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 15 November 2024

Morning (Time: 1 hour 15 minutes)

Paper reference **4BI1/2B**

Biology

UNIT: 4BI1
PAPER: 2B

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.*
- Show all the steps in any calculations and state the units.

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.
- 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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Pearson

Answer ALL questions.

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.

Kidney transplants

The main role of the kidneys is to filter waste products from the blood. If the kidneys lose this ability, waste products can build up, which could lead to death. This loss of kidney function, known as kidney failure, is the most common reason for needing a kidney transplant.

It is possible to use a kidney machine to partially perform the functions of the kidney, using a blood filtering procedure known as dialysis. However, this can be inconvenient and it takes a long time. A kidney transplant is a better solution for kidney failure whenever possible.

A kidney transplant is suitable for people of all ages who need to have one, if they are fit enough for surgery. If a patient has an infection this will need to be cured before the transplant. The person who receives the transplant must agree to continue with the recommended treatments after the transplant. These treatments include taking medication known as immunosuppressant drugs.

People have two kidneys, but they can survive well with only one kidney. This means it is possible for a person to donate a kidney while they are alive. This is known as a living donation. People who want to be considered as a living donor are carefully tested to make sure they are a suitable donor and are fit for the operation needed to remove a kidney. Living donations are best from a close relative as this reduces the risk of the body rejecting the kidney. In the United Kingdom, the number of living donations in 2020 was 1040. In 2021 the number of living donations was 429.

Kidney donations are also possible from people who have recently died. This is known as deceased kidney donation. However, this type of kidney donation has a slightly lower chance of long-term success. In the United Kingdom, the number of deceased donations in 2020 was 2283. In 2021 the number of deceased donations was 1836.

People who need a kidney transplant, but do not have a suitable living donor, will have to wait until a suitable deceased donor kidney becomes available. In the United Kingdom, the average waiting time for a deceased donor kidney transplant is between 30 months and 36 months.

Kidney donors are particularly required from people of non-white ethnic origin, as kidney disease is more common in people of South Asian, African and Afro-Caribbean ethnic origin. However, there are not many donors from these communities.

When a person receives a kidney from a living donor, this is a carefully planned operation. If they are waiting for a deceased donor kidney, they will be contacted when a suitable kidney becomes available. The patient then has surgery to insert the new kidney and connect it to their blood vessels and bladder. The new kidney will be placed in the lower part of the abdomen. The patient's own failed kidneys will usually be left in place.

(a) State two waste products that kidneys remove from the blood. (Line 1)

(2)

1 .....

2 .....

(b) Dialysis can be inconvenient and takes a long time. (Lines 6 and 7)

Suggest two other reasons why a kidney transplant is a better solution for kidney failure than dialysis.

(2)

1 .....

.....

2 .....

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(c) The patient receiving the transplant must take immunosuppressive drugs after the operation. These drugs reduce the action of the immune system. (Lines 12 and 13)

Describe how the immune system responds to disease.

(3)

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(d) Explain why the chances of rejection are lower if the kidney comes from a close relative. (Lines 18 and 19)

(2)

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(e) The number of donations changed between 2020 and 2021. (Lines 20 and 21 and lines 25 and 26)

(i) Calculate the difference between the percentage change in **living** donations from 2020 to 2021 and the percentage change in **deceased** donations from 2020 to 2021.

(3)

difference = ...

(ii) Suggest a reason why there are fewer transplant operations from living donors than from deceased donors.

(1)

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(f) Suggest what is meant by a suitable kidney. (Line 37)

(1)

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(g) Explain why kidney donors are particularly required from people of South Asian, African and Afro-Caribbean ethnic origin. (Lines 32 to 34)

(2)

