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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)

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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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.

Antitranspirants

Antitranspirants are substances applied to plants to reduce water loss. There are three types of antitranspirant, film-forming compounds, stomatal regulators and reflective compounds.

The first type of antitranspirant contains film-forming compounds. These compounds are oils or waxes that are mixed with water to form an emulsion. This emulsion is then sprayed onto the leaves of plants. The emulsion forms a physical barrier that covers the stomata. The film is designed to prevent water loss but allow gas exchange. Scientists have found that that the film-forming antitranspirant is effective in increasing yield and increasing photosynthesis in drought conditions. The increased leaf turgor in plants sprayed with film, compared to control plants, shows that the film decreases water loss and maintains turgor in drought conditions.

Film-forming antitranspirants are used in horticulture to reduce water stress. This can occur during storage, transport and planting of container grown plants. Application of the antitranspirant before transplanting, helps the plant survive until the root system is established. The film-forming compounds are used to reduce drying out in rolled turf and in transporting flowering plants and trees with root balls.

The second type of antitranspirants are stomatal regulators that reduce the size of the stomatal pore. Stomatal pores affect diffusion as well as transpiration. Therefore, photosynthesis and growth may change when stomatal regulators are applied to leaf surfaces. If the stomatal pores close completely this will stop photosynthesis. However, if stomatal openings are only reduced in size, transpiration will be reduced but some photosynthesis will continue.

The third type of antitranspirants are reflective compounds. These work by adding a white coating to leaves. This changes the amount of light that is reflected by the leaf surface. The coating is only applied to the upper surface of leaves so does not block the stomatal pores. Coating a leaf with a reflective chemical can reduce leaf temperature, transpiration rate and also increase the efficiency of water use. Experiments show that transpiration rate can be reduced by up to 30% and leaf temperature reduced from 40 °C to 30 °C after a coating of reflective compound is applied to leaf surfaces.

Crops depend on photosynthesis for growth and final yield. Therefore, it is unlikely that currently available antitranspirants would increase the yield of a crop unless the crop suffers from a low water supply or very high rates of evaporation. Spraying film-forming or stomata regulating antitranspirants on a field-grown cereal crop under drought conditions, produced a grain yield increase of 17%. Experiments also show that any effect that antitranspirants have on the minerals supplied to the leaves has little effect on plant growth.

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(a) Explain why plants that have been dug up and transported are at most risk of drying out (Lines 13 to 18).

(2)

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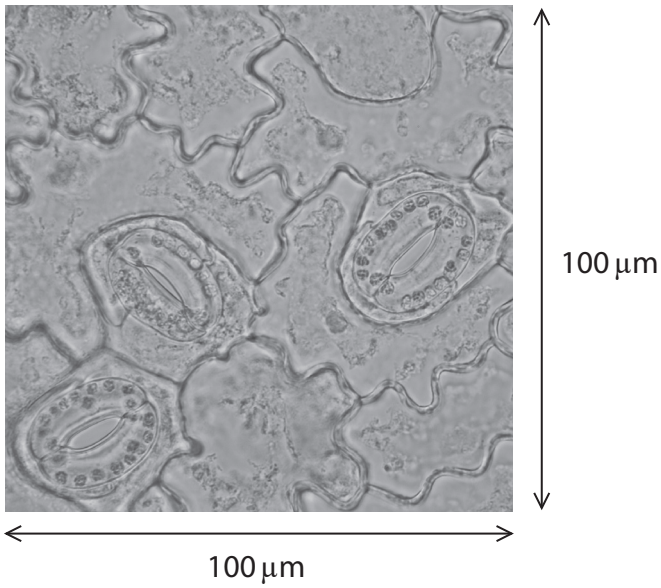
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(b) The photograph shows some stomata on a leaf surface.



(Source: © Dew_gdragon/Shutterstock)

Use the photograph to determine the number of stomata per mm^2 on this leaf surface.

[1 mm = 1000 μm]

(3)

number of stomata per mm^2 = ...

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(c) Explain why stomatal regulators reduce photosynthesis (Lines 19 to 24).

(2)

(d) (i) Explain why reflective compounds should only be applied to the upper surface of a leaf (Lines 27 and 28).

(2)

(ii) Explain why reducing leaf temperature reduces transpiration rate (Lines 28 to 32).

(2)

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(e) Describe the role of one named mineral ion in plant growth.

(2)

(f) Describe how water is transported from the soil to the leaves in plants.

