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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Friday 7 June 2024

Afternoon (Time: 1 hour 15 minutes)

Paper reference **4BI1/2BR**

Biology

Unit: 4BI1

Paper: 2BR

You must have:
Calculator, ruler

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.*

Information

- The total mark for this paper is 70.
- 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. Write your answers in the spaces provided.

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 ☒.

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

Offshore or freshwater fish farming

Fish farming in fresh water and in the sea offers the potential to increase the amount of fish harvested whilst protecting wild fish stocks. Offshore or fish farming at sea has less risk of serious injury or death to people than catching fish by deep sea fishing.

Some scientists predict that smart fish farming at sea could increase ocean fish production by an estimated 21 million tonnes from the 2020 value to 44 million tonnes by 2050. Other estimates suggest that fish farming at sea, using an area the size of Lake Michigan, might produce the same amount of seafood as all of the world's wild-caught fisheries.

Fish farming at sea is done anywhere from three to 200 miles away from the coast. The fish produced are often Atlantic salmon, seabass and cobia. The aim is to reduce the environmental impact of fish farming near the coast by moving them further away from sensitive shorelines. This limits the impact of disease, pollution and pests such as sea lice. Further out to sea, and at deeper depths, the water movement is often faster.



(Source: © Tiwiplusk / Shutterstock)

Fish farm at sea



(Source: © FarisFitrianto / Shutterstock)

Freshwater fish farm

Critics of fish farming at sea claim that it will be more difficult to monitor and regulate any environmental impact and that pollution, disease and pests would still impact the surrounding waters. A major risk of farming at sea is the exposure to high winds and water speeds, increasing the risk of all the fish escaping. In 1997, 300 000 farmed Atlantic salmon escaped into the Pacific Ocean. Wild fish are attracted to the farms by the scent of fish food. These wild fish are at risk of being hit by ships travelling to and from the large fish farms.

In contrast, other scientists support the development of fish farming in fresh water. Freshwater fish farms have increased in numbers steadily in the past 30 years. Asia is the main part of the world where this has happened. It is relatively cheap and easy to grow freshwater fish in small ponds. Fish farming provides incomes for many family farms, workers and small businesses, as well as jobs.

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The main species produced by freshwater farming are carp, tilapia and catfish. These fish are herbivores or omnivores. In the farms they are fed small amounts of fish to speed up growth, but their main diet is the by-products of crops like rice, groundnut and soy. Farmed freshwater fish are an affordable food for millions of low- and middle-income consumers. 30

(a) Suggest why deep sea fishing has a risk of serious injury or death to people. (lines 2 to 3)

(1)

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(b) Give three reasons why the scientists' prediction of an increase in ocean fish production to 44 million tonnes by 2050 is only an estimate. (lines 4 to 6)

(3)

1 .....

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2 .....

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3 .....

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(c) Explain how fish farms cause pollution. (lines 12 to 16)

(3)

(d) Fish farmers use methods to control disease in their fish farms.

(i) Describe the methods a fish farmer could use to reduce the incidence of disease in a fish farm.

(2)

(ii) Explain how these methods may affect the local ecosystem.

(2)

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(e) Explain why locating the fish farms further out to sea may help reduce the effects on the local ecosystem. (lines 12 to 16)

(2)

(f) Suggest why fish farming further out at sea will be more difficult to monitor and regulate. (lines 14 to 16)

(1)

(g) Give a reason why farming fish that are herbivores is an advantage for the fish farmer. (lines 27 and 28)

(1)

(h) Explain why small, local freshwater fish farms would have less impact on global warming than large fish farms at sea.

(2)

(Total for Question 1 = 17 marks)

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2 Mammals, such as humans, need to regulate their internal environment.

(a) What is the process that maintains a constant internal environment?

(1)

- ☒ A absorption
- ☐ **B** diffusion
- ☐ **C** egestion
- ☐ **D** homeostasis

(b) Table 1 shows the water input and output per day for a person in normal temperature conditions.

Water input (intake)		**Water output (losses)**	
source	**volume in litres**	**source**	**volume in litres**
drinking	1.5	urine	1.5
food	0.5	gas exchange	0.4
metabolism	0.5	sweating	0.5
		faeces	0.1

Table 1

The water loss from gas exchange plus the loss from sweating are referred to as the insensible water loss. This water loss is called insensible because it cannot be measured directly.

(i) Calculate the percentage of the water loss that is classified as insensible.