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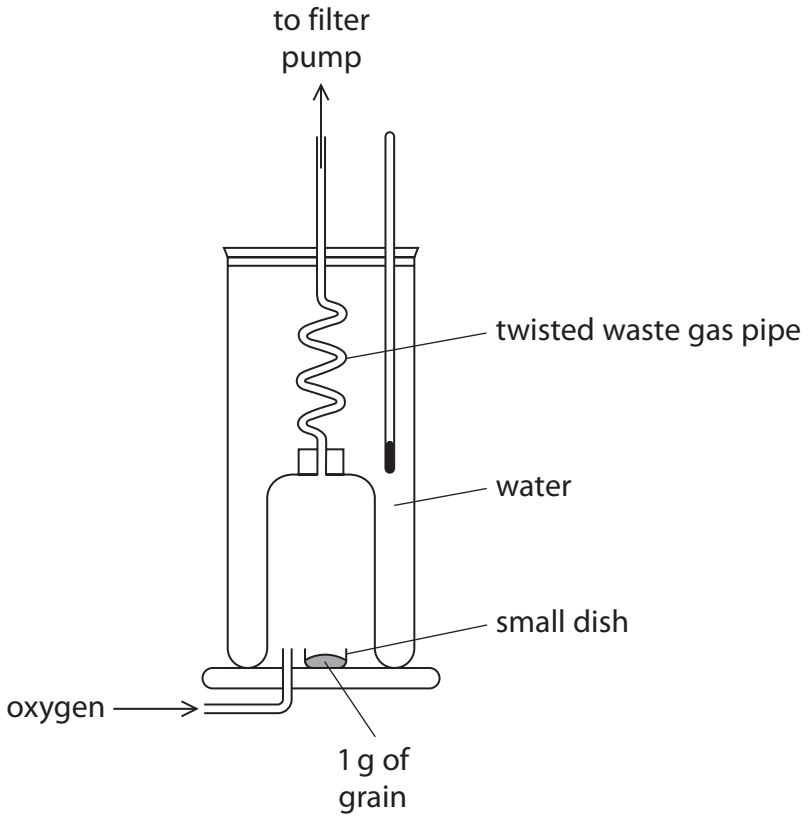
(Total for Question 1 = 16 marks)

2 Scientists use a calorimeter to compare the energy content of different types of grain.



This is the scientists' method

- put 20 cm^3 of water into the calorimeter
- measure the initial temperature of the water
- place 1 g of a grain type in the small dish
- place the small dish in the calorimeter
- light the grain in the small dish
- allow the grain to completely burn
- measure the final temperature of the water

They repeat this method with different types of grain.

(a) Explain how the scientists could use these measurements to calculate the energy released by 1 g of the grain.

(3)

(b) State how the scientists can make sure that their results are reliable.

(1)

(c) (i) This calorimeter has a twisted waste gas pipe passing through the water.

Explain how the twisted waste gas pipe improves the accuracy of the scientists' results compared with a straight pipe.

(2)

(ii) This calorimeter burns the grain in oxygen. Give a reason why this improves the accuracy of the scientists' results.

(1)

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(d) The scientists also collected data on the protein, fat, carbohydrate and fibre content of the grains.

The table shows some of the scientists' results.

Grain type	Protein in g per 100 g	Fat in g per 100 g	Carbohydrate in g per 100 g	Fibre in g per 100 g	Total energy in kJ per 100 g
oats	13	7.0	62	7	1549
rye	8	2.0	60	14	1260
rice	7	2.5	74	3	1481
wheat	28	9.4	32	14	1347

(i) Calculate the mass of protein in 65 g of rice.

(2)

