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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

Friday 8 January 2021

Morning (Time: 2 hours) | Paper Reference **4BI1/1B 4SD0/1B**

Biology

Unit: 4BI1
Science (Double Award) 4SD0
Paper: 1B

You must have:
Calculator, ruler

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 110.
- 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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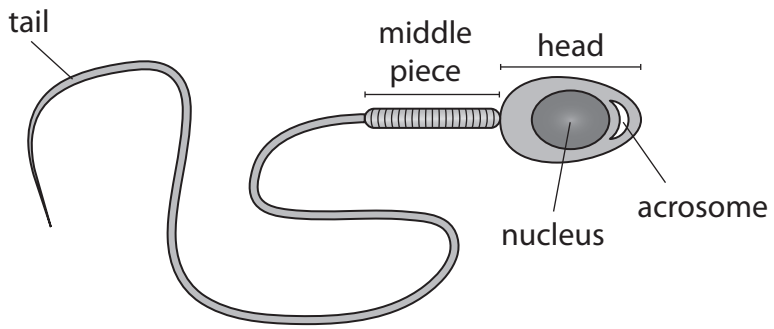
Answer ALL questions.

1 The diagram shows a human sperm cell.



(a) What is the maximum number of X chromosomes found in the nucleus of a sperm cell?

(1)

- ☒ **A** 0
- ☒ **B** 1
- ☒ **C** 2
- ☒ **D** 23

(b) The middle piece of the sperm cell contains mitochondria.

Explain the function of these mitochondria.

(2)

(c) The acrosome contains digestive enzymes.

Suggest the function of the acrosome.

(2)

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(d) Describe the route taken by a sperm cell from when it enters the woman's body to the site of fertilisation of the egg.

(2)

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(Total for Question 1 = 7 marks)

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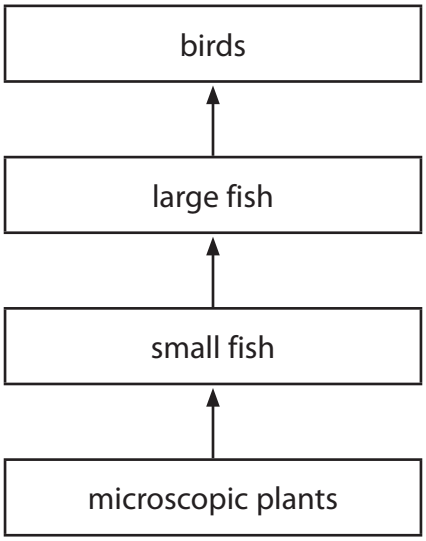
2 The diagram shows a food chain from a lake.



(a) Name the primary consumer in this food chain.

(1)

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(b) The microscopic plants convert light energy into chemical energy.

(i) Describe the process that converts light energy into chemical energy.

(3)

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(ii) Give two reasons why some of the energy in the microscopic plants is not transferred to the small fish.

(2)

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(c) The birds do not have teeth.

The fish they eat is initially crushed in part of their digestive system called a gizzard.

Suggest why crushing the fish in the gizzard helps the birds to digest the fish.

(2)

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(Total for Question 2 = 8 marks)

