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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)

Friday 9 June 2023

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.*
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 7 2 5 8 4 R A 0 1 2 4

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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind t 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.

Tissue culture and plants

In micropropagation, plant tissues are grown *in vitro* on plant tissue culture media, under aseptic conditions in a controlled environment. This technique is possible because plant cells can differentiate and become specialised cells. This allows them to change their metabolism, growth and development to form a whole plant.



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Plant tissue culture media contain substances to support the normal growth and development of plants. The media are mainly composed of minerals, vitamins, and plant hormones. The pH of the media is kept constant.

Plant hormones play an essential role in determining how cells and tissues develop in culture media. Plant cells can differentiate into different tissues and cell types. The concentration of hormones can determine the tissue that develops. Auxins and cytokinins are the most widely used. A balance of both auxin and cytokinin leads to the development of a mass of undifferentiated cells known as a callus.

In vitro cell culture offers an alternative method for conserving endangered species and varieties. Tissue culture can be used when the plant species produce seeds that do not germinate or have seeds that cannot be stored for a long period of time. These can be successfully preserved using *in vitro* techniques for the maintenance of gene banks.

Embryo culture is a type of plant tissue culture that is used to grow embryos from seeds in nutrient media. In embryo culture, the plant develops directly from the embryo or indirectly through the formation of a callus and then subsequent formation of shoots and roots. The technique has been developed to break dormancy in seeds, and to reproduce rare species and haploid plants.

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Scientists are also using cell suspension culture systems from which product be extracted. A suspension culture is developed by transferring a portion of the c into liquid media. The media are maintained under suitable conditions of agitatio
25 light and temperature. This system can provide a continuous, reliable source of natur products independent of climate and soil conditions. The first commercial application of large-scale suspension cultivation of plant cells was carried out to produce shikonin. Shikonin is used in traditional Chinese medicine and is a potential anti-cancer treatment.

(a) State what is meant by the term ***in vitro***. (line 1)

(1)

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(b) Explain how plant cells differ from human cells in their ability to differentiate and specialise. (lines 2 and 3)

(2)

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(c) Give the function of two named minerals included in the culture media. (line 6

1 .....

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2 .....

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(d) Explain why the pH of the media needs to be kept constant. (line 7)

(2)

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(e) Auxin also controls the response of plants to light.

Describe a simple experiment you could do to show the phototropic response of plant stems to light.

(3)

(f) Explain why scientists want to conserve endangered plant species and varieties. (lines 13 and 14)

(2)

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(g) Explain why plant cell suspension culture media are maintained under suitable conditions of agitation, light and temperature. (lines 24 and 25)

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(Total for Question 1= 17 marks)

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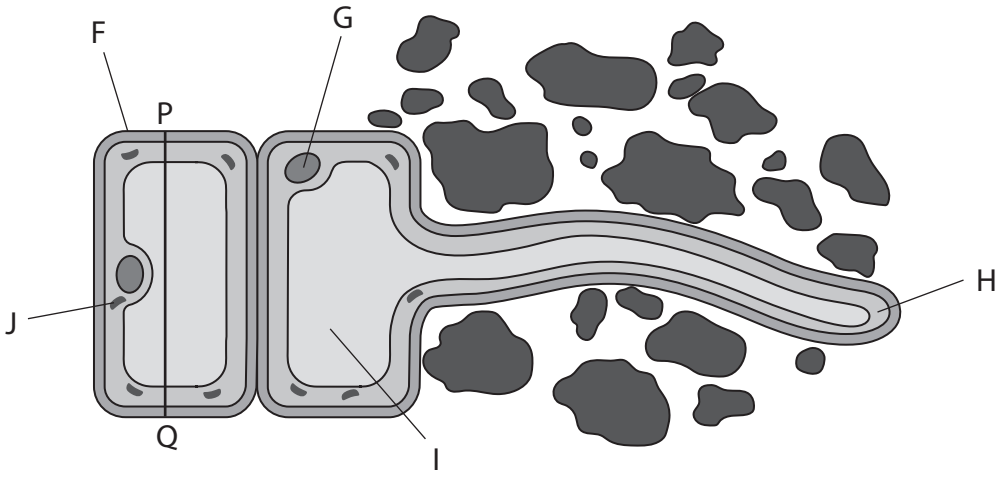
2 The diagram shows two cells from a plant root.