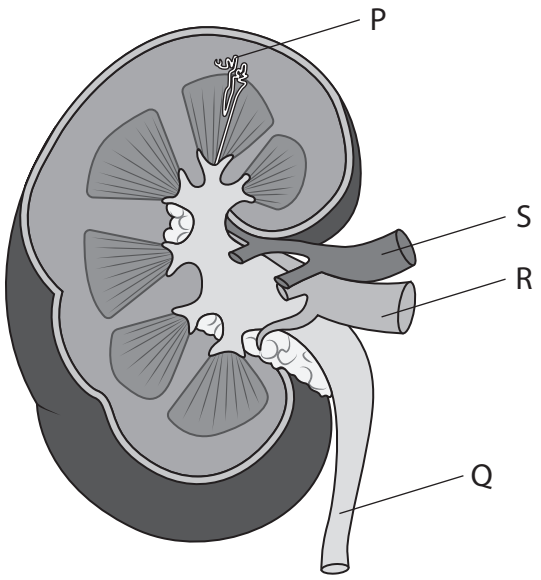
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(Total for Question 1 = 17 marks)

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2 The diagram shows a section through a human kidney with some structures labelled.



(a) (i) Which structure is labelled P in the diagram?

(1)

- ☒ **A** bladder
- ☒ **B** nephron
- ☒ **C** ureter
- ☒ **D** urethra

(ii) Which fluid is carried in tube S?

(1)

- ☒ **A** bile
- ☒ **B** blood
- ☒ **C** filtrate
- ☒ **D** urine

(iii) Which tube is labelled Q in the diagram?

(1)

- ☒ **A** renal artery
- ☒ **B** renal vein
- ☒ **C** ureter
- ☒ **D** urethra

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(b) Analysis of the composition of urine can be used in the diagnosis of problems with kidney function.

Urine samples are taken from three patients and the results are shown in the table.

Patient	Glucose	Water content of urine	Protein
W	absent	normal	present
X	present	normal	absent
Y	absent	very high	absent

(i) Discuss which processes in the kidney may be affected to produce the results shown.

Include in your answer where in the nephron the processes occur.

(5)

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(ii) Describe how to test for glucose in a sample of urine.

(2)

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(Total for Question 2 = 10 marks)

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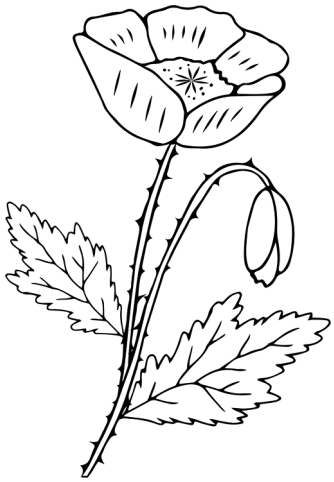
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3 Scientists study the populations of plants in two fields, X and Y, in southern England.

They investigate the numbers of three different wildflower species, A, B and C, so that they can compare the biodiversity in each field.



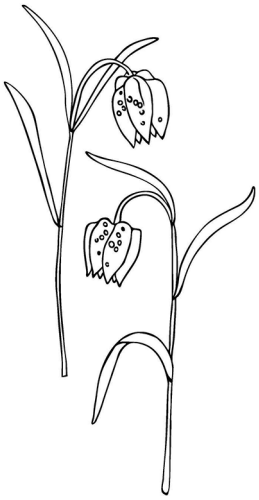
(Source: © Dew_gdragon/ Shutterstock)

Species A



(Source: © Patrick Guenette/ Alamy Stock Vector)

Species B



(Source: © M_Morozova/ Shutterstock)

Species C

The table shows the numbers of plants of each species per m^2 counted in each field.

Species	Number of plants per m^2							
	Field X				Field Y			
	Count 1	Count 2	Count 3	Mean	Count 1	Count 2	Count 3	Mean
A	19	22	25	22	0	0	0	0
B	5	3	13	7	21	26	22	
C	10	13	13	12	1	5	6	4

(a) (i) Calculate the mean number of plants of species B in Field Y.

(1)

mean number = ... per m^2

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(ii) Describe how the scientists could determine the number of each plant species per m^2 in each field.

(3)

(b) Discuss what the results show about the distribution of species in each field and the difference in biodiversity between the two fields.

(4)

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(c) Name an abiotic factor that could affect the distribution of the plant species.

(1)

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(Total for Question 3 = 9 marks)

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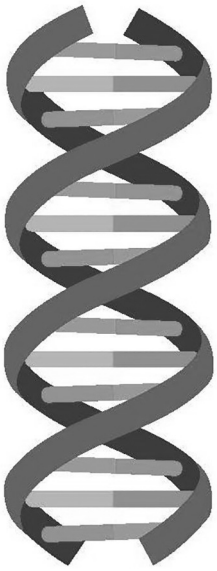
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4 The diagram shows part of a molecule of DNA.