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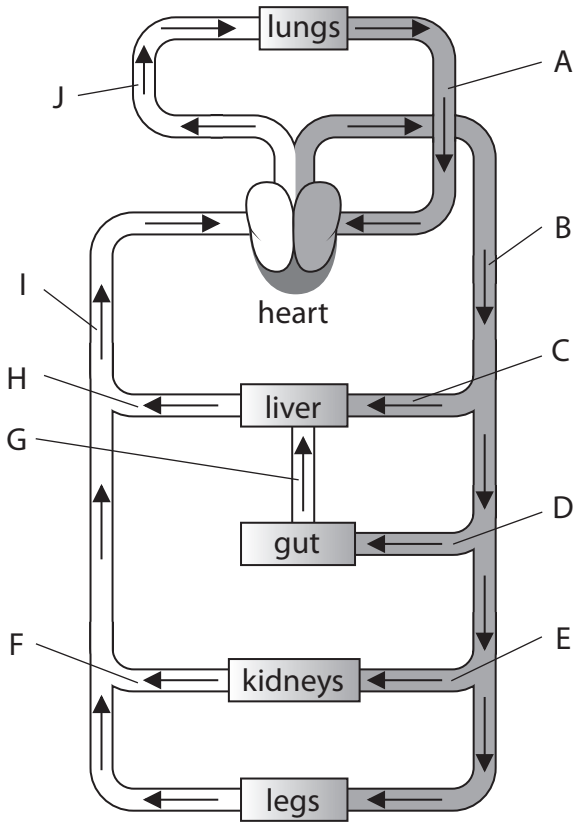
3 The diagram shows the human circulation system with some blood vessels labelled A to J. The arrows show the direction of blood flow.



(a) The table gives some statements about the content of blood vessels in this circulation system.

(i) Complete the table by giving the letter of the blood vessel that matches each statement.

(5)

Statement	Letter
contains the least carbon dioxide	
contains the most glucose after a meal	
contains the least oxygen	
contains the least urea	
contains blood at the highest pressure	

(ii) State two ways in which the structure of blood vessel A differs from the structure of blood vessel J.

(2)

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2 .....

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(b) Muscles in the legs contain capillaries.

A scientist investigates how long-term training affects the number of capillaries in an athlete's leg muscles.

The scientist determines the mean number of capillaries per mm^2 in samples of leg muscle from the athlete before and after a period of training.

The table shows the scientist's results.

Muscle sample	Mean number of capillaries per mm^2
before training	313
after training	349

The scientist concludes that training improves the athletic performance.

Discuss this conclusion.

(5)

(Total for Question 3 = 12 marks)

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4 (a) The table gives some examples of biological processes.

Complete the table by giving the name of each process.

The first one has been done for you.

(3)

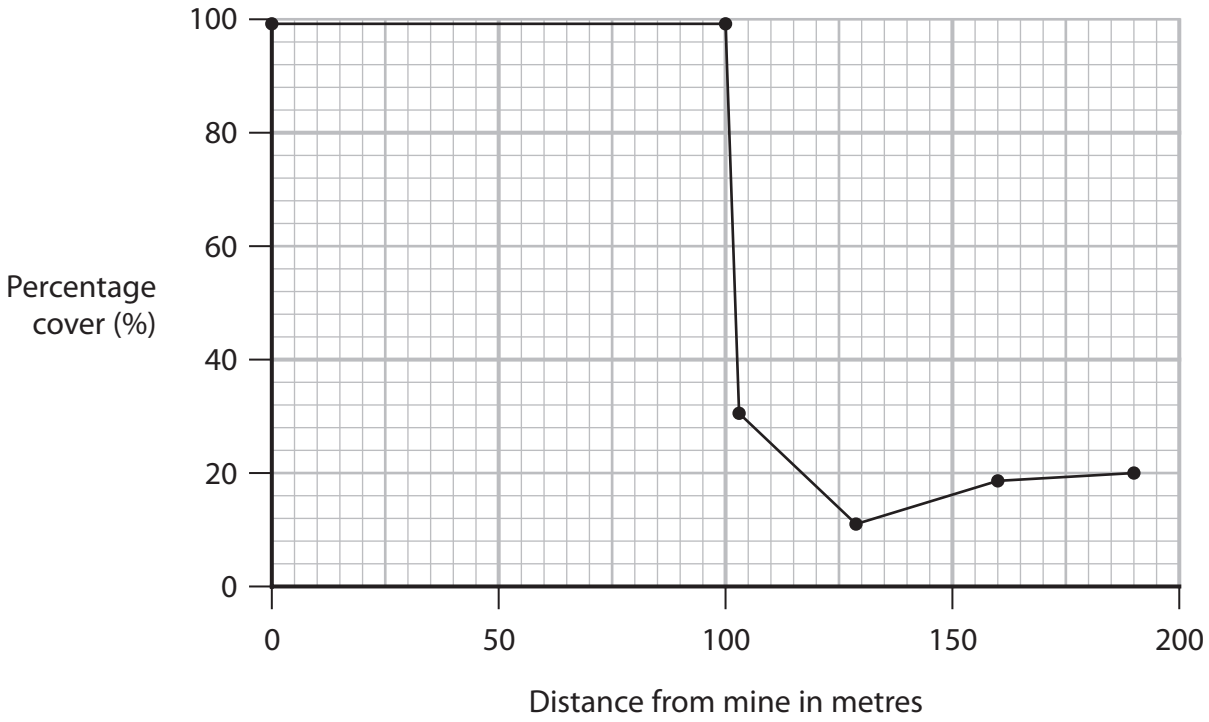
Example of process	Name of process
plants with a short growing season survive drought	natural selection
growth of algae in rivers polluted by fertiliser	
pollen transferred from one plant to another by an insect	
absorption of nitrate ions from soil using ATP	