(2)

percentage = ... %

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(ii) This data comes from a person who has a mass of 70 kg.

Assuming the same proportions, calculate the water input from food for a person who has a mass of 110 kg.

(2)

input from food = ... litres

(iii) Water loss in faeces is usually relatively low.

Illness such as food poisoning can produce symptoms including vomiting, diarrhoea and a high temperature. These symptoms can change water balance in the body.

Explain how the symptoms of food poisoning can change water balance in the body.

(4)

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(c) The photograph shows a mammal called a degu.



(Source: © R. Maximiliane / Shutterstock)

A degu is a rodent that lives in a very dry environment in South America. The degu gets its water input by feeding on plants.

The water intake of the degu changes during the winter and summer months.

Table 2 shows the body mass, water intake and urine concentration of the degu in the winter and in the summer. It also shows the total rainfall in winter and in summer.

Measurement	Winter	Summer
total rainfall in mm	245	12
body mass in g	119.7	124.8
water intake in one day in cm^3	40.4	10.3
urine concentration in arbitrary units	1123	3137

Table 2

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Comment on the differences in body mass, water intake and urine concentration in winter and summer.

Use the data in the table and your own knowledge in your answer.

(4)

(Total for Question 2 = 13 marks)

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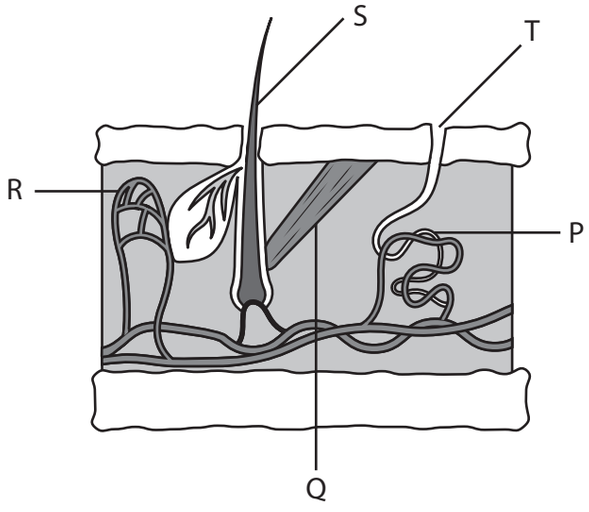
3 The diagram shows a section of human skin with some structures labelled.



(a) (i) Which structure is a pore of a sweat gland?

(1)

- ☒ A Q
- ☒ **B** R
- ☒ **C** S
- ☒ **D** T

(ii) Which structure carries blood?

(1)

- ☒ A P
- ☒ **B** R
- ☒ **C** S
- ☒ **D** T

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(iii) The skin responds to changes in temperature.

Describe how the skin responds when a person enters a cold environment.

(4)

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(b) Scientists investigate the effect of heat strain on two groups of men.

Heat strain is caused by increasing the external temperature.

The scientists measure the skin temperature with no heat strain, low heat strain and moderate heat strain.

They also measure the rate of sweating with low and moderate heat strain.

The table shows the scientists' results.

Group	Number in group	Mean age in years	Mean skin temperature in °C			Mean sweating rate per cm^2 of skin in mg per min	
			no heat strain	low heat strain	moderate heat strain	low heat strain	moderate heat strain
young	14	24	34.9	37.6	38.1	1.0	1.2
old	16	69	34.0	37.3	37.7	0.2	0.8

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Discuss the relationship between age and the effect of heat strain on the mean skin temperature and the mean rate of sweating.

Use information from the table and your own knowledge in your answer.

(5)

(Total for Question 3 = 11 marks)

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4 A teacher investigates gas exchange in different conditions.

They use orange hydrogen-carbonate indicator solution, which changes colour depending upon the concentration of carbon dioxide in the tube.

This is their method.