(a) (i) Which structure is the vacuole?

(1)

- ☒ **A** F
- ☒ **B** G
- ☒ **C** H
- ☒ **D** I

(ii) Which structure is the nucleus?

(1)

- ☒ **A** F
- ☒ **B** G
- ☒ **C** H
- ☒ **D** J

(b) The actual length of the root cell from P to Q is 80 μm.

Determine the magnification of the diagram.

[1000 μm = 1 mm]

(3)

magnification = × .....

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(c) Root hair cells are specialised cells adapted for their functions.

Explain how root hair cells are adapted for their functions in the plant.

(4)

(Total for Question 2 = 9 marks)

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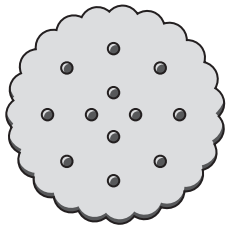
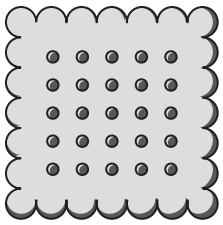
3 The picture shows two biscuits, A and B.



Biscuit A



Biscuit B

The table shows some nutritional information supplied by the manufacturers of the two biscuits.

Biscuit	Energy in kJ per 100 g	Lipid in g per 100 g	Carbohydrates in g per 100 g			Protein in g per 100 g	Salt in g per 100 g
			starch	sugars	total		
A	1860	13.6	66.5	1.5	68.0	10.0	1.2
B	1653	3.7	75.8	1.2	77.0	10.5	0.9

(a) Calculate the percentage of the total carbohydrate in biscuit A that is starch.

(2)

percentage = ...%

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(b) A doctor has advised a person to lose weight.

Comment on which biscuit, A or B, would be most suitable for the person to maintain a healthy diet and to lose weight.

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

(4)

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(c) A teacher tells some students to carry out an experiment to compare the ener values of biscuit A and biscuit B.

(i) Describe a suitable method the students could use for their experiment.

(4)

(ii) The energy values the students determined for the biscuits were much lower than the energy values supplied by the manufacturers.

Give two reasons why this is the case.

(2)

1 .....

2 .....

(Total for Question 3 = 12 marks)

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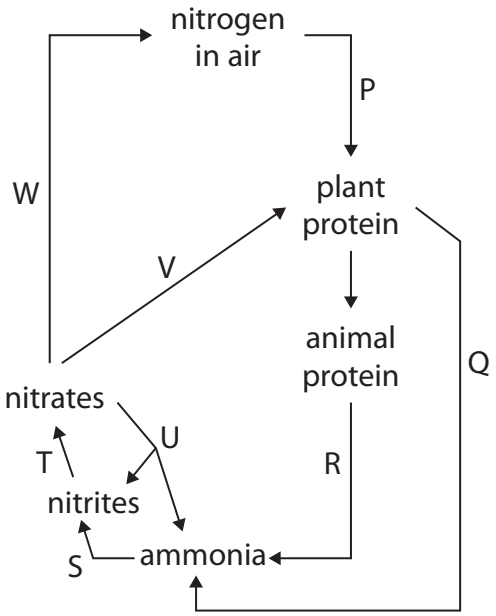
4 The diagram shows the nitrogen cycle. Some of the stages have been labelled.



(a) (i) Which stage shows nitrogen fixation?

(1)

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

(ii) Which stage shows nitrification?

(1)

- ☒ **A** Q
- ☒ **B** U
- ☒ **C** T
- ☒ **D** W

(iii) Which stage shows denitrification?

(1)

- ☒ **A** P
- ☒ **B** T
- ☒ **C** V
- ☒ **D** W

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(b) Farmers sometimes add chemical fertiliser to the soil.

(i) Describe how pollution by fertiliser can affect aquatic ecosystems.

(5)

(ii) Give an alternative to chemical fertiliser that a farmer could use.

(1)

(Total for Question 4 = 9 marks)

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5 (a) Diagram 1 shows part of a DNA molecule.