(b) Zinc is poisonous to many plants and can affect natural selection.

A scientist investigates the ability of one grass species to survive at different distances from a zinc mine.

The scientist uses a sampling method to measure the percentage cover of this grass species at different distances from the zinc mine.

The graph shows the scientist's results.



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(i) The zinc concentration in soil is higher near the zinc mine than it is further from the zinc mine.

Explain how natural selection could be responsible for the results shown in the graph between 0 and 100 metres.

(4)

(ii) Describe a method the scientist could use to compare the population size of the grass species at 50 metres and 100 metres from the mine.

(4)

(Total for Question 4 = 11 marks)

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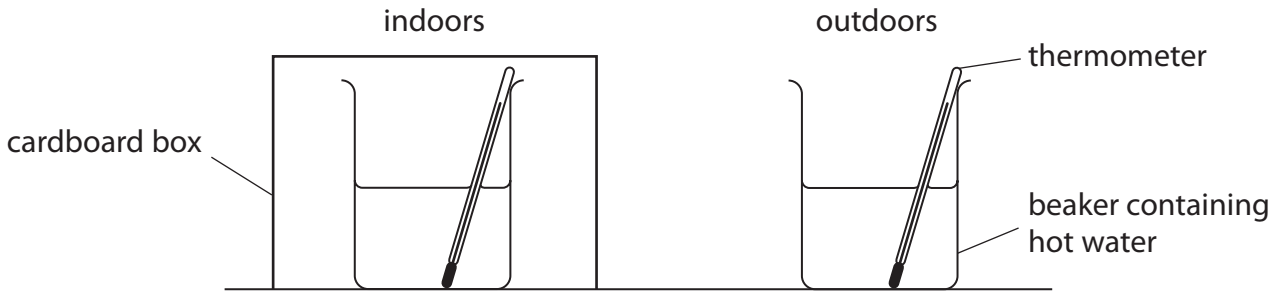
5 Farmers can keep their animals indoors or outdoors.

A student uses this apparatus to compare the heat loss from animals kept indoors and outdoors.

He uses a covered beaker to represent animals indoors and an uncovered beaker to represent animals outdoors.



This is the student's method.

- pour 200 cm^3 of hot water into each beaker
- measure the temperature of the water in each beaker
- cover one beaker with a cardboard box
- measure the temperature of the water in each beaker after 30 minutes

The student repeats the investigation six times and calculates the mean temperature of the water for each beaker.

The table shows the student's results.

Time in minutes	Mean temperature of water in °C	
	uncovered	covered
0	80	80
30	40	44

(a) Give the dependent variable in this investigation.

(1)

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(b) Give one reason why the student uses the same volume of water in each beaker.

(1)

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(c) Calculate the difference between the percentage decrease in temperature for the uncovered beaker and the percentage decrease in temperature for the covered beaker.

(2)

difference = ...%

(d) The student concludes that it is better for farmers to keep their animals indoors.