(Source: © ShadeDesign/Shutterstock)

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

(1)

(b) Describe the differences between the structure of DNA and the structure of RNA.

(3)

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(c) Describe the roles of RNA in protein synthesis.

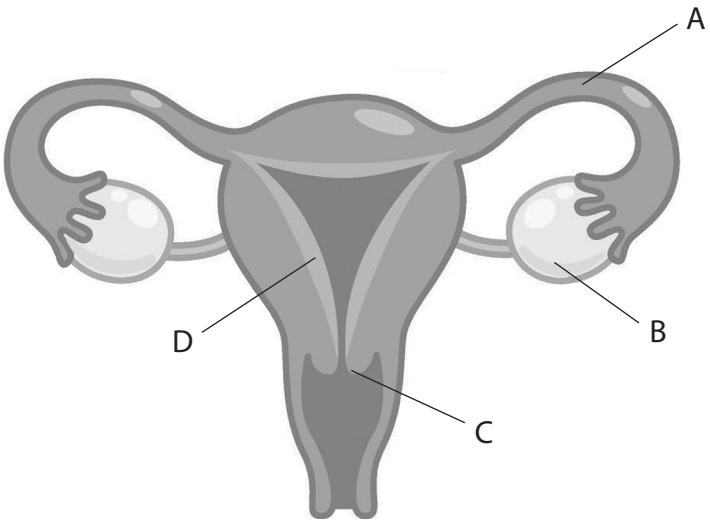
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(Total for Question 4 = 8 marks)

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5 The diagram shows part of the female reproductive system with some structures labelled.



(Source: © polikhay/Shutterstock)

(a) Name the structures labelled A, B and C.

(3)

A .....

B .....

C .....

(b) Describe the role of structure D in reproduction.

(2)

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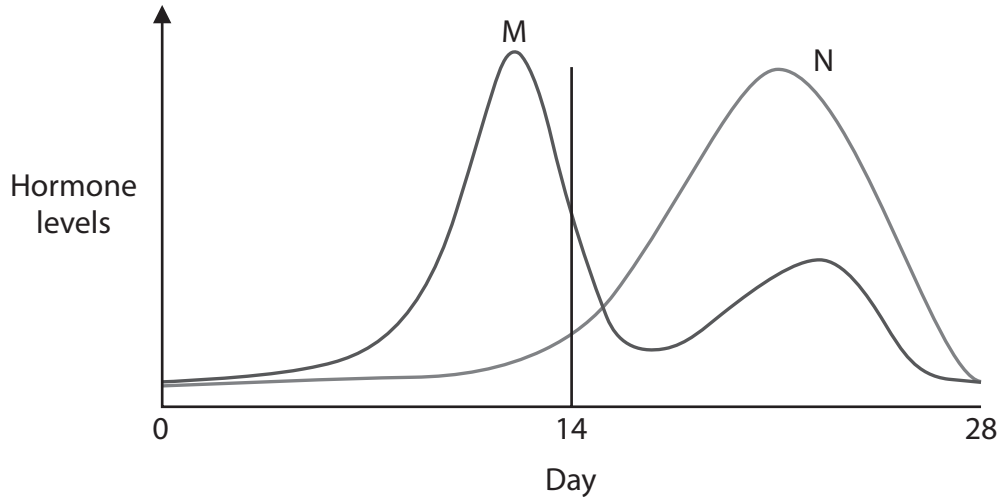
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(c) The graph shows the changes in the levels of hormones released from structure B during one menstrual cycle.



(i) Explain the importance of the changes in hormone M and hormone N during the menstrual cycle.

(4)

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(ii) Other hormones are involved in the menstrual cycle.

Describe the role of one other named hormone in the menstrual cycle.