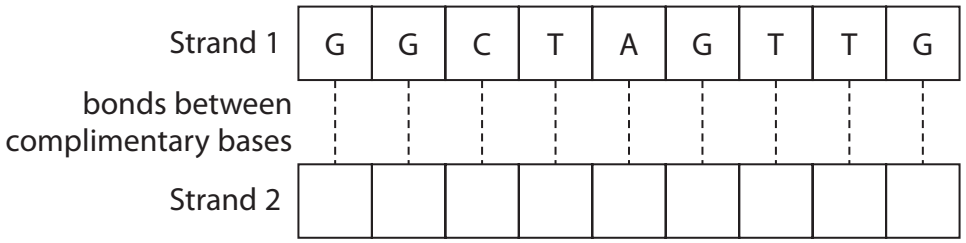

Diagram 1

(i) Complete Diagram 1 by writing the letters of the missing bases in the empty boxes for strand 2.

(2)

(ii) Give the maximum number of amino acids that are coded for by this DNA strand (strand 2).

(1)

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(iii) The original DNA strand is used to produce mRNA.

Complete the empty boxes in Diagram 2 to show the mRNA coded for by this DNA strand.

(2)

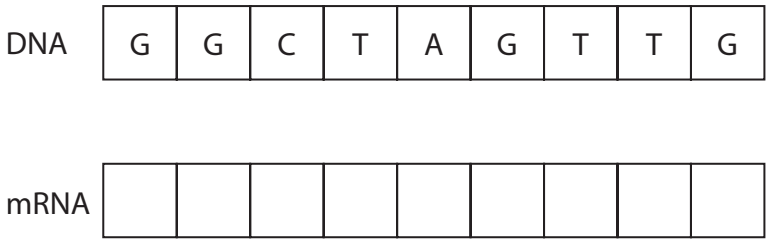

Diagram 2

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(b) A length of DNA consists of 25 000 base pairs.

This makes a total of 50 000 bases.

In this length of DNA, 30% of the bases are adenine (A).

Determine the number of thymine (T) bases, cytosine (C) bases, and guanine (G) bases in this length of DNA.

(3)

number of thymine bases (T) = ...

number of cytosine bases (C) = ...

number of guanine bases (G) = ...

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(c) Describe the differences between the process of transcription and the process of translation.

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(Total for Question 5 = 12 marks)

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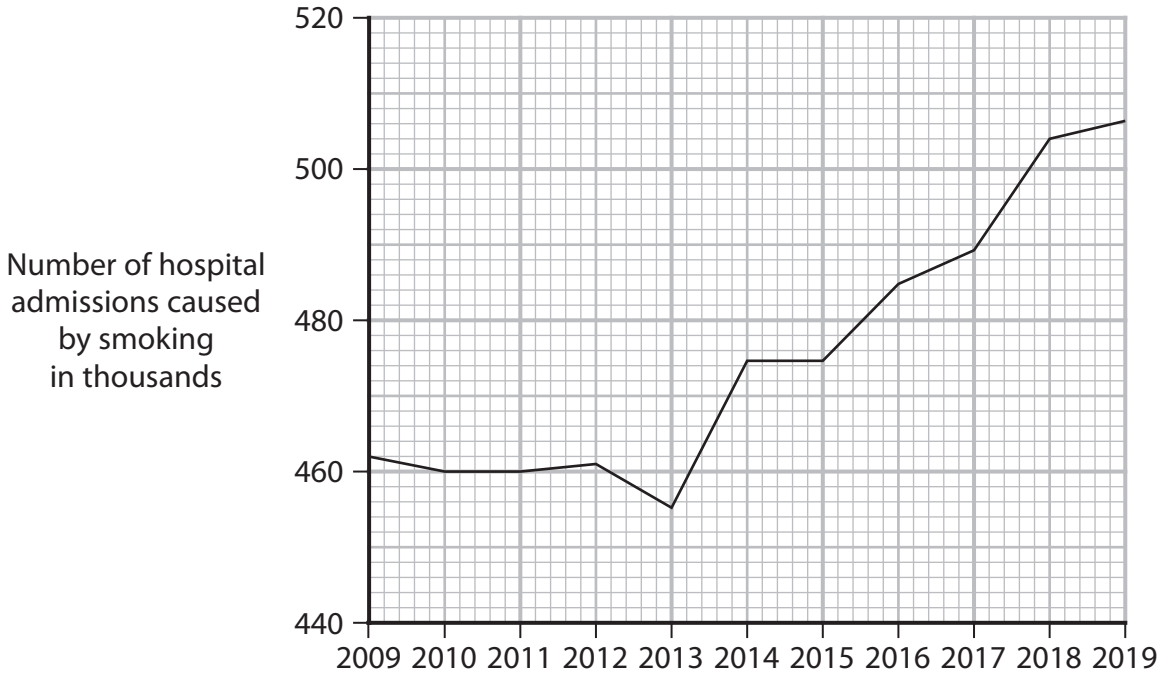
6 Smoking cigarettes has harmful effects on the body.