Step 1 put 5 cm^3 of hydrogen-carbonate indicator solution into each of five test tubes A, B, C, D and E

Step 2 place a wire mesh and two green leaves in test tube A

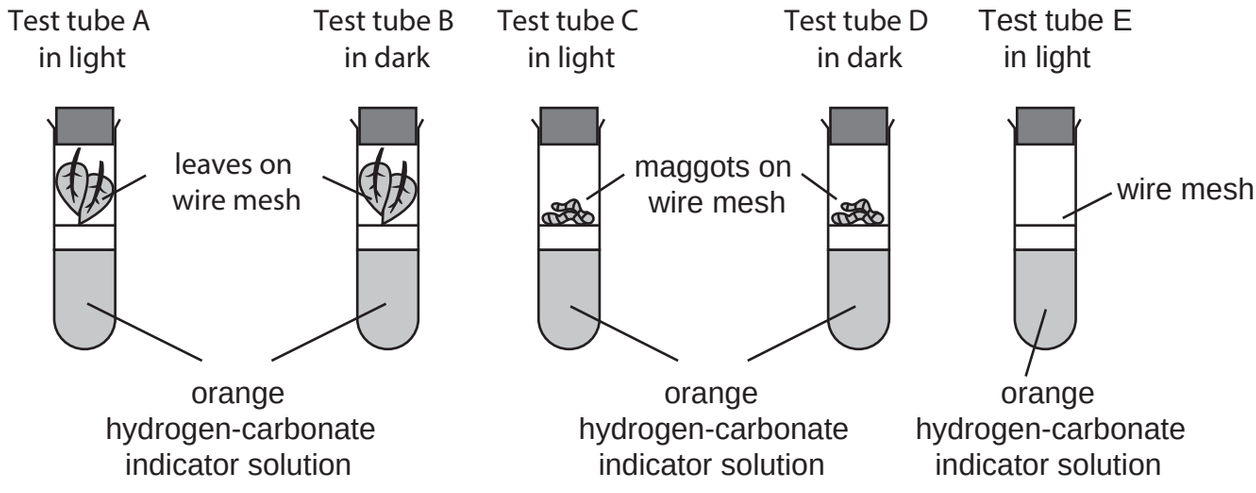
Step 3 set up tubes A to D so that they contain leaves or maggots as shown in the diagrams

Step 4 set up tube E without leaves or maggots

Step 5 place test tubes A, C and E in bright light for two hours

Step 6 place test tubes B and D in the dark for two hours

Step 7 observe the colour of the indicator in each test tube



(a) (i) State the dependent variable in this investigation.

(1)

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(ii) Give the function of the wire mesh in the test tubes.

(1)

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(iii) State one variable that the teacher has controlled in their investigation.

(1)

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(b) The table shows the results of this investigation.

Tube	Contents of test tube	Light condition	Colour of indicator after two hours
A	leaves	light	dark red
B	leaves	dark	yellow
C	maggots	light	yellow
D	maggots	dark	yellow
E	empty	light	orange

Explain the relationship between the test tube contents, the light condition and the colour of the indicator after two hours.

(4)

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(c) The teacher sets up another test tube that contains leaves and maggots. They put the test tube in the light for two hours.

The colour of the indicator after two hours remains orange.

Explain why the indicator remains orange.

(2)

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(Total for Question 4 = 9 marks)

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5 Loss of trees is known as deforestation.

From 2001 to 2021, Russia, Brazil and Canada had the most deforestation.

- Russia lost 76.0 Mha of tree cover. This loss was 10% of forests in Russia. The loss accounted for 17% of the total tree cover lost in the entire world.
- Brazil lost 62.8 Mha of tree cover. This loss was 12% of forests in Brazil. The loss accounted for 14% of the total tree cover loss in the entire world.
- Canada lost 49.3 Mha of tree cover. This loss was 11% of forests in Canada. This loss accounted for 11% of the total tree cover loss in the entire world.

(a) (i) Use this data to determine the total tree cover loss by countries other than Russia, Brazil and Canada from 2001 to 2021.

(2)

tree cover loss = ... Mha

(ii) Calculate the loss of tree cover in Brazil per month from 2001 to 2021.

Give your answer in standard form.

(2)

tree cover loss = ... Mha per month

(iii) Explain why Russia contributed 17% of the total tree cover loss in the entire world even though the loss of tree cover in Russia was only 10%.

(2)

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(b) Describe the effects of deforestation on an ecosystem.

(4)

(Total for Question 5 = 10 marks)

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6 Cells use genetic information when carrying out protein synthesis.

(a) Give the difference between a gene and a genome.

(1)

(b) Describe the process of transcription.

(4)

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(c) Explain why a change in the sequence of bases in the DNA does not always result in a change in enzyme function.

(3)

(d) Some characteristics are determined only by the genes, and some are determined by a combination of the genes and the environment.

Give an example of each type of characteristic in humans.

(2)

determined only by the genes

determined by the genes and the environment

(Total for Question 6 = 10 marks)

TOTAL FOR PAPER = 70 MARKS

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