Discuss this conclusion.

(4)

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(e) Describe how the student could modify his investigation to find out if an animal's body size affects heat loss.

(2)

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(Total for Question 5 = 10 marks)

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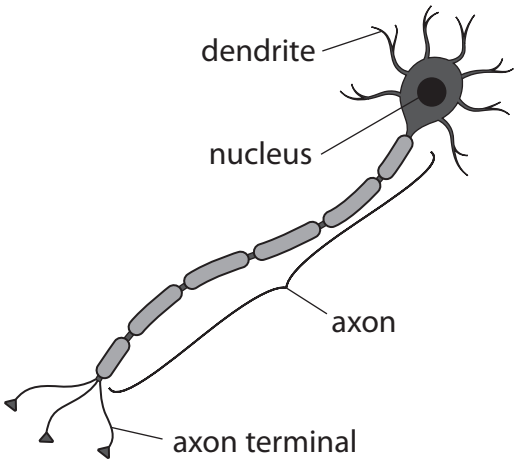
6 Neurones transmit nerve impulses.

The diagram shows a neurone.



(a) This neurone is involved in the withdrawal reflex of a finger from a hot object.

The neurone transmits electrical impulses from the central nervous system to the effector.

(i) Draw a circle on the diagram to show the part of the neurone where the impulses are transferred to the effector.

(1)

(ii) What is the name of this type of neurone?

(1)

- ☒ **A** association
- ☒ **B** motor
- ☒ **C** relay
- ☒ **D** sensory

(iii) Explain the advantage of a withdrawal reflex when a finger touches a hot object.

(2)

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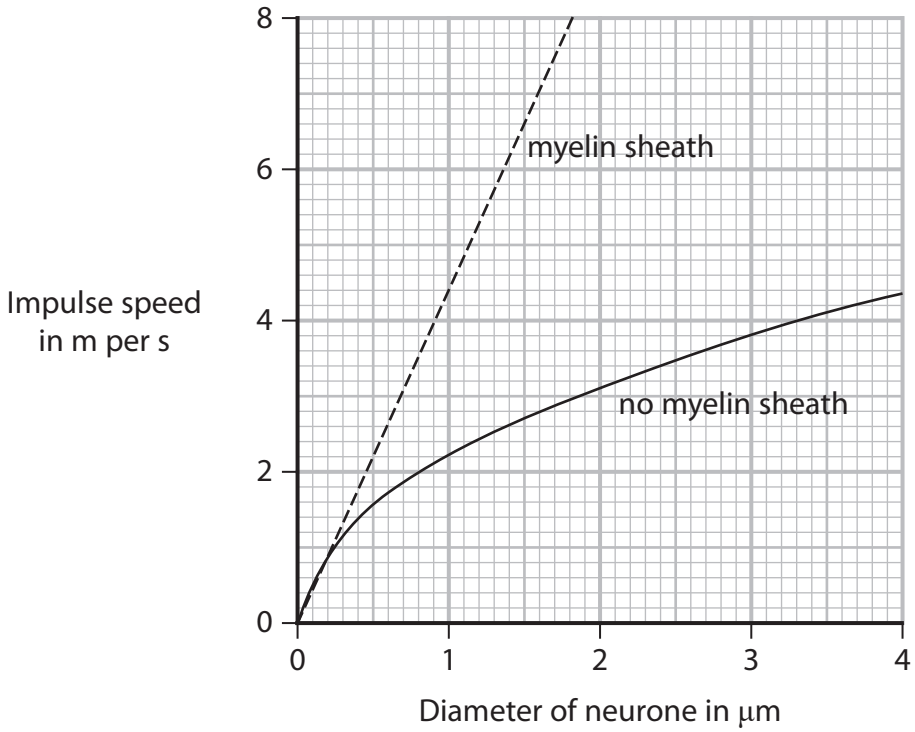
(b) Some neurones do not have a myelin sheath.

