Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Monday 14 January 2019

Morning (Time: 1 hour 30 minutes) | Paper Reference **WBI02/01**

Biology

Advanced Subsidiary
Unit 2: Development, Plants and the Environment

You must have:
Calculator, HB pencil, 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.*

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 5 4 6 7 3 A 0 1 2 8

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 Meiosis and mitosis are both types of nuclear division that take place in eukaryotic organisms.

(a) Put a cross ☒ in the box next to the correct word or words to complete each of the following statements.

(i) DNA synthesis takes place before

(1)

☒ **A** both meiosis and mitosis

☒ **B** meiosis only

☒ **C** mitosis only

☒ **D** neither meiosis nor mitosis

(ii) Crossing over takes place during prophase I in

(1)

☒ **A** both meiosis and mitosis

☒ **B** meiosis only

☒ **C** mitosis only

☒ **D** neither meiosis nor mitosis

(b) Put a cross ☒ in the box next to the row in the table that correctly describes the result of meiosis and the result of mitosis.

(1)

	Meiosis	Mitosis
☒ **A**	two daughter cells with one copy of each chromosome	four daughter cells with two copies of each chromosome
☒ **B**	two daughter cells with one copy of each chromosome	four daughter cells with one copy of each chromosome
☒ **C**	four daughter cells with one copy of each chromosome	two daughter cells with two copies of each chromosome
☒ **D**	four daughter cells with one copy of each chromosome	two daughter cells with one copy of each chromosome

(c) Suggest why neither meiosis nor mitosis take place in prokaryotic organisms.

(2)

(d) The table below shows some features of prokaryotic cells and eukaryotic cells.

For each feature, put **one** cross ☒ in the appropriate box, in each row, to show whether the feature is found in prokaryotic cells and eukaryotic cells, prokaryotic cells only, eukaryotic cells only or not found in either.

(2)

Feature	Prokaryotic cells and eukaryotic cells	Prokaryotic cells only	Eukaryotic cells only	Not found in either prokaryotic cells or eukaryotic cells
cell membrane	☒	☒	☒	☒
ribosomes	☒	☒	☒	☒

(e) The Golgi apparatus is found in eukaryotic cells only.

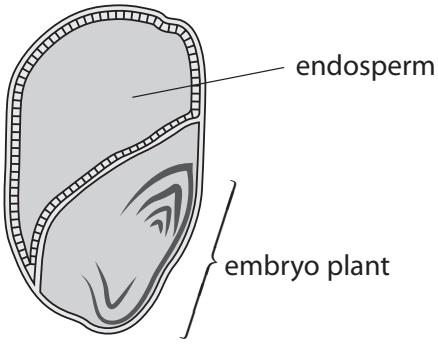
In the space below, draw and label a diagram to show the structure of the Golgi apparatus.

(3)

(Total for Question 1 = 10 marks)

2 Maize grains are formed after the transfer of pollen and the fusion of nuclei.

The diagram below shows the structure of a maize grain.



(a) Describe the role of the pollen tube nucleus.

(2)

(b) The embryo plant results from the fusion of the male gamete and the female gamete.

Put a cross ☒ in the box next to the description of the nucleus of the male gamete and the nucleus of the female gamete.

(1)

☒ **A** both nuclei are diploid

☒ **B** both nuclei are haploid

☒ **C** the male nucleus is diploid and the female nucleus is haploid

☒ **D** the male nucleus is haploid and the female nucleus is diploid

(c) The endosperm contains starch.

(i) Describe the structure of starch.

(2)

(ii) Before a maize grain germinates, enzymes that break down starch are activated.

Explain why starch has to be broken down before the embryo plant can grow.

(2)

(Total for Question 2 = 7 marks)

3 Tits are small birds. The United Kingdom (UK) has six species of tit.

The photograph below shows one of these species, a great tit, feeding from a garden bird feeder.

The natural habitat of the great tit is woodland.

Magnification ×1

(a) Using the great tit as an example, explain what is meant by each of the following terms.

(i) Species

(2)

(ii) Habitat

(2)

(b) Scientists have found that the mean beak length of great tits in the UK is now 0.3 mm longer than it was in the 1970s.

(i) Beak length is an example of polygenic inheritance.

Using beak length as an example, explain what is meant by the term **polygenic inheritance**.

(2)

(ii) The scientists think that an increase in the use of bird feeders has led to an increase in beak length.