Graph 1 shows the number of hospital admissions in thousands due to conditions caused by smoking each year from 2009 to 2019.



Graph 1

(a) Using information from Graph 1, calculate the percentage increase in the number of hospital admissions caused by smoking in 2019 compared with 2009.

(2)

percentage increase = ...%

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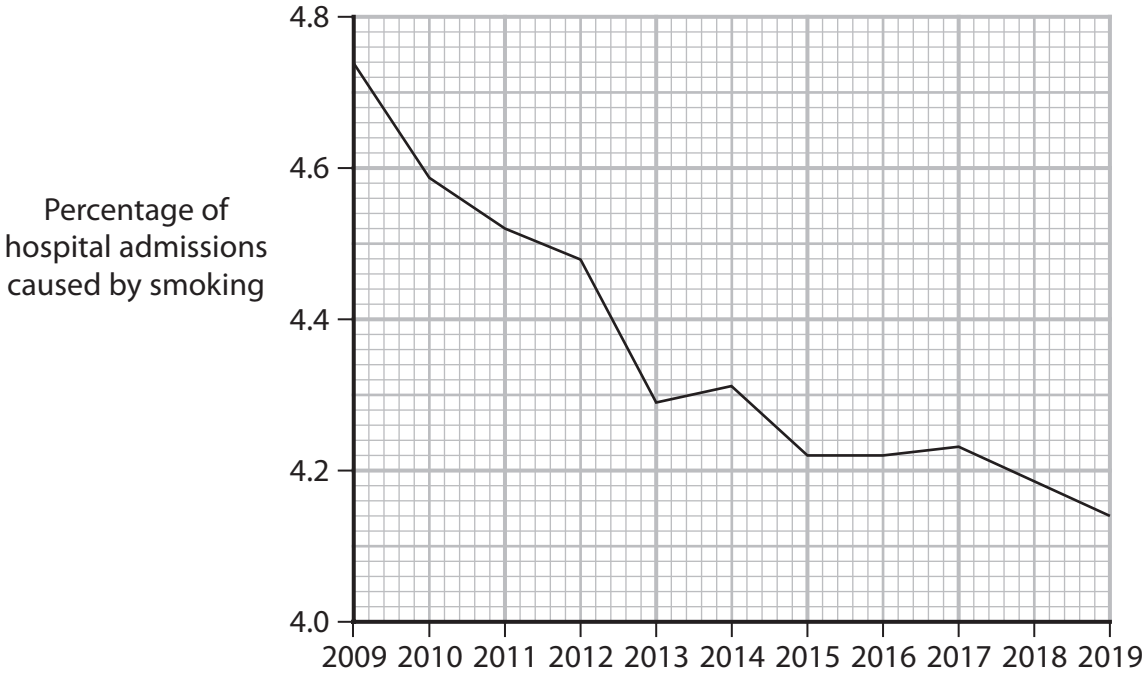
(b) Graph 2 shows the percentage of all hospital admissions that were due to conditions caused by smoking each year from 2009 to 2019.



Graph 2

Comment on the changes in the number of hospital admissions caused by smoking and the percentage of all hospital admissions that were caused by smoking.

Use data from graph 1 and graph 2 in your answer.

(4)

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(c) Smoking causes harmful effects on the lungs.

Describe the consequences of smoking cigarettes for the functioning of the lungs.

(5)

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 70 MARKS

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