A scientist investigates the impulse speed for neurones with different diameters. She does this for neurones with a myelin sheath and neurones without a myelin sheath.

The graph shows the scientist's results.



(i) Which conclusion is supported by the graph?

(1)

☒ **A** impulses are always faster in neurones with a myelin sheath

☒ **B** neurones always have a myelin sheath

☒ **C** wider neurones have a myelin sheath

☒ **D** wider neurones have faster impulses

(ii) A neurone with a myelin sheath has a diameter of 1.0 μm.

Use the graph to determine the speed of an impulse in this neurone.

(1)

speed = ... m per s

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(iii) The neurone is 90 cm long.

Calculate the time taken for an impulse to travel along this neurone.

Give your answer in standard form.

(3)

time = ... s

(Total for Question 6 = 9 marks)

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7 Scientists investigate the effect of salt (NaCl) concentration on the germination of maize seeds.

Batches of seeds are watered with different concentrations of salt solution.

They count the number of seeds that germinate in each batch 12 days after sowing. They then determined the percentage germination.

(a) (i) Describe how the scientists could tell if a maize seed had germinated.

(1)

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(ii) The scientists measured the germination after 12 days.

State two other abiotic variables that the scientists need to control in their investigation.

(2)

1 .....

2 .....

(b) The table shows the scientists' results.

Concentration of salt solution in mmol	Percentage germination (%)
0	89
20	83
40	81
80	73
120	68
160	55
200	52
240	49
280	43
320	38

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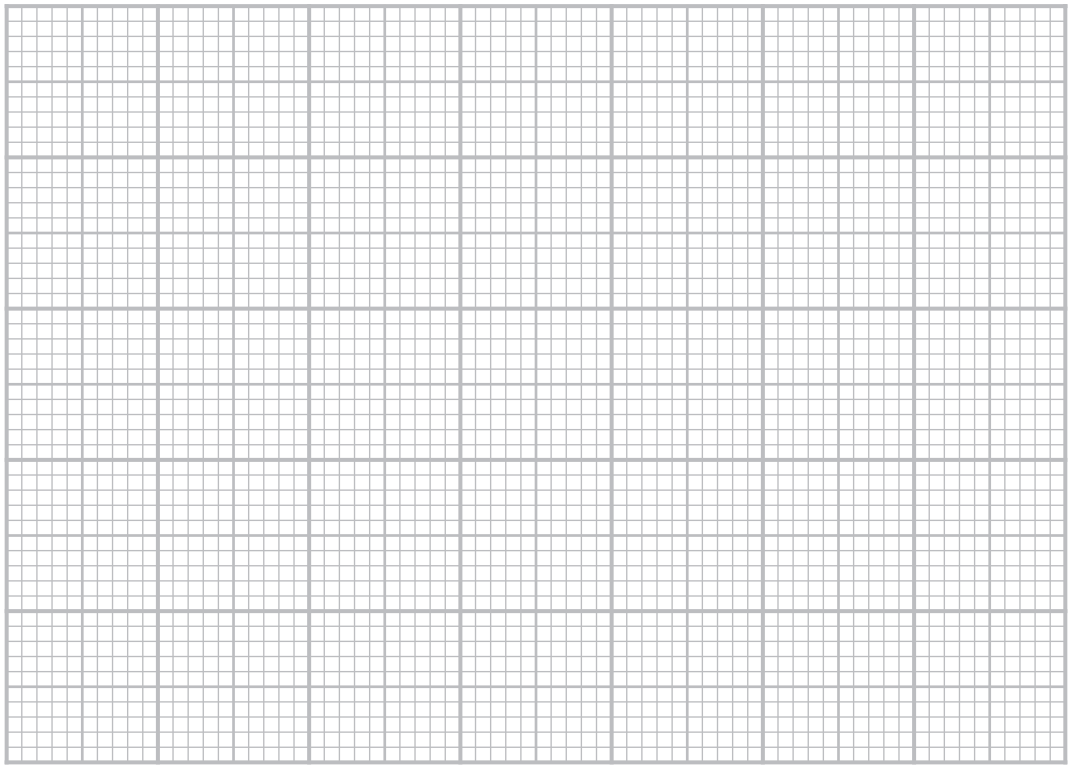
(i) Plot a line graph to show the effect of concentration of salt solution on germination.