(2)

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(Total for Question 5 = 11 marks)

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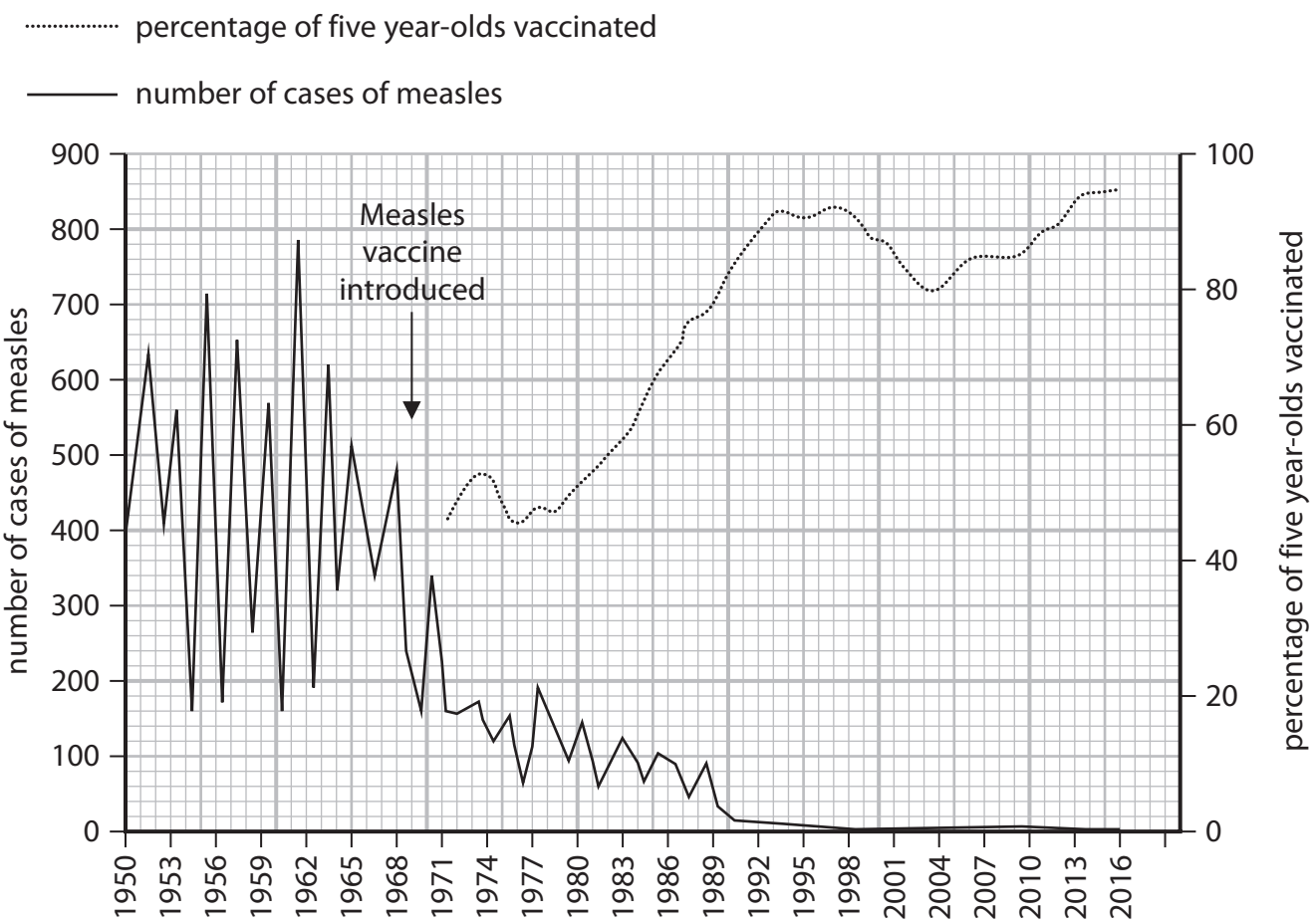
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6 Measles is a disease caused by a virus. The graph shows the number of cases of measles each year and the percentage of five year-olds vaccinated between 1950 and 2016 in the United Kingdom.



(a) Determine the difference in the percentage change in the number of cases of measles between 1950 and 1965 and the percentage change in the number of cases of measles between 1968 and 1983.

(3)

difference = ...

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(b) Explain the relationship between the number of cases of measles and the percentage of five year-olds vaccinated.

Use information from the graph in your answer.

(4)

(c) Some children are receiving treatments that reduce the activity of their immune system.

Explain why vaccinations are not used on these children.

(2)

(Total for Question 6 = 9 marks)

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7 The following passage contains information about using micropropagation to produce plants.

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

(6)

Micropropagation uses small fragments of plants which are regrown into whole plants. These fragments of plants are known as ..... .

The surface of each fragment is sterilised to prevent growth of ..... . The fragments are placed in a growth medium. The growth medium contains agar and a source of energy such as ..... .

This method is able to produce large quantities of genetically identical plants called ..... .

One advantage is that micropropagation is quicker than ..... reproduction, which involves flower and seed production. Another advantage of micropropagation is that plants can be produced ..... the year.

(Total for Question 7 = 6 marks)

TOTAL FOR PAPER = 70 MARKS

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