mass = ... g

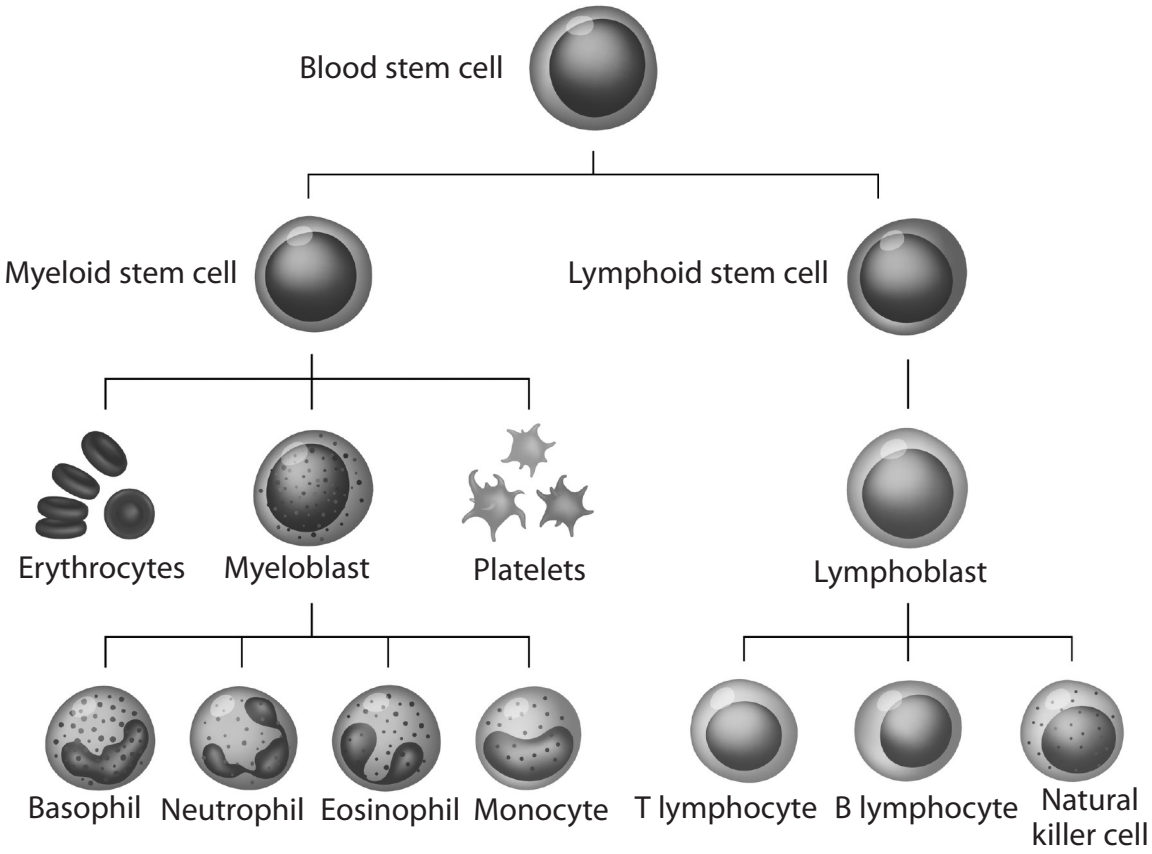
(ii) A long-distance athlete wants to choose a grain to add to their diet.

Comment on the suitability of each grain type for the diet of a long-distance athlete.

(4)

(Total for Question 2 = 13 marks)

3 The diagram shows how human blood develops from blood stem cells.



(Source: © LDarin / Shutterstock)

(a) Describe how stem cells are different from most body cells.

(2)

(b) Describe the role of platelets in the body.

(3)

(c) Explain how vaccination protects the body from disease.

(4)

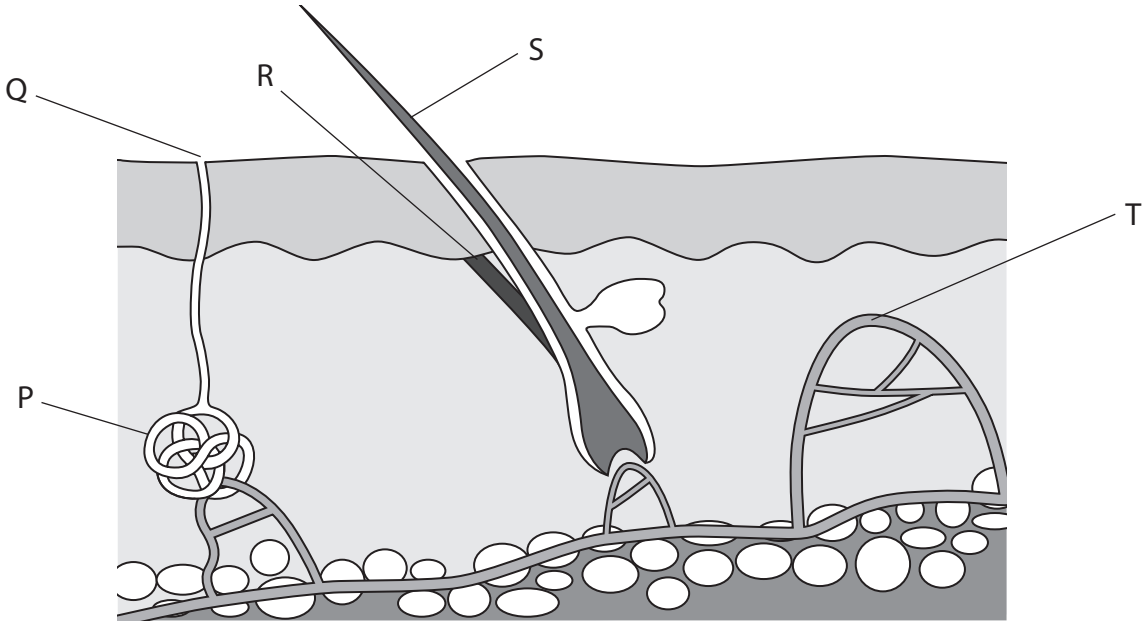
(d) Blood stem cells can be used to treat blood disorders such as sickle cell anaemia which affects red blood cells and leukaemia which affects white blood cells.