Use a ruler to join your points with straight lines.

(5)



(ii) Explain the effect of increasing the concentration of salt solution on germination.

(4)

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(c) As plants grow, they produce roots and stems.

(i) Compare the responses of roots and stems to gravity.

(2)

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(ii) Compare the responses of roots and stems to light.

(2)

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(Total for Question 7 = 16 marks)

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8 The table shows data on crops grown and pesticide used in Norway in 2011.

Crop type	Crop	Total area in km²	Percentage of area sprayed with each type of pesticide (%)		
			herbicide	fungicide	insecticide
vegetable	potato	128	92	88	40
	onion	7	99	96	26
	carrot	13	93	42	73
fruit	strawberry	14	72	87	80
	apple	13	56	80	70
meadows	meadows for mowing and pastures	6207	6	–	–
cereals	barley	1450	91	64	10
	oats	694	94	24	4
	spring wheat	588	98	86	27
	winter wheat	139	96	85	7

(a) State what is meant by the term **pesticide**.

(1)

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(b) Determine which crop had the largest area sprayed with herbicide.

Show your working.

(2)

largest area = ... km²

crop = ...

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(c) Suggest why spring and winter wheat have different percentages of insecticide applied to them.

(2)

(d) Discuss the different combinations of pesticides applied to fruit and cereal crops.

(4)

(e) Explain an alternative to insecticide that a farmer could use.

(2)

(Total for Question 8 = 11 marks)

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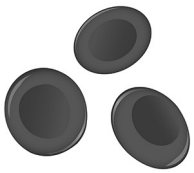
9 Sickle cell anaemia is a condition in which some of the person's red blood cells develop abnormally.

The diagram shows red blood cells from a healthy person and red blood cells from a person with sickle cell anaemia.



cells from a healthy person



cells from a person with sickle cell anaemia

(Source: © solar22/Shutterstock)

(a) A person with sickle cell anaemia often suffers pain as some of their blood vessels become blocked by the sickle cells.

(i) Suggest why the person's blood vessels may become blocked.

(1)

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(ii) People with sickle cell anaemia have symptoms of tiredness and joint pain that get worse if they are exposed to cold temperatures and high altitudes.

Suggest why these symptoms get worse.

(3)

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(b) Sickle cell anaemia is caused by a single recessive allele.

(i) State what is meant by the term **recessive**.

(1)

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(ii) A man and a woman who are both heterozygous for the sickle cell allele have a child.

Calculate the probability that the child will be female and **not** have sickle cell anaemia.

(2)

probability = ...

(c) Sickle cell anaemia is more common in countries where malaria is found. This is because having an allele for sickle cell anaemia can reduce the likelihood of developing malaria.

Which type of organism causes malaria?

(1)

☒ **A** bacterium

☒ **B** fungus

☒ **C** plant

☒ **D** protoctist

(d) What is the name of the pigment found in red blood cells?

(1)

☒ **A** chlorophyll

☒ **B** haemoglobin

☒ **C** iron

☒ **D** magnesium

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(e) Give two differences in structure between red blood cells and white blood cells.

(2)

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2 .....

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(Total for Question 9 = 11 marks)

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10 Substances can move into and out of cells by a variety of mechanisms.

(a) Explain the factors that affect the rate of movement of substances into and out of cells.

(5)

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(b) Describe the differences between diffusion and active transport.

(4)

(Total for Question 10 = 9 marks)

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11 Bread can be produced from flour using yeast.

Design an investigation to find out if changing the starch content of the flour causes the bread to expand more.

Your answer should include experimental details and be written in full sentences.

(6)

(Total for Question 11 = 6 marks)

TOTAL FOR PAPER = 110 MARKS

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