Using the photograph of a great tit feeding from a garden feeder, suggest how natural selection has resulted in great tits with longer beaks.

(4)

(Total for Question 3 = 10 marks)

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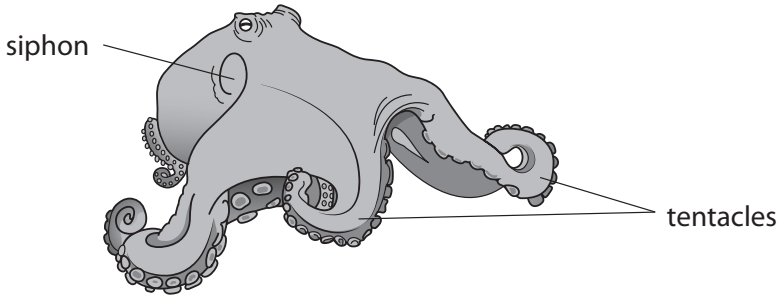
4 The octopus is an animal that lives in the sea.

The diagram below shows a female octopus.



One of the tentacles of a male octopus is adapted to deliver sperm into a female octopus. This tentacle is called a hectocotylus.

When the octopus mates, the male octopus inserts his hectocotylus into the siphon of the female.

(a) After mating, the hectocotylus breaks off and stays inside the siphon of the female.

Suggest advantages to the octopus species of the hectocotylus remaining inside the siphon.

(2)

(b) The male octopus can regrow his hectocotylus.

This involves producing new tissues.

(i) Explain what is meant by the term **tissue**.

(2)

(ii) Explain how the male octopus is able to produce the new tissues of the hectocotylus.

(2)

(c) The egg cells in the female octopus produce peptides that attract the sperm down the siphon and activate them.

An investigation was carried out to determine the effect of the concentration of one of these peptides on sperm movement.

The table below shows the results of this investigation.

Concentration of peptide / a.u.	Percentage of sperm moving towards the peptide (%)
control	5.4
10	13.0
10^2	10.2
10^3	6.6

(i) Describe a suitable control for this investigation.

(1)

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(ii) Put a cross ☒ in the box next to the range of concentrations of peptide that would need to be used to find the optimum concentration for movement of sperm.

(1)

☒ **A** 0 to 10

☒ **B** 0 to 10^2

☒ **C** 10 to 10^2

☒ **D** 10 to 10^3

(iii) Some of the peptides produced activate the sperm. As a result, the acrosome reaction occurs.

Describe the acrosome reaction.

(2)

(Total for Question 4 = 10 marks)

5 Plants, such as rice, can be genetically modified to reduce the thickness of the secondary cell wall.

(a) The secondary cell wall is composed of cellulose and lignin.

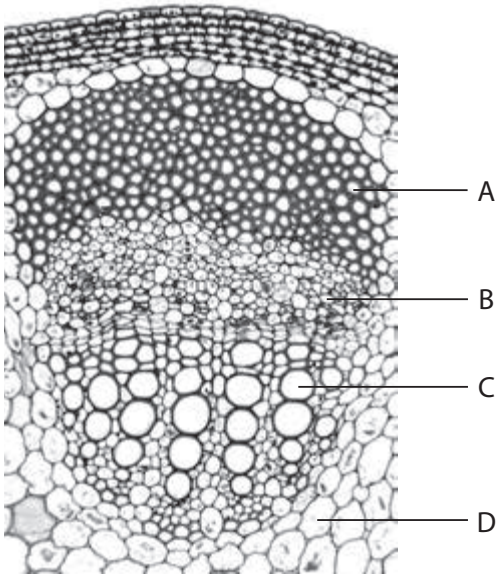
(i) Describe the arrangement of cellulose molecules in cell walls.

(3)

(ii) Explain the importance of lignin in the transport of materials in xylem vessels.

(3)

(iii) The photograph below shows a section through part of the stem of a plant, as seen using a light microscope.



Magnification ×80

Put a cross ☒ in the box that identifies a xylem vessel.

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(b) The table below shows the lignin content in 1 kg of dry mass of unmodified rice plants and the same dry mass of genetically modified rice plants.

Lignin content of 1 kg of dry mass of rice plants / g	
Unmodified	**Genetically modified**
230	180

(i) Calculate the percentage decrease in dry mass of the lignin content of the genetically modified rice plants.