Explain why blood stem cells can be used to treat a variety of blood disorders.

(3)

(Total for Question 3 = 12 marks)

4 (a) The diagram shows a section through the skin with some structures labelled.



(i) Which structure is the sweat gland?

(1)

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

(ii) Which structure is a capillary?

(1)

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

(iii) Describe the changes that take place in the blood vessels in the skin if a person moves to a hot environment.

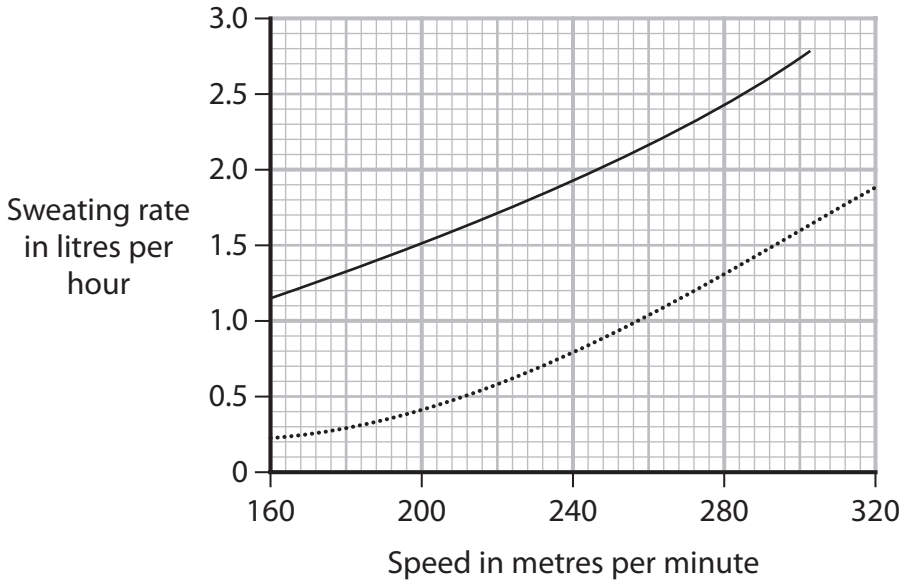
(3)

(b) Scientists investigate the release of sweat from human skin when a person runs at different speeds.

They measure the rate of sweating in litres per hour.

They take measurements in two environments. The first environment is hot and humid, and the second environment is cool and dry.

The graph shows the scientists' results.



(i) Give the dependent variable in this investigation.

(1)

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(ii) A person runs at a speed of 220 metres per minute in hot and humid conditions.

Calculate the volume of sweat the person releases in 15 minutes.

(3)

volume = ... litres

(iii) Using information from the graph, discuss the effect of increased running speed on sweating in the two environments.

(4)

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(Total for Question 4 = 13 marks)

5 The passage gives information about cloning.

Complete the passage by writing a suitable word in each blank space.

(7)

Animals such as sheep have been cloned.

Cloning involves taking the ..... out of a diploid body cell from the sheep that is to be cloned. This structure is then placed into an ..... cell that has had its ..... removed.

Electricity is used to help the cell to ..... by mitosis.

This then develops into an ..... which is then placed into the ..... of an unrelated female.

This female is known as the ..... mother.

(Total for Question 5 = 7 marks)

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6 (a) Using the recommended amount of fertiliser on a crop increases crop yield.
Some farmers think that adding extra fertiliser will give an even greater crop yield.

(i) Give a reason why adding extra fertiliser does not result in an even greater crop yield.

(1)

(ii) Some farmers apply more nitrogen fertiliser and more water to their fields than are needed.

Explain the biological consequences of applying more nitrogen fertiliser and more water than needed.

(5)

(b) The atmosphere can be polluted by gases such as carbon monoxide released from industry.

Describe the effects of carbon monoxide on the human body.

(2)

(c) Which of these is **not** a greenhouse gas?

(1)

- ☒ **A** carbon dioxide
- ☒ **B** methane
- ☒ **C** nitrogen
- ☒ **D** nitrous oxide

(Total for Question 6 = 9 marks)

TOTAL FOR PAPER = 70 MARKS

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