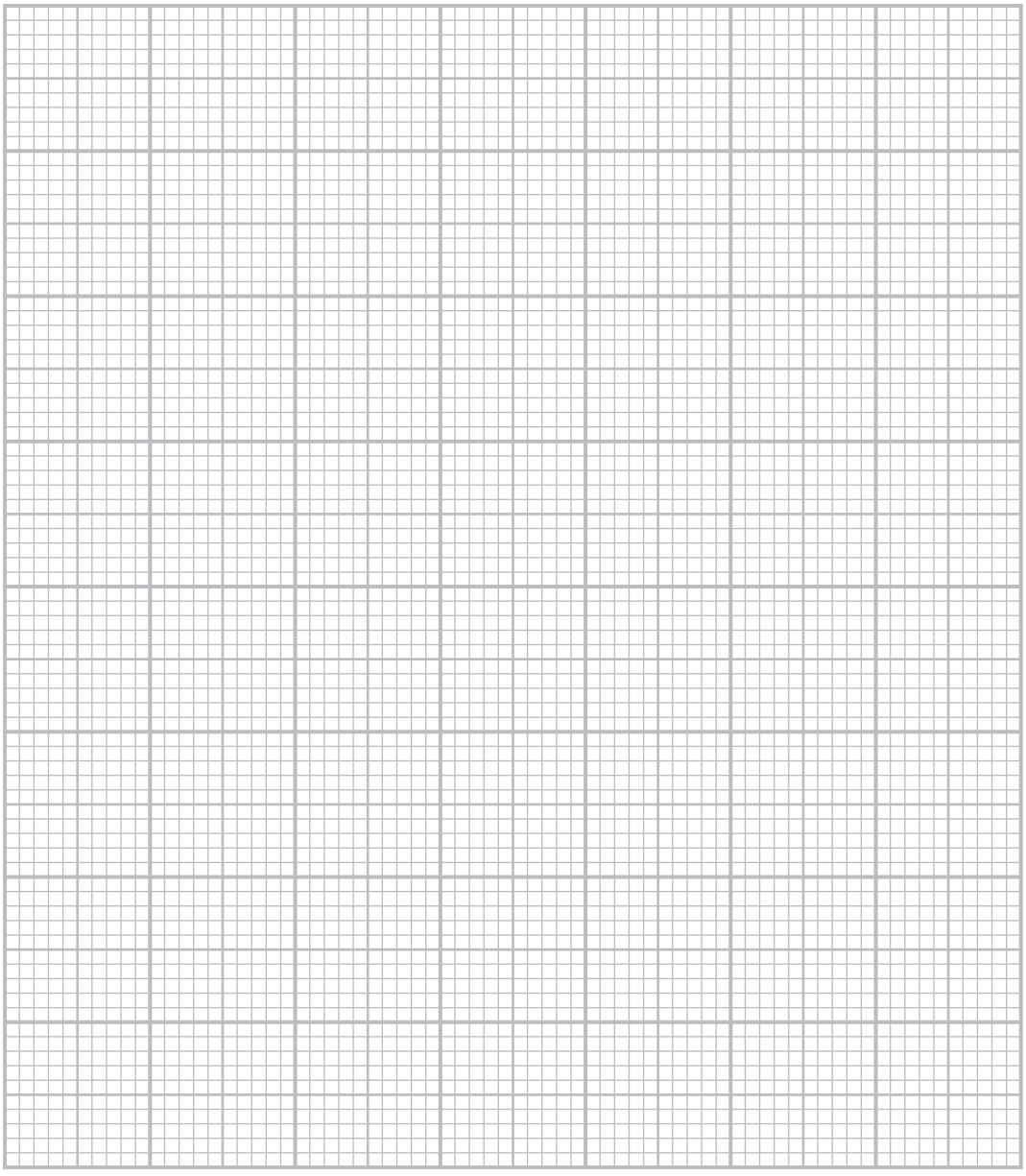
The GFR of a person whose kidneys were not working correctly was measured once a year for nine years.

The table shows the results.

| **Year** | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|
| **GFR in $cm^3$ per minute** | 80 | 75 | 79 | 79 | 67 | 60 | 50 | 45 | 35 |

(a) (i) Plot a line graph of the data on the grid.

**(4)**



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(ii) Explain why it is not possible to determine from the data when the person' kidneys stopped working correctly.

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(iii) A person needs dialysis if the GFR falls to 15 $cm^3$ per minute.

Use the data to estimate when the person will probably need to start dialysis.

**(2)**

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(iv) Discuss the accuracy of this estimate.

**(3)**

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(b) During the early stages when a person's kidneys are not working correctly, the are advised to control the amount of protein in their diet.

Explain why the protein in their diet should be controlled.

**(3)**

**(Total for Question 7 = 14 marks)**

**TOTAL FOR PAPER = 90 MARKS**

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