Show your working.

(2)

.....%

(ii) The photographs below show unmodified rice plants and genetically modified rice plants.

Unmodified rice plants

Genetically modified rice plants

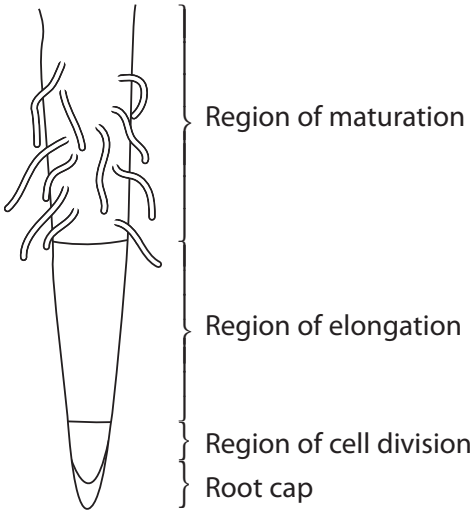
The mean length of the leaves of these rice plants was the same.

Using the information in the table and the photographs, explain the difference in appearance of the genetically modified rice plants.

(3)

(Total for Question 5 = 12 marks)

6 The diagram below shows part of a plant root.

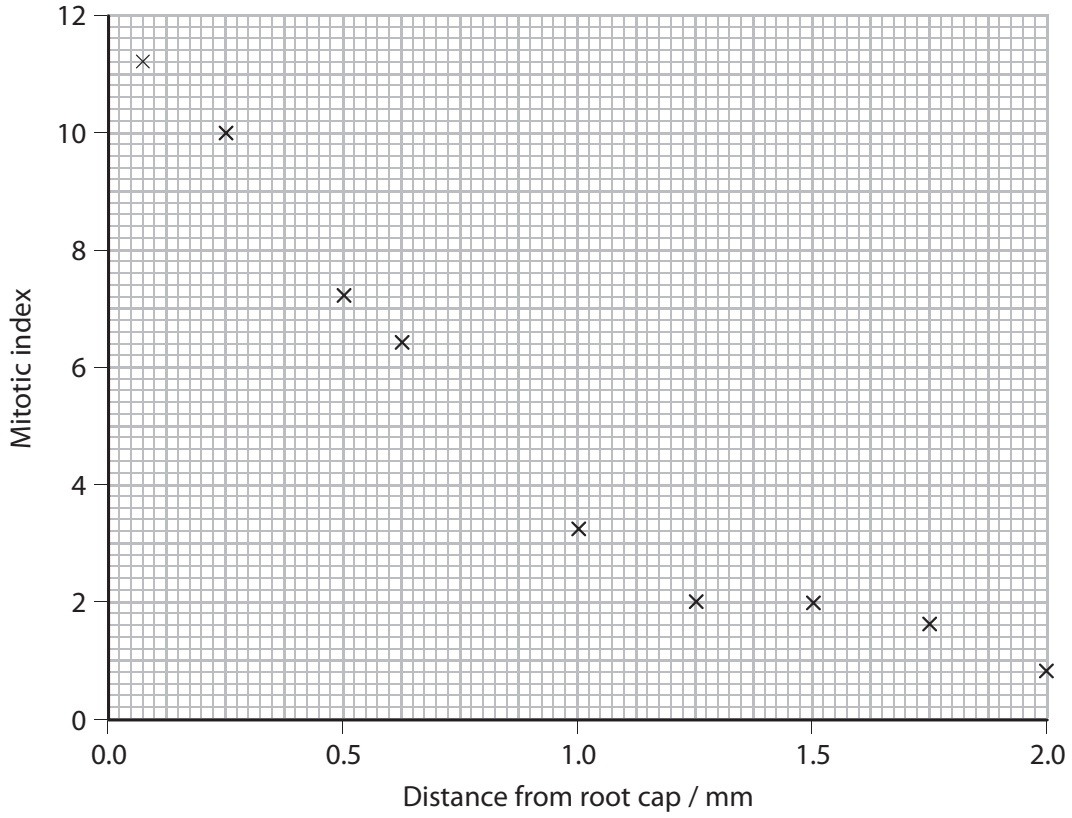


(a) Cell division can be measured using the mitotic index.

The mitotic index is calculated using the formula

$$\frac{\text{number of cells in mitosis}}{\text{total number of cells}} \times 100$$

The graph below shows the mitotic index in a root tip.



(i) State why this graph shows that there is a negative correlation between the mitotic index and the distance from the root cap.

(1)

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(ii) A student counted the number of cells in mitosis and the number of cells in interphase. There were 3 cells in mitosis and 91 cells in interphase.

Using the formula for mitotic index and the information in the graph, calculate how far from the root cap this count was made.

Show your working.

(3)

..... mm

*(iii) Describe an investigation that could be carried out to confirm the results shown in this graph.

(5)

(b) In the zone of elongation, the newly-divided cells increase in size.

(i) Name the process of cell division that occurs after mitosis.

(1)

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(ii) Describe how the root cells increase in size.

(3)

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(Total for Question 6 = 13 marks)

7 Digoxin and digitoxin are two drugs extracted from *Digitalis* plants.

Both of these drugs have been tested using modern drug trials.

(a) William Withering was the first to use *Digitalis* to treat patients.

Give **three** differences between Withering's method of drug testing *Digitalis* and the modern way in which digoxin and digitoxin were tested.

(3)

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2 .....

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3 .....

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(b) The table below shows some information about digoxin and digitoxin when used to treat patients.

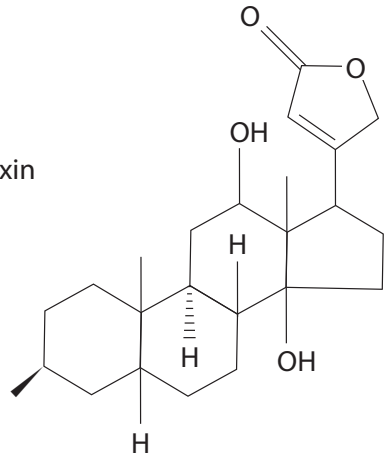
Information	Digoxin	Digitoxin
Daily dose / mg	0.125 to 0.500	0.050 to 0.200
Time for peak effect / hours after dosing	3 to 6	6 to 12
Percentage of drug absorbed into blood (%)	40 to 75	90 to 100

(i) Describe how the clinical trials were used to determine the daily dose of these drugs.

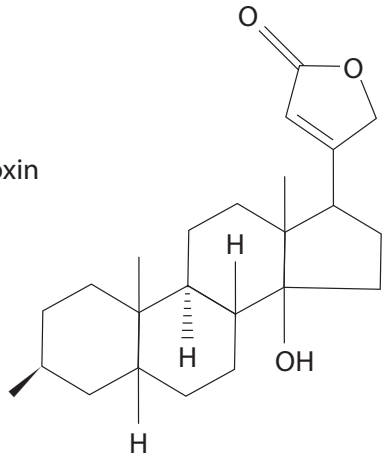
(2)

(ii) The diagrams below show the structures of part of each drug.

digoxin



digitoxin



Using the information in the diagrams, suggest why these two drugs behave differently when tested.

(1)

(iii) Suggest why there are ranges for the information given in the table.

(2)

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(Total for Question 7 = 8 marks)

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8 The photograph below shows a greater flamingo.

Magnification $\times 0.1$

The greater flamingo is one species of flamingo.

Greater flamingos are large, wading birds found in Africa.

They are filter feeders. They feed on microscopic organisms in very salty, alkaline lakes.

Very few other organisms can survive in these lakes.

Below are some more facts about greater flamingos:

- young adults are whitish-grey in colour
- older adults have pink pigments (colours) in their feathers
- the pink pigments come from the carotenoids in the food that the flamingos eat
- the carotenoids are broken down into the pink pigments by the liver
- glands near the base of the tail feathers also contain these pigments
- in the breeding season, the flamingos spread secretions from these glands over their feathers.

*(a) Using the photograph and the information given, explain how the behavioural, physiological and anatomical adaptations of greater flamingos enable them to survive in their environment.

(6)

(b) The lesser flamingo is another species of flamingo found in Africa.

Lesser flamingos can be found feeding in the same lake as the greater flamingos.

Explain why both of these species can be found in the same lake.

(2)

(c) Flamingos lay only one egg in each breeding season. This is a low birth rate for an animal.

Explain why this low birth rate is sufficient to maintain the number of flamingos.

(2)

(Total for Question 8 = 10 marks)

TOTAL FOR PAPER = 80 MARKS

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